All renditions to all questions

The LaTex code that creates this quiz is released to the Public Domain
Attribution for each question is documented in the Appendix
https://bitbucket.org/Guy_vandegrift/qbwiki/wiki/Home
https://en.wikiversity.org/wiki/Quizbank
This is a mixed quiz.

Tuesday 1st January, 2019

Though posted on Wikiversity, this document was created without wikitex using Python to write LaTeX markup. With a bit more development it will be possible for users to download and use software that permits the modification and printing of this document from the users own computer. .

Contents

1 a02_1Dkinem_definitions

1. A car traveling at 35.3 miles/hour stops in 4.3 seconds. What is the average acceleration?[1]
   - A. 2.06×10^{0} m/s^2
   - **B. 3.67×10^{0} m/s^2**
   - C. 6.53×10^{0} m/s^2
   - D. 1.16×10^{1} m/s^2
   - E. 2.06×10^{1} m/s^2
2. A car completes a complete circle of radius 3.1 miles at a speed of 51 miles per hour. How many minutes does it take?[2]
   - A. 7.25×10^{0} minutes
   - B. 9.66×10^{0} minutes
   - C. 1.29×10^{1} minutes
   - D. 1.72×10^{1} minutes
   - **E. 2.29×10^{1} minutes**
3. A car traveling at 21.3 mph increases its speed to 24.2 mph in 1.4seconds. What is the average acceleration?[3]
   - **A. 9.26×10^{-1} m/s^2**
   - B. 1.65×10^{0} m/s^2
   - C. 2.93×10^{0} m/s^2
   - D. 5.21×10^{0} m/s^2
   - E. 9.26×10^{0} m/s^2
4. Mr. Smith is backing his car at a speed of 3.28 mph when he hits a cornfield (seed corn). In the course of 1.92 seconds he stops, puts his car in forward drive, and exits the field at a speed of 5.66 mph. What was the "magnitude" (absolute value) of his acceleration?[4]
   - A. 2.94×10^{0} miles per hour per second
   - B. 3.7×10^{0} miles per hour per second
   - **C. 4.66×10^{0} miles per hour per second**
   - D. 5.86×10^{0} miles per hour per second
   - E. 7.38×10^{0} miles per hour per second

1.1 Renditions

a02_1Dkinem_definitions Q1

1. Mr. Smith is backing his car at a speed of 2.42 mph when he hits a cornfield (seed corn). In the course of 2.35 seconds he stops, puts his car in forward drive, and exits the field at a speed of 6.1 mph. What was the "magnitude" (absolute value) of his acceleration?
   - A. 2.29×10^{0} miles per hour per second
   - B. 2.88×10^{0} miles per hour per second
   - **C. 3.63×10^{0} miles per hour per second**
   - D. 4.56×10^{0} miles per hour per second
   - E. 5.75×10^{0} miles per hour per second

a02_1Dkinem_definitions Q2

1. Mr. Smith is backing his car at a speed of 3.06 mph when he hits a cornfield (seed corn). In the course of 1.29 seconds he stops, puts his car in forward drive, and exits the field at a speed of 5.6 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 3.36×10^0 miles per hour per second

   B. 4.24×10^0 miles per hour per second

   C. 5.33×10^0 miles per hour per second

   D. 6.71×10^0 miles per hour per second

   E. 8.45×10^0 miles per hour per second

a02_1Dkinem_definitions Q3

1. Mr. Smith is backing his car at a speed of 2.33 mph when he hits a cornfield (seed corn). In the course of 1.22 seconds he stops, puts his car in forward drive, and exits the field at a speed of 6.68 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 2.94×10^0 miles per hour per second

   B. 3.7×10^0 miles per hour per second

   C. 4.66×10^0 miles per hour per second

   D. 5.87×10^0 miles per hour per second

   E. 7.39×10^0 miles per hour per second

a02_1Dkinem_definitions Q4

1. Mr. Smith is backing his car at a speed of 3.12 mph when he hits a cornfield (seed corn). In the course of 2.39 seconds he stops, puts his car in forward drive, and exits the field at a speed of 6.32 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 3.95×10^0 miles per hour per second

   B. 4.97×10^0 miles per hour per second

   C. 6.26×10^0 miles per hour per second

   D. 7.88×10^0 miles per hour per second

   E. 9.92×10^0 miles per hour per second

a02_1Dkinem_definitions Q5

1. Mr. Smith is backing his car at a speed of 3.57 mph when he hits a cornfield (seed corn). In the course of 2.8 seconds he stops, puts his car in forward drive, and exits the field at a speed of 6.75 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 1.85×10^0 miles per hour per second

   B. 2.33×10^0 miles per hour per second

   C. 2.93×10^0 miles per hour per second

   D. 3.69×10^0 miles per hour per second

   E. 4.64×10^0 miles per hour per second

a02_1Dkinem_definitions Q6

1. Mr. Smith is backing his car at a speed of 2.39 mph when he hits a cornfield (seed corn). In the course of 2.94 seconds he stops, puts his car in forward drive, and exits the field at a speed of 5.12 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 1.61 x 10^0 miles per hour per second

   B. 2.03 x 10^0 miles per hour per second

   C. 2.55 x 10^0 miles per hour per second

   D. 3.22 x 10^0 miles per hour per second

   E. 4.05 x 10^0 miles per hour per second

a02_1Dkinem_definitions Q7

1. Mr. Smith is backing his car at a speed of 3.8 mph when he hits a cornfield (seed corn). In the course of 2.16 seconds he stops, puts his car in forward drive, and exits the field at a speed of 5.9 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 2.25 x 10^0 miles per hour per second

   B. 2.83 x 10^0 miles per hour per second

   C. 3.57 x 10^0 miles per hour per second

   D. 4.49 x 10^0 miles per hour per second

   E. 5.65 x 10^0 miles per hour per second

a02_1Dkinem_definitions Q8

1. Mr. Smith is backing his car at a speed of 4.27 mph when he hits a cornfield (seed corn). In the course of 1.74 seconds he stops, puts his car in forward drive, and exits the field at a speed of 6.17 mph. What was the "magnitude" (absolute value) of his acceleration?

   A. 6 x 10^0 miles per hour per second

   B. 7.55 x 10^0 miles per hour per second

   C. 9.51 x 10^0 miles per hour per second

   D. 1.2 x 10^1 miles per hour per second

   E. 1.51 x 10^1 miles per hour per second

2 a02_1Dkinem_equations

1. A car is accelerating uniformly at an acceleration of 4.25m/s/s. At x = 7.25m, the speed is 3.7m/s. How fast is it moving at x = 12.25 m?[5]

   A. 7.5 m/s.

   B. 9 m/s.

   C. 10.79 m/s.

   D. 12.95 m/s.

   E. 15.54 m/s.

2. What is the acceleration if a car travelling at 10.8 m/s makes a skid mark that is 6.5 m long before coming to rest? (Assume uniform acceleration.)[6]

   A. 5.19m/s^2.

   B. 6.23m/s^2.

C. $7.48 m/s^2$.

D. $8.97 m/s^2$.

E. $10.77 m/s^2$.

3. A train accelerates uniformly from 16 m/s to 33 m/s, while travelling a distance of 485 m. What is the 'average' acceleration?[7]

   A. 0.86m/s/s.

   B. 1.03m/s/s.

   C. 1.24m/s/s.

   D. 1.48m/s/s.

   E. 1.78m/s/s.

4. A particle accelerates uniformly at 11.25 m/s/s. How long does it take for the velocity to increase from 932 m/s to 1815 m/s?[8]

   A. 45.42 s

   B. 54.51 s

   C. 65.41 s

   D. 78.49 s

   E. 94.19 s

2.1 Renditions

a02_1Dkinem_equations Q1

1. A particle accelerates uniformly at 16.75 m/s/s. How long does it take for the velocity to increase from 957 m/s to 1935 m/s?

   A. 33.79 s

   B. 40.55 s

   C. 48.66 s

   D. 58.39 s

   E. 70.07 s

a02_1Dkinem_equations Q2

1. A particle accelerates uniformly at 10.75 m/s/s. How long does it take for the velocity to increase from 1184 m/s to 2001 m/s?

   A. 43.98 s

   B. 52.78 s

   C. 63.33 s

   D. 76 s

   E. 91.2 s

a02_1Dkinem_equations Q3

1. A particle accelerates uniformly at 17.25 m/s/s. How long does it take for the velocity to increase from 761 m/s to 1698 m/s?

   A. 45.27 s

   B. 54.32 s

   C. 65.18 s

   D. 78.22 s

   E. 93.86 s

a02_1Dkinem_equations Q4

1. A particle accelerates uniformly at 12.5 m/s/s. How long does it take for the velocity to increase from 968 m/s to 1883 m/s?

   A. 42.36 s

   B. 50.83 s

   C. 61 s

   D. 73.2 s

   E. 87.84 s

a02_1Dkinem_equations Q5

1. A particle accelerates uniformly at 12.5 m/s/s. How long does it take for the velocity to increase from 1173 m/s to 1878 m/s?

   A. 39.17 s

   B. 47 s

   C. 56.4 s

   D. 67.68 s

   E. 81.22 s

a02_1Dkinem_equations Q6

1. A particle accelerates uniformly at 11.5 m/s/s. How long does it take for the velocity to increase from 1164 m/s to 2020 m/s?

   A. 35.9 s

   B. 43.08 s

   C. 51.69 s

   D. 62.03 s

   E. 74.43 s

a02_1Dkinem_equations Q7

1. A particle accelerates uniformly at 16 m/s/s. How long does it take for the velocity to increase from 981 m/s to 1816 m/s?

   A. 30.2 s

   B. 36.24 s

   C. 43.49 s

   D. 52.19 s

   E. 62.63 s

a02_1Dkinem_equations Q8

1. A particle accelerates uniformly at 13 m/s/s. How long does it take for the velocity to increase from 1024 m/s to 1888 m/s?

   A. 46.15 s

   B. 55.38 s

   C. 66.46 s

   D. 79.75 s

   E. 95.7 s

a02_1Dkinem_equations Q9

1. A particle accelerates uniformly at 16.75 m/s/s. How long does it take for the velocity to increase from 1210 m/s to 2087 m/s?

   A. 52.36 s

   B. 62.83 s

   C. 75.4 s

   D. 90.47 s

   E. 108.57 s

3 a03_2Dkinem_2dmotion

1. A ball is kicked horizontally from a height of 2.3 m, at a speed of 7.8m/s. How far does it travel before landing?[9]

   A. 3.09 m.

   B. 3.71 m.

   C. 4.45 m.

   D. 5.34 m.

   E. 6.41 m.

2. A particle is initially at the origin and moving in the x direction at a speed of 3.7 m/s. It has an constant acceleration of 2.3 m/s^2 in the y direction, as well as an acceleration of 0.5 in the x direction. What angle does the velocity make with the x axis at time t = 2.8 s?[10]

   A. 51.62 degrees.

   B. 59.37 degrees.

   C. 68.27 degrees.

   D. 78.51 degrees.

   E. 90.29 degrees.

3. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 7.29 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.75 m, and moves at a constant speed of 2.98 m/s in the +y direction. At what time do they meet?[11]

   A. 0.24 s.

   B. 0.29 s.

   C. 0.34 s.

   D. 0.41 s.

E. 0.5 s.

4. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 7.17 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.04 m, and moves at a constant speed of 2.52 m/s in the +y direction. What is the value of θ (in radians)?[12]

   A. 0.27 radians.

   B. 0.31 radians.

   C. 0.36 radians.

   D. 0.41 radians.

   E. 0.47 radians.

3.1 Renditions

a03_2Dkinem_2dmotion Q1

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 5.15 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.05 m, and moves at a constant speed of 2.94 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.46 radians.

   B. 0.53 radians.

   C. 0.61 radians.

   D. 0.7 radians.

   E. 0.8 radians.

a03_2Dkinem_2dmotion Q2

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 8.02 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.27 m, and moves at a constant speed of 2.5 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.18 radians.

   B. 0.21 radians.

   C. 0.24 radians.

   D. 0.28 radians.

   E. 0.32 radians.

a03_2Dkinem_2dmotion Q3

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 5.19 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.76 m, and moves at a constant speed of 2.86 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.44 radians.

   B. 0.51 radians.

   C. 0.58 radians.

   D. 0.67 radians.

   E. 0.77 radians.

a03_2Dkinem_2dmotion Q4

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 5.11 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.69 m, and moves at a constant speed of 2.23 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.26 radians.

   B. 0.3 radians.

   C. 0.34 radians.

   D. 0.39 radians.

   E. 0.45 radians.

a03_2Dkinem_2dmotion Q5

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 7.18 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.15 m, and moves at a constant speed of 2.88 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.24 radians.

   B. 0.27 radians.

   C. 0.31 radians.

   D. 0.36 radians.

   E. 0.41 radians.

a03_2Dkinem_2dmotion Q6

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 6.27 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.38 m, and moves at a constant speed of 2.94 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.42 radians.

   B. 0.49 radians.

   C. 0.56 radians.

   D. 0.65 radians.

   E. 0.74 radians.

a03_2Dkinem_2dmotion Q7

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 5.72 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2 m, and moves at a constant speed of 2.02 m/s in the +y direction. What is the value of θ (in radians)?

   A. 0.21 radians.

   B. 0.24 radians.

   C. 0.27 radians.

   D. 0.31 radians.

   E. 0.36 radians.

a03_2Dkinem_2dmotion Q8

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 5.42 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.27 m, and moves at a constant speed of 2.17 m/s in the +y direction. What is the value of θ (in radians)?
   - A. 0.27 radians.
   - B. 0.31 radians.
   - C. 0.36 radians.
   - **D. 0.41 radians.**
   - E. 0.47 radians.

a03_2Dkinem_2dmotion Q9

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 8.61 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.5 m, and moves at a constant speed of 2.43 m/s in the +y direction. What is the value of θ (in radians)?
   - A. 0.16 radians.
   - B. 0.19 radians.
   - C. 0.22 radians.
   - D. 0.25 radians.
   - **E. 0.29 radians.**

a03_2Dkinem_2dmotion Q10

1. At time, t=0, two particles are on the x axis. Particle A is (initially) at the origin and moves at a constant speed of 8.49 m/s at an angle of θ above the x-axis. Particle B is initially situated at x= 2.73 m, and moves at a constant speed of 2.09 m/s in the +y direction. What is the value of θ (in radians)?
   - A. 0.14 radians.
   - B. 0.16 radians.
   - C. 0.19 radians.
   - D. 0.22 radians.
   - **E. 0.25 radians.**

4 a03_2Dkinem_smithtrain

1. The Smith family is having fun on a high speed train travelling at 49.8 m/s. Mr. Smith is at the back of the train and fires a pellet gun with a muzzle speed of 22.4 m/s at Mrs. Smith who is at the front of the train. What is the speed of the bullet with respect to Earth?[13]
   - A. 14.3 m/s.
   - B. 21.4 m/s.
   - C. 32.1 m/s.
   - D. 48.1 m/s.
   - **E. 72.2 m/s.**

2. The Smith family is having fun on a high speed train travelling at 49.8 m/s. Mrs. Smith, who is at the front of the train, fires straight towards the back with a bullet that is going forward with respect to Earth at a speed of 26.4 m/s. What was the muzzle speed of her bullet?[14]

A. 15.6 m/s.

B. 23.4 m/s.

C. 35.1 m/s.

D. 52.7 m/s.

E. 79 m/s.

3. The Smith family is having fun on a high speed train travelling at 49.8 m/s. The daugher fires at Mr. Smith with a pellet gun whose muzzle speed is 29.2 m/s. She was situated across the isle, perpendicular to the length of the train. What is the speed of her bullet with respect to Earth?[15]

A. 17.1 m/s.

B. 25.7 m/s.

C. 38.5 m/s.

D. 57.7 m/s.

E. 86.6 m/s.

4. The Smith family got in trouble for having fun on a high speed train travelling at 49.8 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 91.8 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?[16]

A. 64.3 m/s.

B. 77.1 m/s.

C. 92.5 m/s.

D. 111.1 m/s.

E. 133.3 m/s.

4.1 Renditions

a03_2Dkinem_smithtrain Q1

1. The Smith family got in trouble for having fun on a high speed train travelling at 48.8 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 92.5 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

A. 45.5 m/s.

B. 54.6 m/s.

C. 65.5 m/s.

D. 78.6 m/s.

E. 94.3 m/s.

a03_2Dkinem_smithtrain Q2

1. The Smith family got in trouble for having fun on a high speed train travelling at 48.1 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 92.7 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

A. 38.2 m/s.

B. 45.9 m/s.

C. 55 m/s.

D. 66 m/s.

E. 79.2 m/s.

a03_2Dkinem_smithtrain Q3

1. The Smith family got in trouble for having fun on a high speed train travelling at 48.4 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 89.1 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

   A. 74.8 m/s.

   B. 89.8 m/s.

   C. 107.7 m/s.

   D. 129.3 m/s.

   E. 155.1 m/s.

a03_2Dkinem_smithtrain Q4

1. The Smith family got in trouble for having fun on a high speed train travelling at 47.5 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 94.6 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

   A. 81.8 m/s.

   B. 98.2 m/s.

   C. 117.8 m/s.

   D. 141.4 m/s.

   E. 169.6 m/s.

a03_2Dkinem_smithtrain Q5

1. The Smith family got in trouble for having fun on a high speed train travelling at 42.3 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 84.5 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

   A. 73.2 m/s.

   B. 87.8 m/s.

   C. 105.3 m/s.

   D. 126.4 m/s.

   E. 151.7 m/s.

a03_2Dkinem_smithtrain Q6

1. The Smith family got in trouble for having fun on a high speed train travelling at 47.1 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 95.6 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?

   A. 69.3 m/s.

   B. 83.2 m/s.

   C. 99.8 m/s.

   D. 119.8 m/s.

   E. 143.8 m/s.

a03_2Dkinem_smithtrain Q7

1. The Smith family got in trouble for having fun on a high speed train travelling at 47.6 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 88.1 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?
   - A. 35.8 m/s.
   - B. 42.9 m/s.
   - C. 51.5 m/s.
   - D. 61.8 m/s.
   - **E. 74.1 m/s.**

a03_2Dkinem_smithtrain Q8

1. The Smith family got in trouble for having fun on a high speed train travelling at 47.6 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 90.4 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?
   - A. 53.4 m/s.
   - B. 64 m/s.
   - **C. 76.9 m/s.**
   - D. 92.2 m/s.
   - E. 110.7 m/s.

a03_2Dkinem_smithtrain Q9

1. The Smith family got in trouble for having fun on a high speed train travelling at 47.6 m/s. Mr. Smith is charged with having fired a pellet gun at his daughter (directly across the isle) with a bullet that had a speed of 97 m/s with respect to Earth. How fast was the bullet going relative to the daughter (i.e. train)?
   - A. 40.8 m/s.
   - B. 48.9 m/s.
   - C. 58.7 m/s.
   - D. 70.4 m/s.
   - **E. 84.5 m/s.**

5 a04DynForce Newton_forces

1. A mass with weight (mg) of 44 newtons is suspended symmetrically from two strings. The angle between the two strings (i.e. where they are attached to the mass) is 60 degrees. What is the tension in the string?[17]
   - A. 16.7 N.
   - B. 19.2 N.
   - C. 22.1 N.
   - **D. 25.4 N.**
   - E. 29.2 N.

2. A mass with weight (mg) equal to 25 newtons is suspended symmetrically from two strings. Each string makes the (same) angle of 69 degrees with respect to the horizontal. What is the tension in each string?[18]
   - A. 10.1 N.
   - B. 11.6 N.

C. 13.4 N.

D. 15.4 N.

E. 17.7 N.

3. A 4.5 kg mass is sliding along a surface that has a kinetic coefficient of friction equal to 0.37 . In addition to the surface friction, there is also an air drag equal to 29 N. What is the magnitude (absolute value) of the acceleration?[19]

   A. 5.8 m/s^2.

   B. 6.6 m/s^2.

   C. 7.6 m/s^2.

   D. 8.8 m/s^2.

   E. 10.1 m/s^2.

4. A mass with weight (mg) 7.3 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 3.94 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction? [20]

   A. 0.37

   B. 0.44

   C. 0.53

   D. 0.64

   E. 0.77

5.1 Renditions

a04DynForce Newton_forces Q1

1. A mass with weight (mg) 5.3 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 3.05 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.34

   B. 0.4

   C. 0.49

   D. 0.58

   E. 0.7

a04DynForce Newton_forces Q2

1. A mass with weight (mg) 8.7 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 4.08 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.31

   B. 0.37

   C. 0.44

   D. 0.53

   E. 0.64

a04DynForce Newton_forces Q3

1. A mass with weight (mg) 7.9 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 1.64 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.1

   B. 0.12

   C. 0.14

   D. 0.17

   E. 0.2

a04DynForce Newton_forces Q4

1. A mass with weight (mg) 10.8 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 4.53 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.38

   B. 0.46

   C. 0.55

   D. 0.66

   E. 0.79

a04DynForce Newton_forces Q5

1. A mass with weight (mg) 11 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 2.77 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.12

   B. 0.14

   C. 0.17

   D. 0.21

   E. 0.25

a04DynForce Newton_forces Q6

1. A mass with weight (mg) 6.8 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 2.5 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.19

   B. 0.23

   C. 0.27

   D. 0.33

   E. 0.39

a04DynForce Newton_forces Q7

1. A mass with weight (mg) 6 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 3.2 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.52

   B. 0.63

   C. 0.76

   D. 0.91

   E. 1.09

a04DynForce Newton_forces Q8

1. A mass with weight (mg) 8.9 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 5.12 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.7

   B. 0.84

   C. 1.01

   D. 1.21

   E. 1.45

a04DynForce Newton_forces Q9

1. A mass with weight (mg) 8.7 newtons is on a horzontal surface. It is being pulled on by a string at an angle of 30 degrees above the horizontal, with a force equal to 4.08 newtons. If this is the maximum force before the block starts to move, what is the static coefficient of friction?

   A. 0.44

   B. 0.53

   C. 0.64

   D. 0.76

   E. 0.92

6 a04DynForce Newton_sled

1. A sled of mass 5.4 kg is at rest on a rough surface. A string pulls with a tension of 43.4N at an angle of 31 degrees above the horizontal. What is the magnitude of the friction?[21]

   A. 24.46 N.

   B. 28.13 N.

   C. 32.35 N.

   D. 37.2 N.

   E. 42.78 N.

2. A sled of mass 5.3 kg is at rest on a rough surface. A string pulls with a tension of 44.9N at an angle of 57 degrees above the horizontal. What is the normal force?[22]

   A. 8.17 N.

   B. 9.39 N.

C. 10.8 N.

D. 12.42 N.

E. 14.28 N.

3. A sled of mass 5.9 kg is at rest on a perfectly smooth surface. A string pulls with a tension of 47.3N at an angle of 48 degrees above the horizontal. How long will it take to reach a speed of 10.8 m/s?[23]

A. 1.15 s

B. 1.32 s

C. 1.52 s

D. 1.75 s

E. 2.01 s

4. A sled of mass 2.1 kg is on perfectly smooth surface. A string pulls with a tension of 17.5N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2.8 m/s^2?[24]

A. 70.4 degrees

B. 80.9 degrees

C. 93.1 degrees

D. 107 degrees

E. 123.1 degrees

6.1 Renditions

a04DynForce Newton_sled Q1

1. A sled of mass 2.3 kg is on perfectly smooth surface. A string pulls with a tension of 18.3N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2.8 m/s^2?

A. 69.4 degrees

B. 79.8 degrees

C. 91.8 degrees

D. 105.5 degrees

E. 121.4 degrees

a04DynForce Newton_sled Q2

1. A sled of mass 2.6 kg is on perfectly smooth surface. A string pulls with a tension of 16.4N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 3.1 m/s^2?

A. 34.6 degrees

B. 39.8 degrees

C. 45.8 degrees

D. 52.7 degrees

E. 60.6 degrees

a04DynForce Newton_sled Q3

1. A sled of mass 2.6 kg is on perfectly smooth surface. A string pulls with a tension of 19.3N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2.5 m/s^2?
   - **A. 70.3 degrees**
   - B. 80.9 degrees
   - C. 93 degrees
   - D. 106.9 degrees
   - E. 123 degrees

a04DynForce Newton_sled Q4

1. A sled of mass 2.5 kg is on perfectly smooth surface. A string pulls with a tension of 18.1N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2 m/s^2?
   - **A. 74 degrees**
   - B. 85.1 degrees
   - C. 97.8 degrees
   - D. 112.5 degrees
   - E. 129.4 degrees

a04DynForce Newton_sled Q5

1. A sled of mass 2.2 kg is on perfectly smooth surface. A string pulls with a tension of 17.2N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 3.5 m/s^2?
   - A. 36.3 degrees
   - B. 41.7 degrees
   - C. 47.9 degrees
   - D. 55.1 degrees
   - **E. 63.4 degrees**

a04DynForce Newton_sled Q6

1. A sled of mass 2.5 kg is on perfectly smooth surface. A string pulls with a tension of 17.7N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 3.1 m/s^2?
   - A. 48.4 degrees
   - B. 55.7 degrees
   - **C. 64 degrees**
   - D. 73.6 degrees
   - E. 84.7 degrees

a04DynForce Newton_sled Q7

1. A sled of mass 2.6 kg is on perfectly smooth surface. A string pulls with a tension of 19.2N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2.4 m/s^2?
   - A. 53.7 degrees
   - B. 61.8 degrees
   - **C. 71 degrees**
   - D. 81.7 degrees
   - E. 93.9 degrees

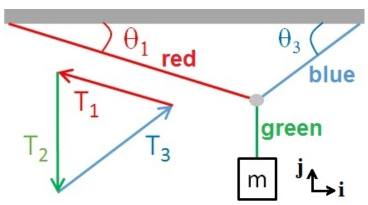
a04DynForce Newton_sled Q8

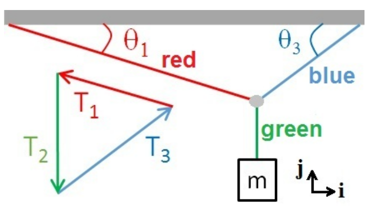
1. A sled of mass 2 kg is on perfectly smooth surface. A string pulls with a tension of 17.4N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 2.9 m/s^2?
   - A. 53.3 degrees
   - B. 61.3 degrees
   - **C. 70.5 degrees**
   - D. 81.1 degrees
   - E. 93.3 degrees

a04DynForce Newton_sled Q9

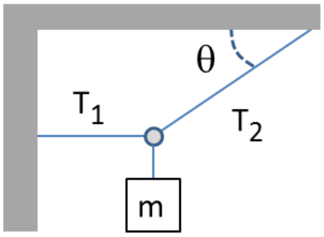
1. A sled of mass 2.1 kg is on perfectly smooth surface. A string pulls with a tension of 17.7N. At what angle above the horizontal must the string pull in order to achieve an accelerations of 3.6 m/s^2?
   - A. 56.3 degrees
   - **B. 64.7 degrees**
   - C. 74.4 degrees
   - D. 85.6 degrees
   - E. 98.4 degrees

7 a04DynForce Newton_tensions

1. 

In the figure shown, θ_1 is 18 degrees, and θ_3 is 34 degrees. The tension T_3 is 24 N. What is the tension, T_1? [25]
   - A. 15.82 N.
   - B. 18.19 N.
   - **C. 20.92 N.**
   - D. 24.06 N.
   - E. 27.67 N.
2. 

In the figure shown, θ_1 is 18 degrees, and θ_3 is 34 degrees. The tension T_3 is 24 N. What is the weight?[26]
   - A. 13.1 N.
   - B. 15 N.
   - C. 17.3 N.
   - **D. 19.9 N.**
   - E. 22.9 N.

3. 

In the figure shown, θ is 35 degrees, and the mass is 3.8 kg. What is T_2? [27]

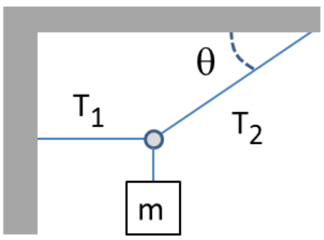
A. 56.46 N.

B. 64.93 N.

C. 74.66 N.

D. 85.86 N.

E. 98.74 N.

4. 

In the figure shown, θ is 35 degrees, and the mass is 3.8 kg. What is T_1?[28]

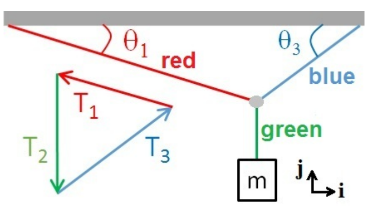
A. 30.8 N.

B. 36.9 N.

C. 44.3 N.

D. 53.2 N.

E. 63.8 N.

5. 

In the figure shown, θ_1 is 15 degrees , and θ_3 is 40 degrees . The mass has a 'weight' of 26 N. What is the tension, T_1? [29]

A. 15.99 N.

B. 18.39 N.

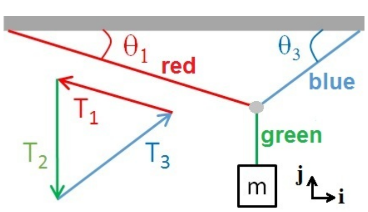
C. 21.14 N.

D. 24.31 N.

E. 27.96 N.

7.1 Renditions

a04DynForce Newton_tensions Q1

1. 

In the figure shown, θ_1 is 16 degrees , and θ_3 is 30 degrees . The mass has a 'weight' of 44 N. What is the tension, T_1?

A. 34.83 N.

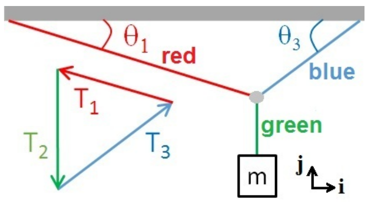
B. 40.05 N.

C. 46.06 N.

D. 52.97 N.

E. 60.92 N.

a04DynForce Newton_tensions Q2

1. 

In the figure shown, θ_1 is 17 degrees , and θ_3 is 33 degrees . The mass has a 'weight' of 33 N. What is the tension, T_1?

   A. 27.32 N.

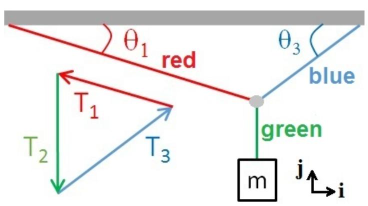
   B. 31.42 N.

   C. 36.13 N.

   D. 41.55 N.

   E. 47.78 N.

a04DynForce Newton_tensions Q3

1. 

In the figure shown, θ_1 is 16 degrees , and θ_3 is 35 degrees . The mass has a 'weight' of 28 N. What is the tension, T_1?

   A. 19.41 N.

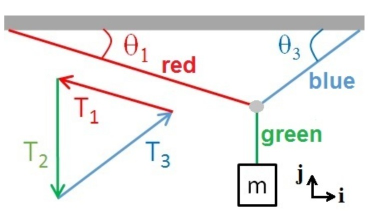
   B. 22.32 N.

   C. 25.66 N.

   D. 29.51 N.

   E. 33.94 N.

a04DynForce Newton_tensions Q4

1. 

In the figure shown, θ_1 is 17 degrees , and θ_3 is 29 degrees . The mass has a "weight" of 29 N. What is the tension, T_1?

   A. 20.16 N.

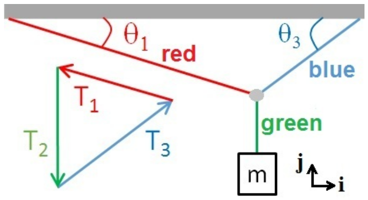
   B. 23.18 N.

   C. 26.66 N.

   D. 30.66 N.

   E. 35.26 N.

a04DynForce Newton_tensions Q5

1. 

In the figure shown, θ_1 is 20 degrees , and θ_3 is 31 degrees . The mass has a "weight" of 36 N. What is the tension, T_1?

   A. 22.7 N.

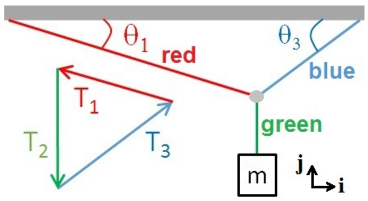
   B. 26.11 N.

   C. 30.02 N.

   D. 34.53 N.

   E. 39.71 N.

a04DynForce Newton_tensions Q6

1. 

In the figure shown, θ_1 is 18 degrees , and θ_3 is 29 degrees . The mass has a "weight" of 50 N. What is the tension, T_1?

   A. 34.19 N.

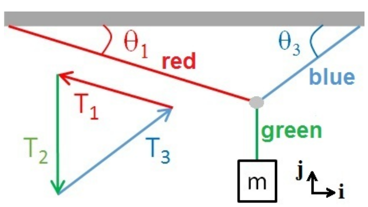
   B. 39.32 N.

   C. 45.21 N.

   D. 52 N.

   E. 59.79 N.

a04DynForce Newton_tensions Q7

1. 

In the figure shown, θ_1 is 20 degrees , and θ_3 is 37 degrees . The mass has a "weight" of 41 N. What is the tension, T_1?

   A. 29.52 N.

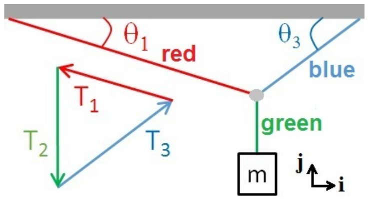
   B. 33.95 N.

   C. 39.04 N.

   D. 44.9 N.

   E. 51.63 N.

a04DynForce Newton_tensions Q8

1. 

In the figure shown, θ_1 is 20 degrees , and θ_3 is 33 degrees . The mass has a "weight" of 31 N. What is the tension, T_1?

   A. 32.55 N.

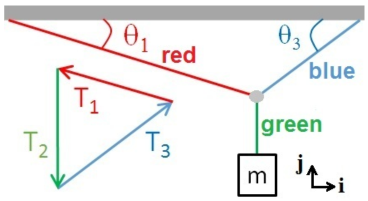
   B. 37.44 N.

   C. 43.05 N.

   D. 49.51 N.

   E. 56.94 N.

a04DynForce Newton_tensions Q9

1. 

In the figure shown, θ_1 is 17 degrees , and θ_3 is 39 degrees . The mass has a "weight" of 42 N. What is the tension, T_1?

   A. 34.24 N.

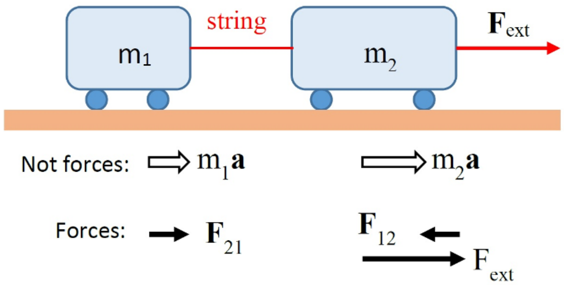
   B. 39.37 N.

   C. 45.28 N.

   D. 52.07 N.

   E. 59.88 N.

8 a05frictDragElast_3rdLaw



1. In the figure shown above, the mass of m_1 is 5.4 kg, and the mass of m_2 is 3.2 kg. If the external force, F_{ext} on m_2 is 104 N, what is the tension in the connecting string? Assume no friction is present.[30]

   A. 56.8 N

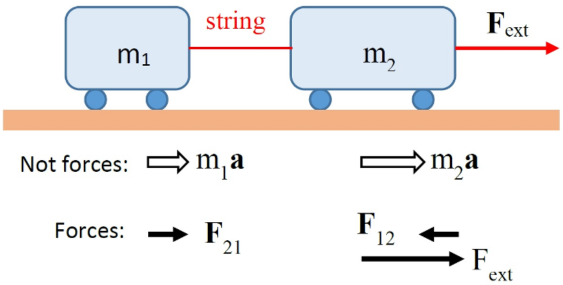
   B. 65.3 N

   C. 75.1 N

   D. 86.4 N

   E. 99.3 N

2.



In the figure shown above (with m_1 = 5.4 kg, m_2 = 3.2 kg, and F_{ext} = 104 N), what is the acceleration? Assume no friction is present. [31]

A. 9.1 m/s^2

B. 10.5 m/s^2

C. 12.1 m/s^2

D. 13.9 m/s^2

E. 16 m/s^2

3. Nine barefoot baseball players, with a total mass of 647 kg plays tug of war against five basketball players wearing shoes that provide a static coefficient of friction of 0.58 . The net mass of the (shoed) basketball team is 392 kg. What is the maximum coefficient of the barefoot boys if they lose?[32]

A. 0.351

B. 0.387

C. 0.425

D. 0.468

E. 0.514

4. Without their shoes, members of a 9 person baseball team have a coefficient of static friction of only 0.23 . But the team wins a game of tug of war due to their superior mass of 638 kg. They are playing against a 5 person basketball team with a net mass of 415 kg. What is the maximum coefficient of static friction of the basketball team? [33]

A. 0.321

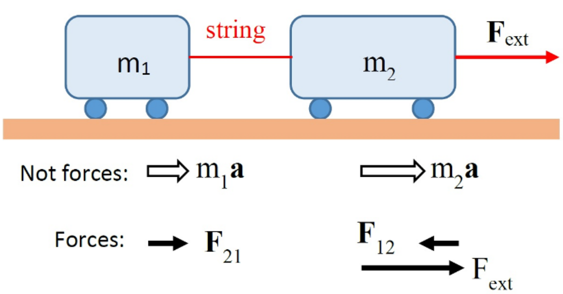
B. 0.354

C. 0.389

D. 0.428

E. 0.471

5.



In the figure shown above, the mass of m_1 is 6.6 kg, and the mass of m_2 is 2.6 kg. If the external force, F_{ext} on m_2 is 126 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.37, and that for m_2 the coefficient is 0.44 .[34]

A. 67.4 N

B. 77.5 N

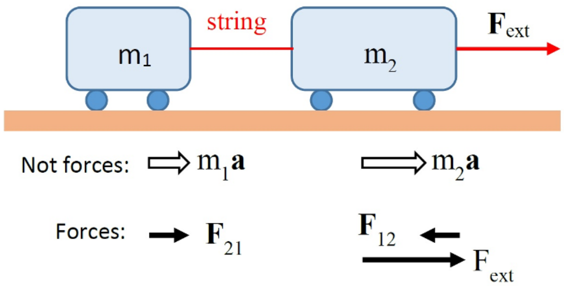
C. 89.1 N

D. 102.5 N

E. 117.9 N

8.1 Renditions

a05frictDragElast_3rdLaw Q1



1. In the figure shown above, the mass of m_1 is 6.9 kg, and the mass of m_2 is 3 kg. If the external force, F_{ext} on m_2 is 131 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.31, and that for m_2 the coefficient is 0.49 .

   A. 76.2 N

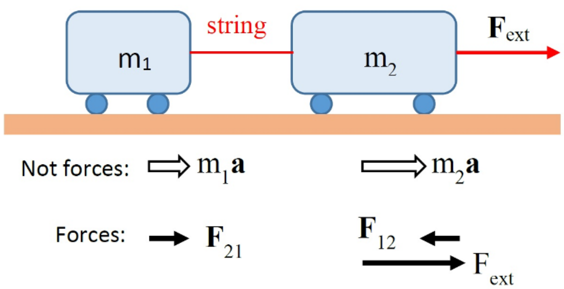
   B. 87.6 N

   C. 100.8 N

   D. 115.9 N

   E. 133.3 N

a05frictDragElast_3rdLaw Q2



1. In the figure shown above, the mass of m_1 is 5.7 kg, and the mass of m_2 is 3.1 kg. If the external force, F_{ext} on m_2 is 137 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.34, and that for m_2 the coefficient is 0.47 .

   A. 56.7 N

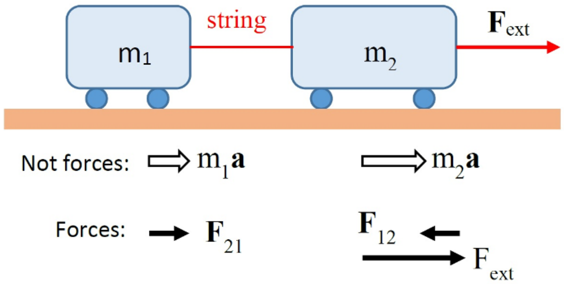
   B. 65.2 N

   C. 74.9 N

   D. 86.2 N

   E. 99.1 N

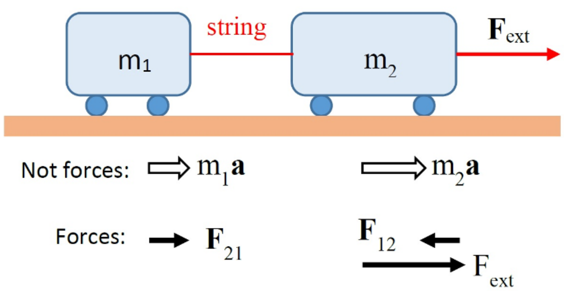
a05frictDragElast_3rdLaw Q3



1. In the figure shown above, the mass of m_1 is 5.7 kg, and the mass of m_2 is 2.5 kg. If the external force, F_{ext} on m_2 is 159 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.34, and that for m_2 the coefficient is 0.46 .

   A. 82 N
   B. 94.3 N
   C. 108.5 N
   D. 124.8 N
   E. 143.5 N

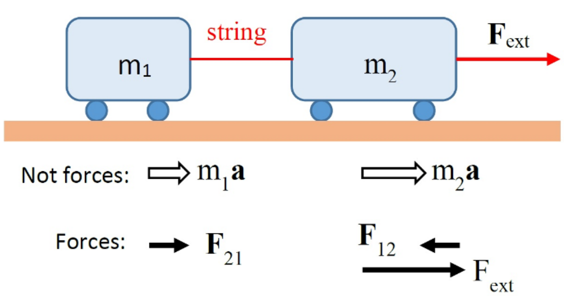
a05frictDragElast_3rdLaw Q4



1. In the figure shown above, the mass of m_1 is 6.9 kg, and the mass of m_2 is 2.5 kg. If the external force, F_{ext} on m_2 is 165 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.35, and that for m_2 the coefficient is 0.44 .

   A. 68.3 N
   B. 78.6 N
   C. 90.4 N
   D. 103.9 N
   E. 119.5 N

a05frictDragElast_3rdLaw Q5



1. In the figure shown above, the mass of m_1 is 6.5 kg, and the mass of m_2 is 2.9 kg. If the external force, F_{ext} on

m_2 is 132 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.37, and that for m_2 the coefficient is 0.48 .

A. 89.1 N

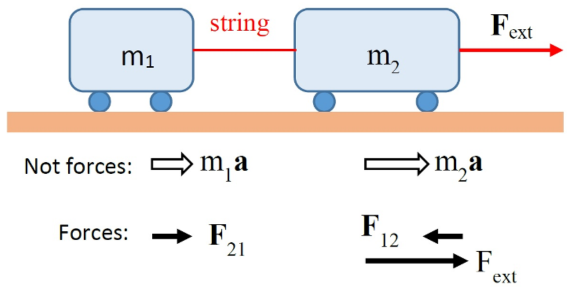
B. 102.5 N

C. 117.9 N

D. 135.5 N

E. 155.9 N

a05frictDragElast_3rdLaw Q6



1. In the figure shown above, the mass of m_1 is 6.8 kg, and the mass of m_2 is 3.3 kg. If the external force, F_{ext} on m_2 is 112 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.39, and that for m_2 the coefficient is 0.46 .

A. 48.6 N

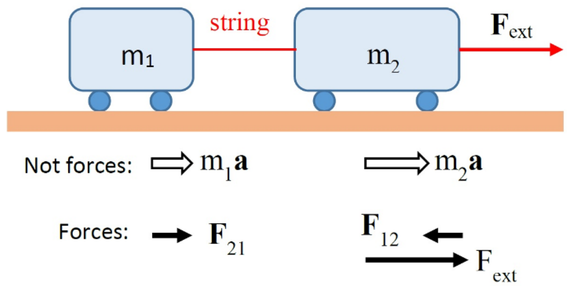
B. 55.9 N

C. 64.2 N

D. 73.9 N

E. 85 N

a05frictDragElast_3rdLaw Q7



1. In the figure shown above, the mass of m_1 is 6.5 kg, and the mass of m_2 is 3 kg. If the external force, F_{ext} on m_2 is 175 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.33, and that for m_2 the coefficient is 0.48 .

A. 66.7 N

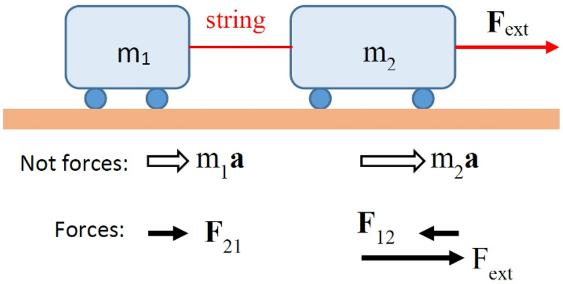
B. 76.7 N

C. 88.3 N

D. 101.5 N

E. 116.7 N

a05frictDragElast_3rdLaw Q8



1. In the figure shown above, the mass of m_1 is 6 kg, and the mass of m_2 is 3.2 kg. If the external force, F_{ext} on m_2 is 173 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.31, and that for m_2 the coefficient is 0.44 .

    A. 110.2 N

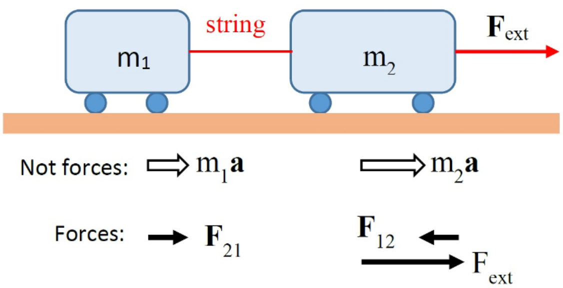
    B. 126.7 N

    C. 145.7 N

    D. 167.6 N

    E. 192.7 N

a05frictDragElast_3rdLaw Q9



1. In the figure shown above, the mass of m_1 is 5.2 kg, and the mass of m_2 is 2.9 kg. If the external force, F_{ext} on m_2 is 179 N, what is the tension in the connecting string? Assume that m_1 has a kinetic coefficient of friction equal to 0.36, and that for m_2 the coefficient is 0.46 .

    A. 74.4 N

    B. 85.5 N

    C. 98.3 N

    D. 113.1 N

    E. 130.1 N

9 a06uniformCircMotGravitation_friction

1. A merry-go-round has an angular frequency, ω, equal to 0.15 rad/sec. How many minutes does it take to complete 8.5 revolutions? [35]

    A. 4.49 minutes.

    B. 5.16 minutes.

    C. 5.93 minutes.

    D. 6.82 minutes.

E. 7.85 minutes.

2. A merry-go round has a period of 0.22 minutes. What is the centripetal force on a 81.2 kg person who is standing 1.64 meters from the center?[36]

   A. 26.2 newtons.

   B. 30.2 newtons.

   C. 34.7 newtons.

   D. 39.9 newtons.

   E. 45.9 newtons.

3. A merry-go round has a period of 0.22 minutes. What is the minimum coefficient of static friction that would allow a 81.2 kg person to stand1.64 meters from the center, without grabbing something?[37]

   A. 0.033

   B. 0.038

   C. 0.044

   D. 0.05

   E. 0.058

4. What is the gravitational acceleration on a plant that is 2.37 times more massive than Earth, and a radius that is 1.52 times greater than Earths?[38]

   A. 10.1 m/s^2

   B. 11.6 m/s^2

   C. 13.3 m/s^2

   D. 15.3 m/s^2

   E. 17.6 m/s^2

5. What is the gravitational acceleration on a plant that is 2.89 times more dense than Earth, and a radius that is 2.38 times greater than Earth's?[39]

   A. 58.6 m/s^2

   B. 67.4 m/s^2

   C. 77.5 m/s^2

   D. 89.1 m/s^2

   E. 102.5 m/s^2

9.1 Renditions

a06uniformCircMotGravitation_friction Q1

1. What is the gravitational acceleration on a plant that is 1.95 times more dense than Earth, and a radius that is 2.12 times greater than Earth's?

   A. 40.5 m/s^2

   B. 46.6 m/s^2

   C. 53.6 m/s^2

   D. 61.6 m/s^2

   E. 70.9 m/s^2

a06uniformCircMotGravitation_friction Q2

1. What is the gravitational acceleration on a plant that is 1.92 times more dense than Earth, and a radius that is 1.69 times greater than Earth's?
   - A. 24 m/s^2
   - B. 27.7 m/s^2
   - **C. 31.8 m/s^2**
   - D. 36.6 m/s^2
   - E. 42.1 m/s^2

a06uniformCircMotGravitation_friction Q3

1. What is the gravitational acceleration on a plant that is 1.94 times more dense than Earth, and a radius that is 2.35 times greater than Earth's?
   - A. 38.9 m/s^2
   - **B. 44.7 m/s^2**
   - C. 51.4 m/s^2
   - D. 59.1 m/s^2
   - E. 67.9 m/s^2

a06uniformCircMotGravitation_friction Q4

1. What is the gravitational acceleration on a plant that is 1.29 times more dense than Earth, and a radius that is 1.53 times greater than Earth's?
   - A. 12.7 m/s^2
   - B. 14.6 m/s^2
   - C. 16.8 m/s^2
   - **D. 19.3 m/s^2**
   - E. 22.2 m/s^2

a06uniformCircMotGravitation_friction Q5

1. What is the gravitational acceleration on a plant that is 2.98 times more dense than Earth, and a radius that is 1.81 times greater than Earth's?
   - A. 30.2 m/s^2
   - B. 34.8 m/s^2
   - C. 40 m/s^2
   - D. 46 m/s^2
   - **E. 52.9 m/s^2**

a06uniformCircMotGravitation_friction Q6

1. What is the gravitational acceleration on a plant that is 1.23 times more dense than Earth, and a radius that is 2.98 times greater than Earth's?
   - **A. 35.9 m/s^2**
   - B. 41.3 m/s^2
   - C. 47.5 m/s^2
   - D. 54.6 m/s^2
   - E. 62.8 m/s^2

a06uniformCircMotGravitation_friction Q7

1. What is the gravitational acceleration on a plant that is 1.73 times more dense than Earth, and a radius that is 2.44 times greater than Earth's?

   A. 41.4 m/s^2
   B. 47.6 m/s^2
   C. 54.7 m/s^2
   D. 62.9 m/s^2
   E. 72.4 m/s^2

a06uniformCircMotGravitation_friction Q8

1. What is the gravitational acceleration on a plant that is 1.23 times more dense than Earth, and a radius that is 1.83 times greater than Earth's?

   A. 19.2 m/s^2
   B. 22.1 m/s^2
   C. 25.4 m/s^2
   D. 29.2 m/s^2
   E. 33.5 m/s^2

a06uniformCircMotGravitation_friction Q9

1. What is the gravitational acceleration on a plant that is 1.47 times more dense than Earth, and a radius that is 1.42 times greater than Earth's?

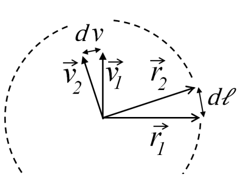
   A. 20.5 m/s^2
   B. 23.5 m/s^2
   C. 27.1 m/s^2
   D. 31.1 m/s^2
   E. 35.8 m/s^2

a06uniformCircMotGravitation_friction Q10

1. What is the gravitational acceleration on a plant that is 2.01 times more dense than Earth, and a radius that is 1.54 times greater than Earth's?

   A. 26.4 m/s^2
   B. 30.3 m/s^2
   C. 34.9 m/s^2
   D. 40.1 m/s^2
   E. 46.1 m/s^2

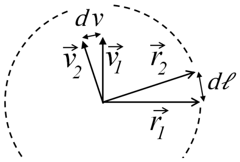
10 a06uniformCircMotGravitation_proof

1. 

   Is $dv/d\ell = v/r$ valid for uniform circular motion? [40]

A. Yes

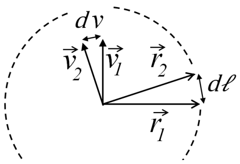
B. No

2. 

Is $dv/r = d\ell/v$ valid for uniform circular motion? [41]

A. Yes

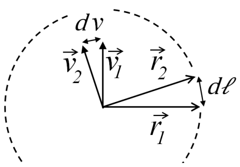
B. No

3. 

Is $rd\ell = vdv$ valid for uniform circular motion? [42]

A. Yes

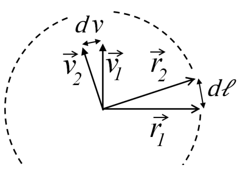
B. No

4. 

Is $dv = |\vec{v}_2| - |\vec{v}_1|$ valid for uniform circular motion? [43]

A. Yes

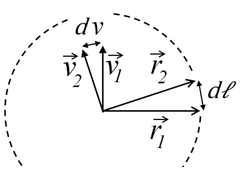
B. No

5. 

Is $d\ell/dv = v/r$ valid for uniform circular motion? [44]

A. Yes

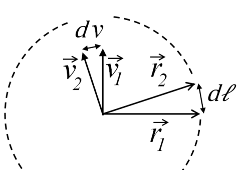
B. No

6. 

Is $dv/d\ell = r/v$ valid for uniform circular motion? [45]

A. Yes

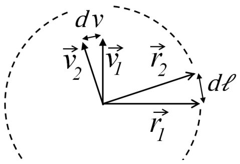
B. No

7. 

Is $dv = |\vec{v}_2 - \vec{v}_1|$ valid for uniform circular motion? [46]

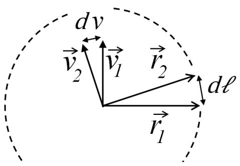
A. Yes

B. No

8. 

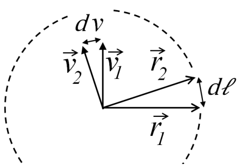
Is $d\ell = vdt$ valid for uniform circular motion? [47]

A. Yes
B. No

9. 

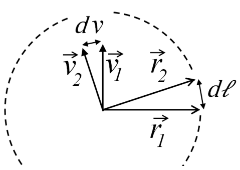
Is $adt/v = vdt/r$ valid for uniform circular motion? [48]

A. Yes
B. No

10. 

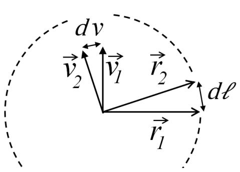
Is $dv = adt$ valid for uniform circular motion? [49]

A. Yes
B. No

11. 

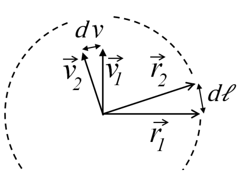
Is $|d\vec{v}| = adt$ valid for uniform circular motion? [50]

A. Yes
B. No

12. 

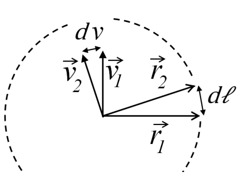
Is $d\ell = |\vec{r}_2 - \vec{r}_1|$ valid for uniform circular motion? [51]

A. Yes
B. No

13. 

Is $d\ell = |\vec{r}_2| - |\vec{r}_1|$ valid for uniform circular motion? [52]

A. Yes
B. No

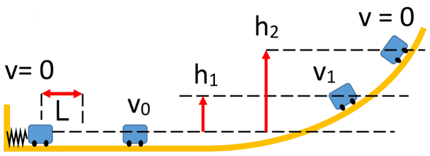
14. 

Is $v/d\ell = r/dv$ valid for uniform circular motion? [53]

A. Yes
B. No

11 a07energy_cart1

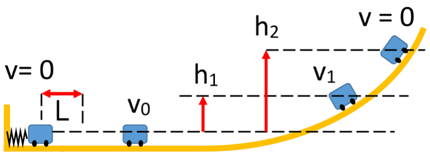
1. If the initial velocity after leaving the spring is 5.00 m/s, how high does it reach before coming to rest?



54

   A.) 1.10 m
   B.) 1.16 m
   C.) 1.21 m
   D.) 1.28 m
   E.) 1.34 m

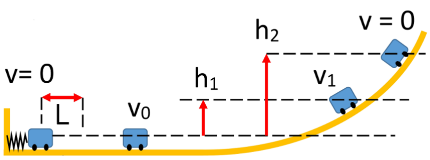
2. The mass of the cart is 2.0kg, and the spring constant is 5447N/m. If the initial compression of the spring is 0.10m, how high does it reach before coming to rest?



55

   A.) 1.32E+00 m
   B.) 1.39E+00 m
   C.) 1.46E+00 m
   D.) 1.53E+00 m
   E.) 1.61E+00 m

3. What is the highest point the cart reaches if the speed was 1.4m/s, when the cart was situated at a height of 2.2m?,



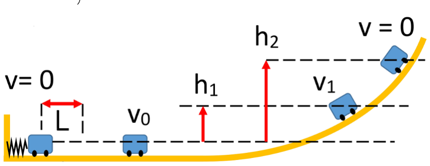
56

   A.) 2.00 m
   B.) 2.10 m
   C.) 2.20 m
   D.) 2.31 m
   E.) 2.43 m

11.1 Renditions

a07energy_cart1 Q1

1. What is the highest point the cart reaches if the speed was 2.8m/s, when the cart was situated at a height of 2.3m?,



A.) 2.19 m

B.) 2.30 m

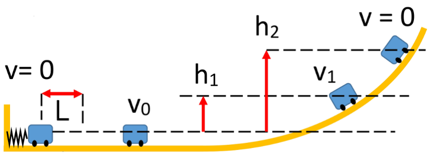
C.) 2.42 m

D.) 2.54 m

E.) 2.66 m

a07energy_cart1 Q2

1. What is the highest point the cart reaches if the speed was 2.2m/s, when the cart was situated at a height of 2.4m?,



A.) 1.97 m

B.) 2.07 m

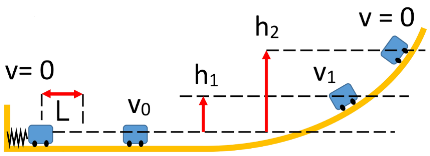
C.) 2.18 m

D.) 2.29 m

E.) 2.40 m

a07energy_cart1 Q3

1. What is the highest point the cart reaches if the speed was 2.4m/s, when the cart was situated at a height of 3.8m?,



A.) 3.28 m

B.) 3.45 m

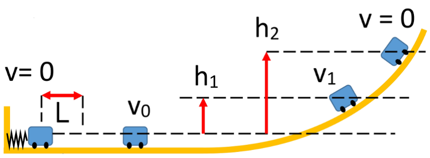
C.) 3.62 m

D.) 3.80 m

E.) 3.99 m

a07energy_cart1 Q4

1. What is the highest point the cart reaches if the speed was 1.4m/s, when the cart was situated at a height of 2.7m?,



A.) 2.70 m

B.) 2.84 m

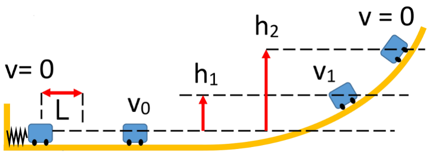
C.) 2.98 m

D.) 3.13 m

E.) 3.28 m

a07energy_cart1 Q5

1. What is the highest point the cart reaches if the speed was 2.4m/s, when the cart was situated at a height of 2.3m?,



A.) 1.99 m

B.) 2.09 m

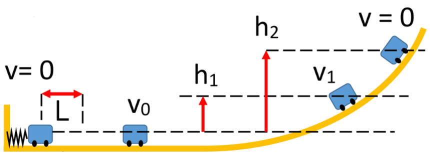
C.) 2.19 m

D.) 2.30 m

E.) 2.42 m

a07energy_cart1 Q6

1. What is the highest point the cart reaches if the speed was 2.1m/s, when the cart was situated at a height of 2.7m?,



A.) 2.45 m

B.) 2.57 m

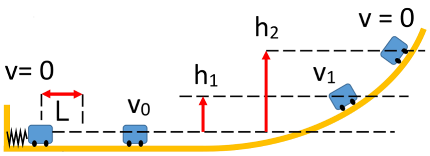
C.) 2.70 m

D.) 2.84 m

E.) 2.98 m

a07energy_cart1 Q7

1. What is the highest point the cart reaches if the speed was 2.5m/s, when the cart was situated at a height of 3.6m?,



A.) 3.43 m

B.) 3.60 m

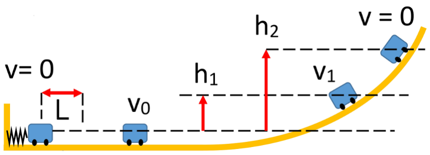
C.) 3.78 m

D.) 3.97 m

E.) 4.17 m

a07energy_cart1 Q8

1. What is the highest point the cart reaches if the speed was 1.8m/s, when the cart was situated at a height of 2.8m?,



A.) 2.42 m

B.) 2.54 m

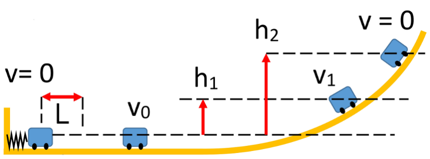
C.) 2.67 m

D.) 2.80 m

E.) 2.94 m

a07energy_cart1 Q9

1. What is the highest point the cart reaches if the speed was 2.7m/s, when the cart was situated at a height of 3.5m?,



A.) 2.88 m

B.) 3.02 m

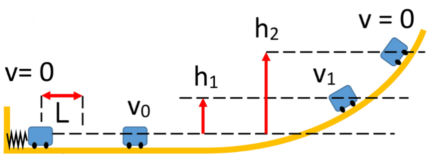
C.) 3.17 m

D.) 3.33 m

E.) 3.50 m

a07energy_cart1 Q10

1. What is the highest point the cart reaches if the speed was 2.7m/s, when the cart was situated at a height of 2.5m?,



A.) 2.06 m

B.) 2.16 m

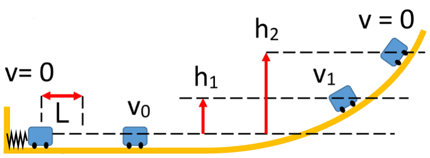
C.) 2.27 m

D.) 2.38 m

E.) 2.50 m

a07energy_cart1 Q11

1. What is the highest point the cart reaches if the speed was 2.9m/s, when the cart was situated at a height of 3.5m?,



A.) 2.88 m

B.) 3.02 m

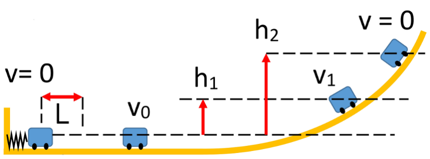
C.) 3.17 m

D.) 3.33 m

E.) 3.50 m

a07energy_cart1 Q12

1. What is the highest point the cart reaches if the speed was 1.5m/s, when the cart was situated at a height of 3.3m?,



A.) 3.14 m

B.) 3.30 m

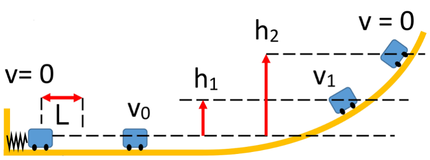
C.) 3.46 m

D.) 3.64 m

E.) 3.82 m

a07energy_cart1 Q13

1. What is the highest point the cart reaches if the speed was 2.4m/s, when the cart was situated at a height of 3.7m?,



A.) 3.52 m

B.) 3.70 m

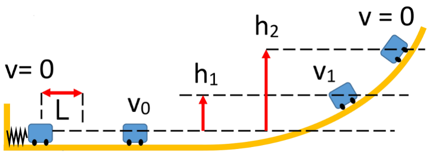
C.) 3.89 m

D.) 4.08 m

E.) 4.28 m

a07energy_cart1 Q14

1. What is the highest point the cart reaches if the speed was 2.6m/s, when the cart was situated at a height of 2.5m?,



A.) 2.27 m

B.) 2.38 m

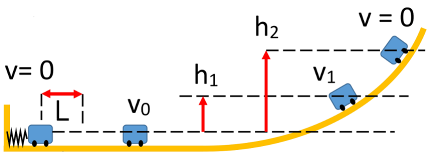
C.) 2.50 m

D.) 2.63 m

E.) 2.76 m

a07energy_cart1 Q15

1. What is the highest point the cart reaches if the speed was 2.4m/s, when the cart was situated at a height of 3.4m?,



A.) 3.24 m

B.) 3.40 m

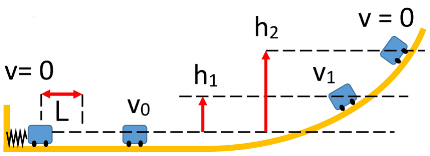
C.) 3.57 m

D.) 3.75 m

E.) 3.94 m

a07energy_cart1 Q16

1. What is the highest point the cart reaches if the speed was 1.8m/s, when the cart was situated at a height of 3.8m?,



A.) 3.28 m

B.) 3.45 m

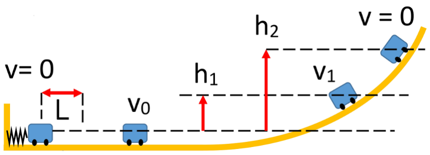
C.) 3.62 m

D.) 3.80 m

E.) 3.99 m

a07energy_cart1 Q17

1. What is the highest point the cart reaches if the speed was 1.5m/s, when the cart was situated at a height of 3.3m?,



A.) 3.30 m

B.) 3.46 m

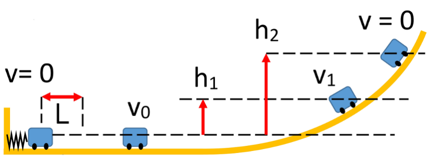
C.) 3.64 m

D.) 3.82 m

E.) 4.01 m

a07energy_cart1 Q18

1. What is the highest point the cart reaches if the speed was 2.6m/s, when the cart was situated at a height of 3.7m?,



A.) 3.52 m

B.) 3.70 m

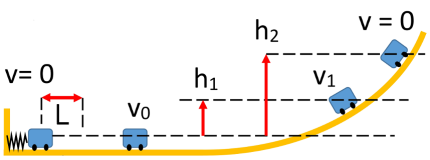
C.) 3.89 m

D.) 4.08 m

E.) 4.28 m

a07energy_cart1 Q19

1. What is the highest point the cart reaches if the speed was 1.6m/s, when the cart was situated at a height of 3.5m?,



A.) 3.33 m

B.) 3.50 m

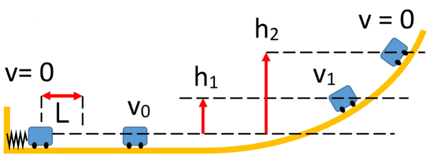
C.) 3.68 m

D.) 3.86 m

E.) 4.05 m

a07energy_cart1 Q20

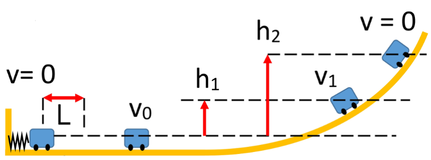
1. What is the highest point the cart reaches if the speed was 1.8m/s, when the cart was situated at a height of 2.5m?,



A.) 2.50 m
B.) 2.63 m
C.) 2.76 m
D.) 2.89 m
E.) 3.04 m

12 a07energy_cart2

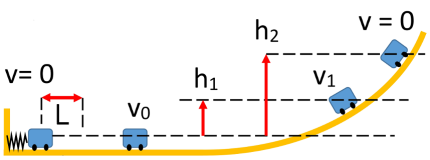
1. The spring constant is 561N/m, and the initial compression is 0.12m. What is the mass if the cart reaches a height of 1.38m,



before coming to rest?[57]

A.) 0.271 kg
B.) 0.284 kg
C.) 0.299 kg
D.) 0.314 kg
E.) 0.329 kg

2. The cart has a mass of 3.03kg. It is moving at a speed of 2.10m/s, when it is at a height of 2.45m. If the spring constant was 572N/m, what was the initial compression?



[58]

A.) 0.43 m
B.) 0.46 m
C.) 0.49 m
D.) 0.53 m
E.) 0.56 m

3. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?[59]

A.) 1.149 m/s
B.) 1.218 m/s
C.) 1.291 m/s
D.) 1.368 m/s
E.) 1.450 m/s

12.1 Renditions

a07energy_cart2 Q1

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   A.) 1.291 m/s
   B.) 1.368 m/s
   C.) 1.450 m/s
   D.) 1.537 m/s
   E.) 1.630 m/s

a07energy_cart2 Q2

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   A.) 1.022 m/s
   B.) 1.084 m/s
   C.) 1.149 m/s
   D.) 1.218 m/s
   E.) 1.291 m/s

a07energy_cart2 Q3

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   A.) 1.084 m/s
   B.) 1.149 m/s
   C.) 1.218 m/s
   D.) 1.291 m/s
   E.) 1.368 m/s

a07energy_cart2 Q4

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   A.) 1.218 m/s
   B.) 1.291 m/s
   C.) 1.368 m/s
   D.) 1.450 m/s
   E.) 1.537 m/s

a07energy_cart2 Q5

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   A.) 1.291 m/s
   B.) 1.368 m/s

C.) 1.450 m/s

D.) 1.537 m/s

E.) 1.630 m/s

a07energy_cart2 Q6

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

    A.) 1.218 m/s

    B.) 1.291 m/s

    C.) 1.368 m/s

    D.) 1.450 m/s

    E.) 1.537 m/s

a07energy_cart2 Q7

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

    A.) 1.022 m/s

    B.) 1.084 m/s

    C.) 1.149 m/s

    D.) 1.218 m/s

    E.) 1.291 m/s

a07energy_cart2 Q8

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

    A.) 1.218 m/s

    B.) 1.291 m/s

    C.) 1.368 m/s

    D.) 1.450 m/s

    E.) 1.537 m/s

a07energy_cart2 Q9

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

    A.) 1.084 m/s

    B.) 1.149 m/s

    C.) 1.218 m/s

    D.) 1.291 m/s

    E.) 1.368 m/s

a07energy_cart2 Q10

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   - A.) 1.022 m/s
   - B.) 1.084 m/s
   - C.) 1.149 m/s
   - D.) 1.218 m/s
   - **E.) 1.291 m/s**

a07energy_cart2 Q11

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   - A.) 1.022 m/s
   - B.) 1.084 m/s
   - C.) 1.149 m/s
   - D.) 1.218 m/s
   - **E.) 1.291 m/s**

a07energy_cart2 Q12

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   - A.) 1.218 m/s
   - **B.) 1.291 m/s**
   - C.) 1.368 m/s
   - D.) 1.450 m/s
   - E.) 1.537 m/s

a07energy_cart2 Q13

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   - **A.) 1.291 m/s**
   - B.) 1.368 m/s
   - C.) 1.450 m/s
   - D.) 1.537 m/s
   - E.) 1.630 m/s

a07energy_cart2 Q14

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?
   - A.) 1.149 m/s
   - B.) 1.218 m/s
   - **C.) 1.291 m/s**
   - D.) 1.368 m/s
   - E.) 1.450 m/s

a07energy_cart2 Q15

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.291 m/s

   B.) 1.368 m/s

   C.) 1.450 m/s

   D.) 1.537 m/s

   E.) 1.630 m/s

a07energy_cart2 Q16

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.084 m/s

   B.) 1.149 m/s

   C.) 1.218 m/s

   D.) 1.291 m/s

   E.) 1.368 m/s

a07energy_cart2 Q17

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.022 m/s

   B.) 1.084 m/s

   C.) 1.149 m/s

   D.) 1.218 m/s

   E.) 1.291 m/s

a07energy_cart2 Q18

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.149 m/s

   B.) 1.218 m/s

   C.) 1.291 m/s

   D.) 1.368 m/s

   E.) 1.450 m/s

a07energy_cart2 Q19

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.149 m/s

   B.) 1.218 m/s

   C.) 1.291 m/s

   D.) 1.368 m/s

   E.) 1.450 m/s

a07energy_cart2 Q20

1. You are riding a bicycle on a flat road. Assume no friction or air drag, and that you are coasting. Your speed is 4.9m/s, when you encounter a hill of height 1.14m. What is your speed at the top of the hill?

   A.) 1.291 m/s

   B.) 1.368 m/s

   C.) 1.450 m/s

   D.) 1.537 m/s

   E.) 1.630 m/s

13 a08linearMomentumCollisions

1. On object of mass 2.8 kg that is moving at a velocity of 23m/s collides with a stationary object of mass 20.47 kg. What is the final velocity if they stick? (Assume no external friction.)[60]

   A. 2.31m/s.

   B. 2.77m/s.

   C. 3.32m/s.

   D. 3.99m/s.

   E. 4.78m/s.

2. A car of mass 637 kg is driving on an icy road at a speed of 22 m/s, when it collides with a stationary truck. After the collision they stick and move at a speed of 7.7 m/s. What was the mass of the truck?[61]

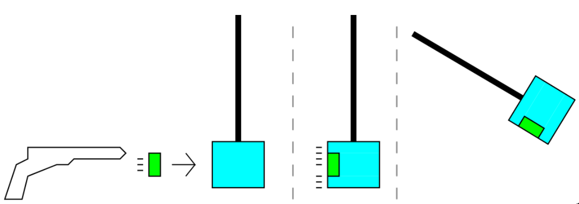
   A. 822

   B. 986

   C. 1183

   D. 1420

   E. 1704

3.  A 167 gm bullet strikes a ballistic pendulum of mass 2.1 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?[62]

   A. 37 m/s.

   B. 40 m/s.

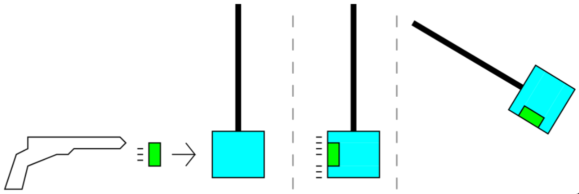
   C. 42 m/s.

   D. 45 m/s.

   E. 48 m/s.

13.1 Renditions

a08linearMomentumCollisions Q1

1.  A 159 gm bullet strikes a ballistic pendulum of mass 2.08 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

    A. 44 m/s.

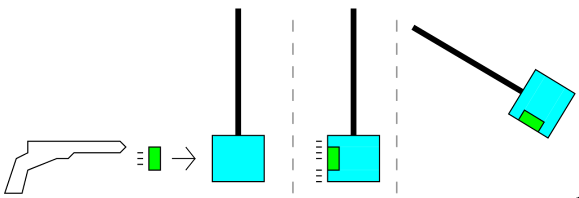
    B. 47 m/s.

    C. 50 m/s.

    D. 54 m/s.

    E. 58 m/s.

a08linearMomentumCollisions Q2

1.  A 171 gm bullet strikes a ballistic pendulum of mass 2.41 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

    A. 41 m/s.

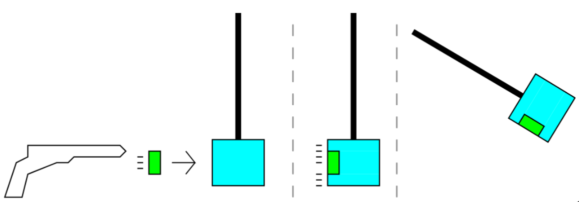
    B. 44 m/s.

    C. 47 m/s.

    D. 50 m/s.

    E. 54 m/s.

a08linearMomentumCollisions Q3

1.  A 157 gm bullet strikes a ballistic pendulum of mass 2.22 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

    A. 47 m/s.

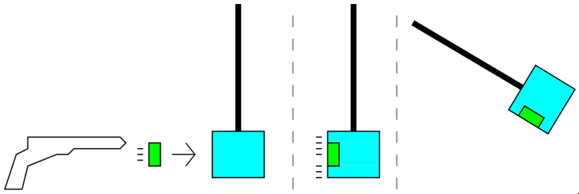
    B. 51 m/s.

    C. 54 m/s.

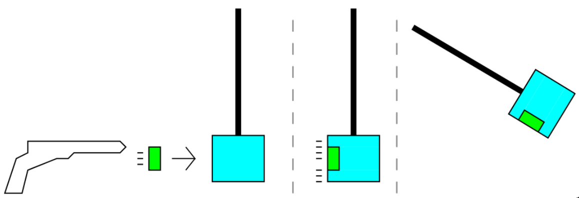
    D. 58 m/s.

    E. 62 m/s.

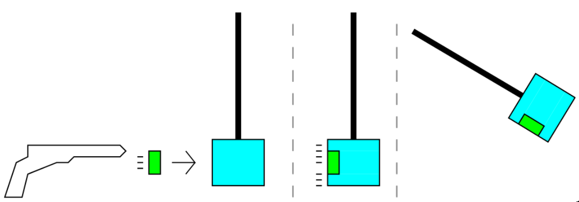
a08linearMomentumCollisions Q4

1.  A 195 gm bullet strikes a ballistic pendulum of mass 2.13 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?
   - A. 32 m/s.
   - B. 35 m/s.
   - C. 37 m/s.
   - D. 40 m/s.
   - **E. 43 m/s.**

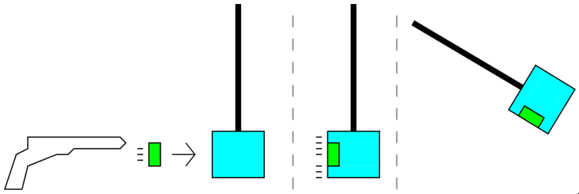
a08linearMomentumCollisions Q5

1.  A 191 gm bullet strikes a ballistic pendulum of mass 2.19 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?
   - A. 34 m/s.
   - B. 36 m/s.
   - C. 39 m/s.
   - D. 42 m/s.
   - **E. 44 m/s.**

a08linearMomentumCollisions Q6

1.  A 191 gm bullet strikes a ballistic pendulum of mass 2.02 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?
   - A. 34 m/s.
   - B. 36 m/s.
   - C. 39 m/s.
   - **D. 41 m/s.**
   - E. 44 m/s.

a08linearMomentumCollisions Q7

1.  A 159 gm bullet strikes a ballistic pendulum of mass 2.11 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 39 m/s.

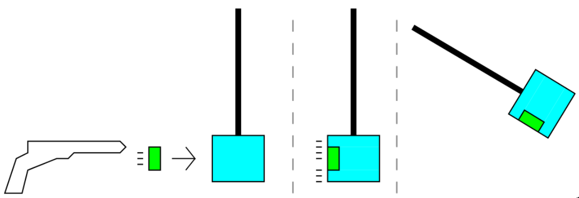
   B. 42 m/s.

   C. 44 m/s.

   D. 48 m/s.

   E. 51 m/s.

a08linearMomentumCollisions Q8

1.  A 169 gm bullet strikes a ballistic pendulum of mass 2.45 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 55 m/s.

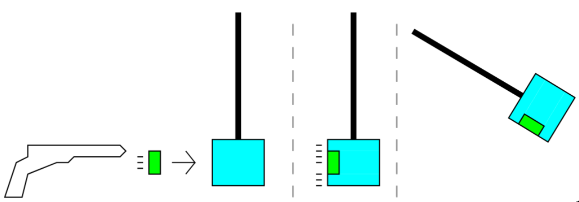
   B. 59 m/s.

   C. 63 m/s.

   D. 68 m/s.

   E. 73 m/s.

a08linearMomentumCollisions Q9

1.  A 161 gm bullet strikes a ballistic pendulum of mass 2.1 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 44 m/s.

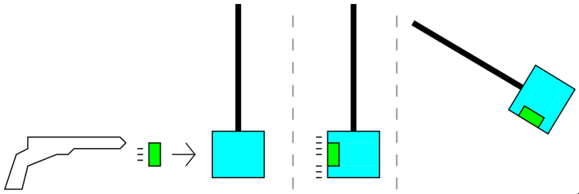
   B. 47 m/s.

   C. 50 m/s.

   D. 54 m/s.

   E. 57 m/s.

a08linearMomentumCollisions Q10

1.  A 159 gm bullet strikes a ballistic pendulum of mass 2.27 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 55 m/s.

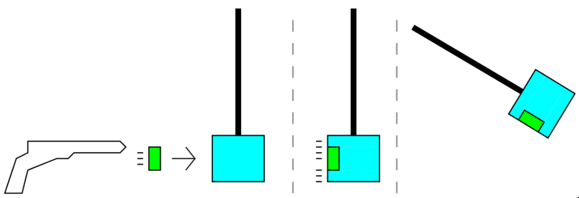
   B. 58 m/s.

   C. 62 m/s.

   D. 67 m/s.

   E. 71 m/s.

a08linearMomentumCollisions Q11

1.  A 167 gm bullet strikes a ballistic pendulum of mass 2.28 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 43 m/s.

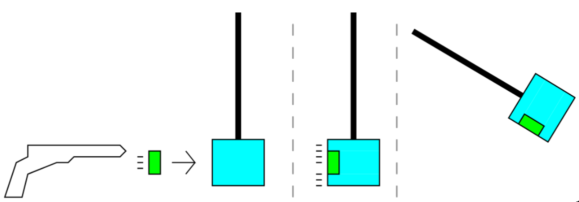
   B. 46 m/s.

   C. 49 m/s.

   D. 52 m/s.

   E. 56 m/s.

a08linearMomentumCollisions Q12

1.  A 164 gm bullet strikes a ballistic pendulum of mass 2.48 kg (before the bullet struck). After impact, the pendulum rises by 65 cm. What was the speed of the bullet?

   A. 54 m/s.

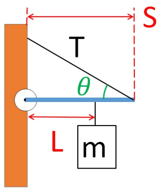
   B. 58 m/s.

   C. 62 m/s.

   D. 66 m/s.

   E. 70 m/s.

14 a09staticsTorques_torque

1. 

A massless bar of length, S = 7.6m is attached to a wall by a frictionless hinge (shown as a circle). The bar is held horizontal by a string that makes and angle θ = 37.4 degrees above the horizontal. An object of mass, M = 6kg is suspended at a length, L = 5.4m from the wall. What is the tension, T, in the string?[63]

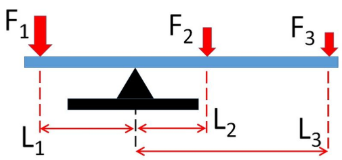
   A. 3.45E+01 N

   B. 4.34E+01 N

   C. 5.46E+01 N

   D. 6.88E+01 N

   E. 8.66E+01 N

2. 

In the figure shown, L_1 = 5.3m, L_2 = 4.3m and L_3 = 7.3m. What is F_1 if F_2 =3.6N and F_3 =5.1N?[64]

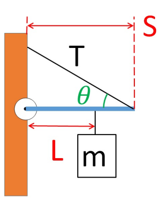
   A. 8.21E+00 N

   B. 9.95E+00 N

   C. 1.20E+01 N

   D. 1.46E+01 N

   E. 1.77E+01 N

3. 

A massless bar of length, S = 8.1m is attached to a wall by a frictionless hinge (shown as a circle). The bar is held horizontal by a string that makes and angle θ = 28.2 degrees above the horizontal. An object of mass, M = 9.2kg is suspended at a length, L = 5.7m from the wall. What is the x (horizontal) component of the force exerted by the wall on the horizontal bar?[65]

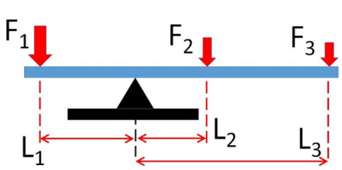
   A. 8.06E+01 N

   B. 9.77E+01 N

   C. 1.18E+02 N

   D. 1.43E+02 N

   E. 1.74E+02 N

4. 

In the figure shown, L_1 = 6.5m, L_2 = 4.5m and L_3 = 7.8m. What is F_2 if F_1 =0.56N and F_3 =0.4N?[66]

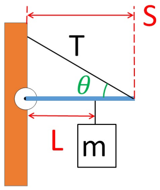
   A. 6.50E-02 N

B. 7.87E-02 N

C. 9.54E-02 N

D. 1.16E-01 N

E. 1.40E-01 N

5. 

A massless bar of length, S = 9.5m is attached to a wall by a frictionless hinge (shown as a circle). The bar is held horizontal by a string that makes and angle θ = 26.5 degrees above the horizontal. An object of mass, M = 6.8kg is suspended at a length, L =6.6m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?[67]

A. 1.39E+01 N

B. 1.68E+01 N

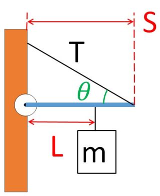
C. 2.03E+01 N

D. 2.46E+01 N

E. 2.99E+01 N

14.1 Renditions

a09staticsTorques_torque Q1

1. 

A massless bar of length, S = 7.6m is attached to a wall by a frictionless hinge (shown as a circle). The bar is held horizontal by a string that makes and angle θ = 27.6 degrees above the horizontal. An object of mass, M = 5.1kg is suspended at a length, L =6.2m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 7.60E+00 N

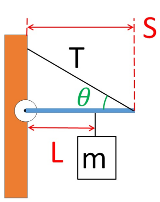
B. 9.21E+00 N

C. 1.12E+01 N

D. 1.35E+01 N

E. 1.64E+01 N

a09staticsTorques_torque Q2

1. 

A massless bar of length, S = 9.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar is held horizontal by a string that makes and angle θ = 27.4 degrees above the horizontal. An object of mass, M = 7.1kg is suspended at a length, L =5.2m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.70E+01 N

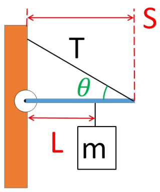
B. 3.27E+01 N

C. 3.96E+01 N

D. 4.79E+01 N

E. 5.81E+01 N

a09staticsTorques_torque Q3

1. 

A massless bar of length, S = 9.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 26 degrees above the horizontal. An object of mass, M = 8.5kg is suspended at a length, L =6.1m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.46E+01 N

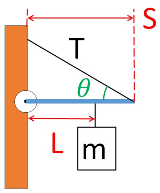
B. 1.77E+01 N

C. 2.14E+01 N

D. 2.60E+01 N

E. 3.15E+01 N

a09staticsTorques_torque Q4

1. 

A massless bar of length, S = 7.7m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 28.6 degrees above the horizontal. An object of mass, M = 6.2kg is suspended at a length, L =4.2m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.28E+01 N

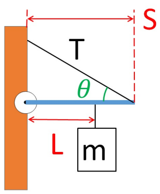
B. 2.76E+01 N

C. 3.35E+01 N

D. 4.05E+01 N

E. 4.91E+01 N

a09staticsTorques_torque Q5

1. 

A massless bar of length, S = 7.7m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 33.2 degrees above the horizontal. An object of mass, M = 8.2kg is suspended at a length, L =5.7m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.09E+01 N

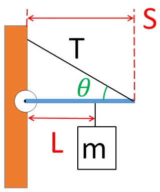
B. 2.53E+01 N

C. 3.06E+01 N

D. 3.71E+01 N

E. 4.50E+01 N

a09staticsTorques_torque Q6

1. 

A massless bar of length, S = 9.4m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 31.9 degrees above the horizontal. An object of mass, M = 5.7kg is suspended at a length, L =6.4m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.47E+01 N

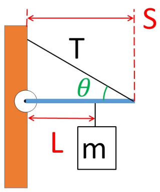
B. 1.78E+01 N

C. 2.16E+01 N

D. 2.62E+01 N

E. 3.17E+01 N

a09staticsTorques_torque Q7

1. 

A massless bar of length, S = 8.4m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 32.6 degrees above the horizontal. An object of mass, M = 5.2kg is suspended at a length, L =5.6m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.40E+01 N

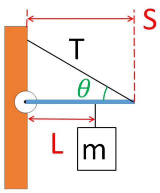
B. 1.70E+01 N

C. 2.06E+01 N

D. 2.49E+01 N

E. 3.02E+01 N

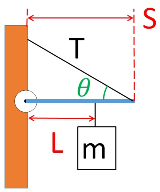
a09staticsTorques_torque Q8

1. 

A massless bar of length, S = 9.1m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 30.3 degrees above the horizontal. An object of mass, M = 5.8kg is suspended at a length, L =6.5m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.62E+01 N
B. 1.97E+01 N
C. 2.38E+01 N
D. 2.89E+01 N
E. 3.50E+01 N

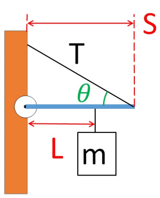
a09staticsTorques_torque Q9

1. 

A massless bar of length, S = 8.5m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 36 degrees above the horizontal. An object of mass, M = 7.4kg is suspended at a length, L =5.6m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.04E+01 N
B. 2.47E+01 N
C. 3.00E+01 N
D. 3.63E+01 N
E. 4.40E+01 N

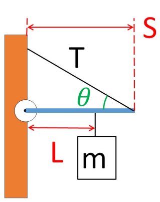
a09staticsTorques_torque Q10

1. 

A massless bar of length, S = 9m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 31.7 degrees above the horizontal. An object of mass, M = 9.8kg is suspended at a length, L =5.7m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 3.52E+01 N
B. 4.27E+01 N
C. 5.17E+01 N
D. 6.26E+01 N
E. 7.59E+01 N

a09staticsTorques_torque Q11

1. 

A massless bar of length, S = 7.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 31.4 degrees above the horizontal. An object of mass, M = 5.7kg is suspended at a length, L =6.4m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 6.83E+00 N

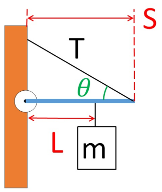
B. 8.28E+00 N

C. 1.00E+01 N

D. 1.21E+01 N

E. 1.47E+01 N

a09staticsTorques_torque Q12

1. 

A massless bar of length, S = 7.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 30 degrees above the horizontal. An object of mass, M = 6.4kg is suspended at a length, L =6.5m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.05E+01 N

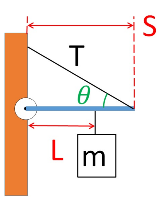
B. 1.27E+01 N

C. 1.53E+01 N

D. 1.86E+01 N

E. 2.25E+01 N

a09staticsTorques_torque Q13

1. 

A massless bar of length, S = 9.6m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 35 degrees above the horizontal. An object of mass, M = 5.1kg is suspended at a length, L =5.5m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.13E+01 N

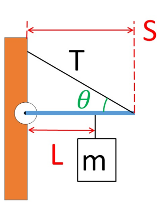
B. 2.59E+01 N

C. 3.13E+01 N

D. 3.80E+01 N

E. 4.60E+01 N

a09staticsTorques_torque Q14

1. 

A massless bar of length, S = 7.5m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 32.7 degrees above the horizontal. An object of mass, M = 8.5kg is suspended at a length, L =5.1m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.82E+01 N

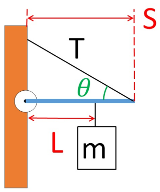
B. 2.20E+01 N

C. 2.67E+01 N

D. 3.23E+01 N

E. 3.91E+01 N

a09staticsTorques_torque Q15



1. A massless bar of length, S = 9.4m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 33.4 degrees above the horizontal. An object of mass, M = 3.5kg is suspended at a length, L =5.6m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 9.45E+00 N

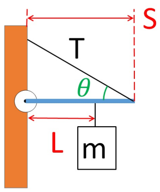
B. 1.14E+01 N

C. 1.39E+01 N

D. 1.68E+01 N

E. 2.04E+01 N

a09staticsTorques_torque Q16



1. A massless bar of length, S = 7.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 29.1 degrees above the horizontal. An object of mass, M = 4kg is suspended at a length, L =5.5m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 6.50E+00 N

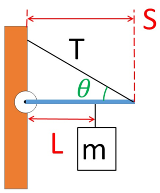
B. 7.88E+00 N

C. 9.54E+00 N

D. 1.16E+01 N

E. 1.40E+01 N

a09staticsTorques_torque Q17



1. A massless bar of length, S = 8.9m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 32.4 degrees above the horizontal. An object of mass, M = 7kg is suspended at a length, L =6.2m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.17E+01 N

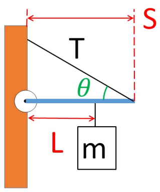
B. 1.42E+01 N

C. 1.72E+01 N

D. 2.08E+01 N

E. 2.52E+01 N

a09staticsTorques_torque Q18



1. A massless bar of length, S = 9.8m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 36.7 degrees above the horizontal. An object of mass, M = 4.7kg is suspended at a length, L =4.4m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.18E+01 N

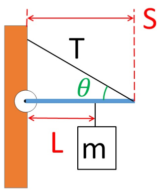
B. 1.43E+01 N

C. 1.73E+01 N

D. 2.09E+01 N

E. 2.54E+01 N

a09staticsTorques_torque Q19



1. A massless bar of length, S = 9.2m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 30.9 degrees above the horizontal. An object of mass, M = 3.6kg is suspended at a length, L =4.9m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.12E+01 N

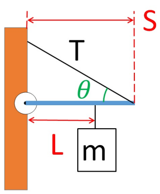
B. 1.36E+01 N

C. 1.65E+01 N

D. 2.00E+01 N

E. 2.42E+01 N

a09staticsTorques_torque Q20



1. A massless bar of length, S = 8.6m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 35.8 degrees above the horizontal. An object of mass, M = 7.3kg is suspended at a length, L =4.4m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 1.96E+01 N

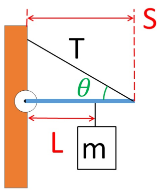
B. 2.38E+01 N

C. 2.88E+01 N

D. 3.49E+01 N

E. 4.23E+01 N

a09staticsTorques_torque Q21



1. A massless bar of length, S = 9.9m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle $\theta = 26$ degrees above the horizontal. An object of mass, M = 9.1kg is suspended at a length, L =5.6m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 3.20E+01 N

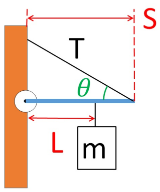
B. 3.87E+01 N

C. 4.69E+01 N

D. 5.69E+01 N

E. 6.89E+01 N

a09staticsTorques_torque Q22



1. A massless bar of length, S = 7.3m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle $\theta = 27.3$ degrees above the horizontal. An object of mass, M = 9.1kg is suspended at a length, L =5.3m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 2.44E+01 N

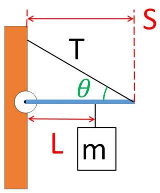
B. 2.96E+01 N

C. 3.59E+01 N

D. 4.34E+01 N

E. 5.26E+01 N

a09staticsTorques_torque Q23



1. A massless bar of length, S = 8.6m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle $\theta = 35.4$ degrees above the horizontal. An object of mass, M = 9.1kg is suspended at a length, L =4.7m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

A. 3.34E+01 N

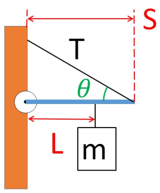
B. 4.04E+01 N

C. 4.90E+01 N

D. 5.94E+01 N

E. 7.19E+01 N

a09staticsTorques_torque Q24



1. A massless bar of length, S = 7.7m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 30.4 degrees above the horizontal. An object of mass, M = 4.3kg is suspended at a length, L =4.1m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

   A. 1.34E+01 N

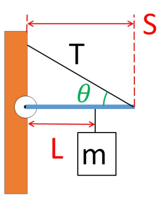
   B. 1.63E+01 N

   C. 1.97E+01 N

   D. 2.39E+01 N

   E. 2.89E+01 N

a09staticsTorques_torque Q25



1. A massless bar of length, S = 8.4m is attached to a wall by a frictionless hinge (shown as a circle). The bar his held horizontal by a string that makes and angle θ = 31.1 degrees above the horizontal. An object of mass, M = 8.4kg is suspended at a length, L =6.1m from the wall. What is the y (vertical) component of the force exerted by the wall on the horizontal bar?

   A. 1.54E+01 N

   B. 1.86E+01 N

   C. 2.25E+01 N

   D. 2.73E+01 N

   E. 3.31E+01 N

15 a10rotationalMotionAngMom_dynamics

1. A car with a tire radius of 0.26 m accelerates from 0 to 36 m/s in 6.8 seconds. What is the angular acceleration of the wheel?[68]

   A. 1.15 x 10^1 m

   B. 1.39 x 10^1 m

   C. 1.68 x 10^1 m

   D. 2.04 x 10^1 m

E. 2.47 x 10^1 m

2. A lead filled bicycle wheel of radius 0.57 m and mass 2.2 kg is rotating at a frequency of 1.7 revolutions per second. What is the moment of inertia?[69]

    A. 4.02 x 10^{-1} kg m^2/s^2

    B. 4.87 x 10^{-1} kg m^2/s^2

    C. 5.9 x 10^{-1} kg m^2/s^2

    D. 7.15 x 10^{-1} kg m^2/s^2

    E. 8.66 x 10^{-1} kg m^2/s^2

3. A lead filled bicycle wheel of radius 0.57 m and mass 2.2 kg is rotating at a frequency of 1.7 revolutions per second. What is the total kinetic energy if the wheel is rotating about a stationary axis?[70]

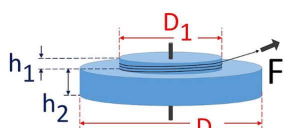
    A. 1.99 x 10^1 J

    B. 2.29 x 10^1 J

    C. 2.76 x 10^1 J

    D. 3.43 x 10^1 J

    E. 4.08 x 10^1 J



4. The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 3.8 kg are attached. The larger disk has a diameter of 0.9 m, and the smaller disk has a diameter of 0.46 m. If a force of 76 N is applied at the rim of the smaller disk, what is the angular acceleration?[71]

    A. 2.03 x 10^1 s^{-2}

    B. 2.45 x 10^1 s^{-2}

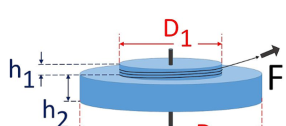
    C. 2.97 x 10^1 s^{-2}

    D. 3.6 x 10^1 s^{-2}

    E. 4.36 x 10^1 s^{-2}

15.1 Renditions

a10rotationalMotionAngMom_dynamics Q1



1. The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 2.7 kg are attached. The larger disk has a diameter of 0.87 m, and the smaller disk has a diameter of 0.45 m. If a force of 55 N is applied at the rim of the smaller disk, what is the angular acceleration?

    A. 2.6 x 10^1 s^{-2}

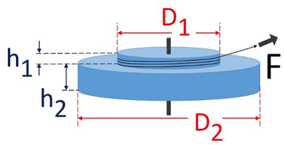
    B. 3.15 x 10^1 s^{-2}

    C. 3.82 x 10^1 s^{-2}

    D. 4.63 x 10^1 s^{-2}

    E. 5.61 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q2

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 3.6 kg are attached. The larger disk has a diameter of 0.71 m, and the smaller disk has a diameter of 0.32 m. If a force of 13 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 5.19 x 10^0 s^{-2}

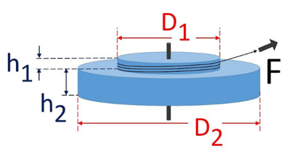
   B. 6.29 x 10^0 s^{-2}

   C. 7.62 x 10^0 s^{-2}

   D. 9.23 x 10^0 s^{-2}

   E. 1.12 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q3

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 4.7 kg are attached. The larger disk has a diameter of 0.81 m, and the smaller disk has a diameter of 0.44 m. If a force of 97 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 4.27 x 10^1 s^{-2}

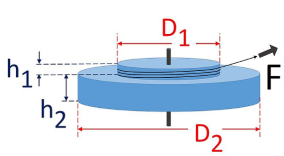
   B. 5.18 x 10^1 s^{-2}

   C. 6.27 x 10^1 s^{-2}

   D. 7.6 x 10^1 s^{-2}

   E. 9.21 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q4

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 3.4 kg are attached. The larger disk has a diameter of 0.91 m, and the smaller disk has a diameter of 0.56 m. If a force of 35 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 9.37 x 10^0 s^{-2}

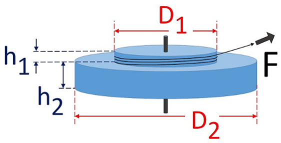
   B. 1.14 x 10^1 s^{-2}

   C. 1.38 x 10^1 s^{-2}

   D. 1.67 x 10^1 s^{-2}

   E. 2.02 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q5

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 9.3 kg are attached. The larger disk has a diameter of 0.83 m, and the smaller disk has a diameter of 0.46 m. If a force of 96 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 9.79 x 10^0 s^{-2}

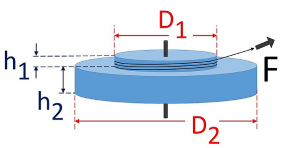
   B. 1.19 x 10^1 s^{-2}

   C. 1.44 x 10^1 s^{-2}

   D. 1.74 x 10^1 s^{-2}

   E. 2.11 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q6

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 3 kg are attached. The larger disk has a diameter of 0.92 m, and the smaller disk has a diameter of 0.48 m. If a force of 70 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 2.83 x 10^1 s^{-2}

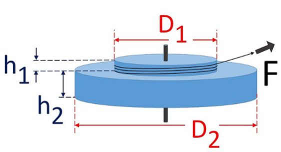
   B. 3.43 x 10^1 s^{-2}

   C. 4.16 x 10^1 s^{-2}

   D. 5.04 x 10^1 s^{-2}

   E. 6.11 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q7

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 5.2 kg are attached. The larger disk has a diameter of 0.92 m, and the smaller disk has a diameter of 0.47 m. If a force of 53 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 1.48 x 10^1 s^{-2}

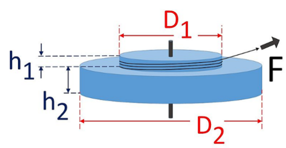
   B. 1.8 x 10^1 s^{-2}

   C. 2.18 x 10^1 s^{-2}

   D. 2.64 x 10^1 s^{-2}

   E. 3.19 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q8

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 9.7 kg are attached. The larger disk has a diameter of 0.83 m, and the smaller disk has a diameter of 0.41 m. If a force of 31 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 3.44 x 10^0 s^{-2}

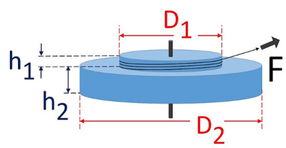
   B. 4.17 x 10^0 s^{-2}

   C. 5.05 x 10^0 s^{-2}

   D. 6.12 x 10^0 s^{-2}

   E. 7.41 x 10^0 s^{-2}

a10rotationalMotionAngMom_dynamics Q9

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 1.8 kg are attached. The larger disk has a diameter of 0.85 m, and the smaller disk has a diameter of 0.44 m. If a force of 14 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 8.4 x 10^0 s^{-2}

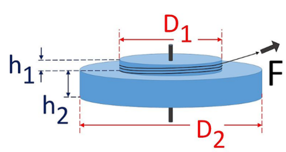
   B. 1.02 x 10^1 s^{-2}

   C. 1.23 x 10^1 s^{-2}

   D. 1.49 x 10^1 s^{-2}

   E. 1.81 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q10

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 8.1 kg are attached. The larger disk has a diameter of 0.99 m, and the smaller disk has a diameter of 0.63 m. If a force of 87 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 9.12 x 10^0 s^{-2}

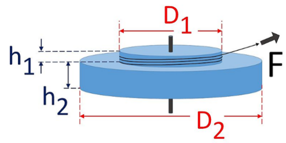
   B. 1.11 x 10^1 s^{-2}

   C. 1.34 x 10^1 s^{-2}

   D. 1.62 x 10^1 s^{-2}

   E. 1.97 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q11

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 3.9 kg are attached. The larger disk has a diameter of 0.9 m, and the smaller disk has a diameter of 0.46 m. If a force of 44 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 9.43 x 10^0 s^{-2}

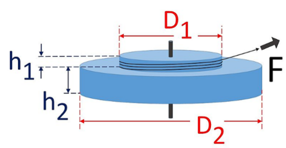
   B. 1.14 x 10^1 s^{-2}

   C. 1.38 x 10^1 s^{-2}

   D. 1.68 x 10^1 s^{-2}

   E. 2.03 x 10^1 s^{-2}

a10rotationalMotionAngMom_dynamics Q12

1. 

The moment of inertia of a solid disk of mass, M, and radius, R, is $\frac{1}{2}MR^2$. Two identical disks, each with mass 1.8 kg are attached. The larger disk has a diameter of 0.86 m, and the smaller disk has a diameter of 0.38 m. If a force of 31 N is applied at the rim of the smaller disk, what is the angular acceleration?

   A. 1.37 x 10^1 s^{-2}

   B. 1.67 x 10^1 s^{-2}

   C. 2.02 x 10^1 s^{-2}

   D. 2.44 x 10^1 s^{-2}

   E. 2.96 x 10^1 s^{-2}

16 a11fluidStatics_buoyantForce

1. A cylinder with a radius of 0.22 m and a length of 2.2 m is held so that the top circular face is 4.8 m below the water. The mass of the block is 826.0 kg. The mass density of water is 1000kg/m^3. What is the pressure at the top face of the cylinder?[72]

   A. .20E4 Pa

   B. .88E4 Pa

   C. .70E4 Pa

   D. .70E4 Pa

   E. .90E4 Pa

2. A cylinder with a radius of 0.22 m and a length of 2.2 m is held so that the top circular face is 4.8 m below the water. The mass of the block is 826.0 kg. The mass density of water is 1000kg/m^3. What is the buoyant force?[73]

   A. .71E3 N

   B. .28E3 N

   C. .97E3 N

   D. .81E3 N

E. .83E3 N

3. A cylinder with a radius of 0.22 m and a length of 2.2 m is held so that the top circular face is 4.8 m below the water. The mass of the block is 826.0 kg. The mass density of water is $1000 kg/m^3$. What is the force exerted by the water at the top surface?[74]

   A. .15E3 N

   B. .00E3 N

   C. .13E4 N

   D. .43E4 N

   E. .80E4 N

4. A cylinder with a radius of 0.22 m and a length of 2.2 m is held so that the top circular face is 4.8 m below the water. The mass of the block is 826.0 kg. The mass density of water is $1000 kg/m^3$. What,what is the force exerted by the fluid on the bottom of the cylinder?[75]

   A. .04E4 Pa

   B. .31E4 Pa

   C. .65E4 Pa

   D. .08E4 Pa

   E. .62E4 Pa

16.1 Renditions

a11fluidStatics_buoyantForce Q1

1. A cylinder with a radius of 0.25 m and a length of 2.5 m is held so that the top circular face is 4.2 m below the water. The mass of the block is 853.0 kg. The mass density of water is $1000 kg/m^3$. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .02E4 Pa

   B. .29E4 Pa

   C. .62E4 Pa

   D. .04E4 Pa

   E. .57E4 Pa

a11fluidStatics_buoyantForce Q2

1. A cylinder with a radius of 0.38 m and a length of 2.2 m is held so that the top circular face is 3.8 m below the water. The mass of the block is 903.0 kg. The mass density of water is $1000 kg/m^3$. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .68E4 Pa

   B. .12E4 Pa

   C. .67E4 Pa

   D. .36E4 Pa

   E. .23E4 Pa

a11fluidStatics_buoyantForce Q3

1. A cylinder with a radius of 0.38 m and a length of 3.6 m is held so that the top circular face is 4.2 m below the water. The mass of the block is 829.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?
   - A. .74E4 Pa
   - B. .19E4 Pa
   - C. .75E4 Pa
   - **D. .47E4 Pa**
   - E. .37E4 Pa

a11fluidStatics_buoyantForce Q4

1. A cylinder with a radius of 0.28 m and a length of 2.9 m is held so that the top circular face is 4.6 m below the water. The mass of the block is 880.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?
   - A. .14E4 Pa
   - B. .44E4 Pa
   - **C. .81E4 Pa**
   - D. .28E4 Pa
   - E. .87E4 Pa

a11fluidStatics_buoyantForce Q5

1. A cylinder with a radius of 0.24 m and a length of 3.8 m is held so that the top circular face is 3.5 m below the water. The mass of the block is 853.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?
   - A. .17E3 Pa
   - B. .03E4 Pa
   - **C. .29E4 Pa**
   - D. .63E4 Pa
   - E. .05E4 Pa

a11fluidStatics_buoyantForce Q6

1. A cylinder with a radius of 0.29 m and a length of 2.8 m is held so that the top circular face is 4.6 m below the water. The mass of the block is 952.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?
   - A. .52E4 Pa
   - **B. .92E4 Pa**
   - C. .41E4 Pa
   - D. .04E4 Pa
   - E. .82E4 Pa

a11fluidStatics_buoyantForce Q7

1. A cylinder with a radius of 0.33 m and a length of 2.9 m is held so that the top circular face is 4.1 m below the water. The mass of the block is 912.0 kg. The mass density of water is 1000kg/m^3. What is is the force exerted by the fluid on the bottom of the cylinder?

   A. .35E4 Pa

   B. .95E4 Pa

   C. .72E4 Pa

   D. .68E4 Pa

   E. .90E4 Pa

a11fluidStatics_buoyantForce Q8

1. A cylinder with a radius of 0.31 m and a length of 3.5 m is held so that the top circular face is 4.8 m below the water. The mass of the block is 933.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .95E4 Pa

   B. .46E4 Pa

   C. .09E4 Pa

   D. .89E4 Pa

   E. .90E4 Pa

a11fluidStatics_buoyantForce Q9

1. A cylinder with a radius of 0.29 m and a length of 2.3 m is held so that the top circular face is 4.7 m below the water. The mass of the block is 968.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .44E4 Pa

   B. .81E4 Pa

   C. .28E4 Pa

   D. .87E4 Pa

   E. .62E4 Pa

a11fluidStatics_buoyantForce Q10

1. A cylinder with a radius of 0.28 m and a length of 2.6 m is held so that the top circular face is 4.1 m below the water. The mass of the block is 831.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .11E3 Pa

   B. .02E4 Pa

   C. .28E4 Pa

   D. .62E4 Pa

   E. .04E4 Pa

a11fluidStatics_buoyantForce Q11

1. A cylinder with a radius of 0.38 m and a length of 2.3 m is held so that the top circular face is 4.5 m below the water. The mass of the block is 909.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .02E4 Pa

   B. .81E4 Pa

   C. .79E4 Pa

   D. .03E4 Pa

   E. .59E4 Pa

a11fluidStatics_buoyantForce Q12

1. A cylinder with a radius of 0.25 m and a length of 3.5 m is held so that the top circular face is 3.3 m below the water. The mass of the block is 922.0 kg. The mass density of water is 1000kg/m^3. What is the force exerted by the fluid on the bottom of the cylinder?

   A. .26E3 Pa

   B. .04E4 Pa

   C. .31E4 Pa

   D. .65E4 Pa

   E. .07E4 Pa

17 a12fluidDynamics_pipeDiameter

1. A 8.3 cm diameter pipe can fill a 1.7 m^3 volume in 6.0 minutes. Before exiting the pipe, the diameter is reduced to 3.0 cm (with no loss of flow rate). What is the speed in the first (wider) pipe?[76]

   A. 7.20E-1 m/s

   B. 8.73E-1 m/s

   C. 1.06E0 m/s

   D. 1.28E0 m/s

   E. 1.55E0 m/s

2. A 8.3 cm diameter pipe can fill a 1.7 m^3 volume in 6.0 minutes. Before exiting the pipe, the diameter is reduced to 3.0 cm (with no loss of flow rate). What is the pressure difference (in Pascals) between the two regions of the pipe?[77]

   A. 1.81E4

   B. 2.19E4

   C. 2.66E4

   D. 3.22E4

   E. 3.90E4

3. A 8.3 cm diameter pipe can fill a 1.7 m^3 volume in 6.0 minutes. Before exiting the pipe, the diameter is reduced to 3.0 cm (with no loss of flow rate). If two fluid elements at the center of the pipe are separated by 19.0 mm when they are both in the wide pipe, and we neglect turbulence, what is the separation when both are in the narrow pipe?[78]

   A. 1.45E2 mm

   B. 1.76E2 mm

C. 2.13E2 mm

D. 2.59E2 mm

E. 3.13E2 mm

4. A large cylinder is filled with water so that the bottom is 7.8 m below the waterline. At the bottom is a small hole with a diameter of 5.4E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)[79]

A. 8.42E0 m/s

B. 1.02E1 m/s

C. 1.24E1 m/s

D. 1.50E1 m/s

E. 1.81E1 m/s

17.1 Renditions

a12fluidDynamics_pipeDiameter Q1

1. A large cylinder is filled with water so that the bottom is 8.6 m below the waterline. At the bottom is a small hole with a diameter of 9.1E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 1.30E1 m/s

B. 1.57E1 m/s

C. 1.91E1 m/s

D. 2.31E1 m/s

E. 2.80E1 m/s

a12fluidDynamics_pipeDiameter Q2

1. A large cylinder is filled with water so that the bottom is 8.8 m below the waterline. At the bottom is a small hole with a diameter of 6.3E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 1.08E1 m/s

B. 1.31E1 m/s

C. 1.59E1 m/s

D. 1.93E1 m/s

E. 2.34E1 m/s

a12fluidDynamics_pipeDiameter Q3

1. A large cylinder is filled with water so that the bottom is 8.0 m below the waterline. At the bottom is a small hole with a diameter of 9.1E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 7.04E0 m/s

B. 8.53E0 m/s

C. 1.03E1 m/s

D. 1.25E1 m/s

E. 1.52E1 m/s

a12fluidDynamics_pipeDiameter Q4

1. A large cylinder is filled with water so that the bottom is 7.0 m below the waterline. At the bottom is a small hole with a diameter of 7.8E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

   A. 7.98E0 m/s

   B. 9.67E0 m/s

   C. 1.17E1 m/s

   D. 1.42E1 m/s

   E. 1.72E1 m/s

a12fluidDynamics_pipeDiameter Q5

1. A large cylinder is filled with water so that the bottom is 7.0 m below the waterline. At the bottom is a small hole with a diameter of 8.2E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

   A. 7.98E0 m/s

   B. 9.67E0 m/s

   C. 1.17E1 m/s

   D. 1.42E1 m/s

   E. 1.72E1 m/s

a12fluidDynamics_pipeDiameter Q6

1. A large cylinder is filled with water so that the bottom is 5.7 m below the waterline. At the bottom is a small hole with a diameter of 5.7E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

   A. 5.94E0 m/s

   B. 7.20E0 m/s

   C. 8.72E0 m/s

   D. 1.06E1 m/s

   E. 1.28E1 m/s

a12fluidDynamics_pipeDiameter Q7

1. A large cylinder is filled with water so that the bottom is 6.8 m below the waterline. At the bottom is a small hole with a diameter of 7.4E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

   A. 9.53E0 m/s

   B. 1.15E1 m/s

C. 1.40E1 m/s

D. 1.69E1 m/s

E. 2.05E1 m/s

a12fluidDynamics_pipeDiameter Q8

1. A large cylinder is filled with water so that the bottom is 6.4 m below the waterline. At the bottom is a small hole with a diameter of 9.7E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 9.24E0 m/s

B. 1.12E1 m/s

C. 1.36E1 m/s

D. 1.64E1 m/s

E. 1.99E1 m/s

a12fluidDynamics_pipeDiameter Q9

1. A large cylinder is filled with water so that the bottom is 8.9 m below the waterline. At the bottom is a small hole with a diameter of 7.6E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 1.09E1 m/s

B. 1.32E1 m/s

C. 1.60E1 m/s

D. 1.94E1 m/s

E. 2.35E1 m/s

a12fluidDynamics_pipeDiameter Q10

1. A large cylinder is filled with water so that the bottom is 5.4 m below the waterline. At the bottom is a small hole with a diameter of 9.6E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 7.01E0 m/s

B. 8.49E0 m/s

C. 1.03E1 m/s

D. 1.25E1 m/s

E. 1.51E1 m/s

a12fluidDynamics_pipeDiameter Q11

1. A large cylinder is filled with water so that the bottom is 7.8 m below the waterline. At the bottom is a small hole with a diameter of 5.4E-4 m. How fast is the water flowing at the hole? (Neglect viscous effects, turbulence, and also assume that the hole is so small that no significant motion occurs at the top of the cylinder.)

A. 8.42E0 m/s

B. 1.02E1 m/s

C. 1.24E1 m/s
D. 1.50E1 m/s
E. 1.81E1 m/s

18 a13TemperatureKineticTheoGasLaw

1. What is the root-mean-square of 27, 4, and -39?[80]
   A. 1.734 x 10^1
   B. 1.946 x 10^1
   C. 2.183 x 10^1
   D. 2.449 x 10^1
   E. 2.748 x 10^1

2. What is the rms speed of a molecule with an atomic mass of 9 if the temperature is 60 degrees Fahrenheit?[81]
   A. 5.03 x 10^2 m/s
   B. 6.09 x 10^2 m/s
   C. 7.38 x 10^2 m/s
   D. 8.95 x 10^2 m/s
   E. 1.08 x 10^3 m/s

3. If a molecule with atomic mass equal to 7 amu has a speed of 289 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 22 ?[82]
   A. 1.11 x 10^2 m/s
   B. 1.35 x 10^2 m/s
   C. 1.63 x 10^2 m/s
   D. 1.98 x 10^2 m/s
   E. 2.39 x 10^2 m/s

18.1 Renditions

a13TemperatureKineticTheoGasLaw Q1

1. If a molecule with atomic mass equal to 9 amu has a speed of 431 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 23 ?
   A. 1.84 x 10^2 m/s
   B. 2.23 x 10^2 m/s
   C. 2.7 x 10^2 m/s
   D. 3.27 x 10^2 m/s
   E. 3.96 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q2

1. If a molecule with atomic mass equal to 7 amu has a speed of 399 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 31 ?
   A. 8.8 x 10^1 m/s
   B. 1.07 x 10^2 m/s
   C. 1.29 x 10^2 m/s
   D. 1.56 x 10^2 m/s
   E. 1.9 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q3

1. If a molecule with atomic mass equal to 5 amu has a speed of 263 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 21 ?
   - A. 7.22 x 10^1 m/s
   - B. 8.74 x 10^1 m/s
   - C. 1.06 x 10^2 m/s
   - **D. 1.28 x 10^2 m/s**
   - E. 1.55 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q4

1. If a molecule with atomic mass equal to 2 amu has a speed of 305 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 29 ?
   - **A. 8.01 x 10^1 m/s**
   - B. 9.7 x 10^1 m/s
   - C. 1.18 x 10^2 m/s
   - D. 1.42 x 10^2 m/s
   - E. 1.73 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q5

1. If a molecule with atomic mass equal to 3 amu has a speed of 405 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 24 ?
   - A. 8.05 x 10^1 m/s
   - B. 9.76 x 10^1 m/s
   - C. 1.18 x 10^2 m/s
   - **D. 1.43 x 10^2 m/s**
   - E. 1.73 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q6

1. If a molecule with atomic mass equal to 6 amu has a speed of 265 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 28 ?
   - A. 1.01 x 10^2 m/s
   - **B. 1.23 x 10^2 m/s**
   - C. 1.49 x 10^2 m/s
   - D. 1.8 x 10^2 m/s
   - E. 2.18 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q7

1. If a molecule with atomic mass equal to 2 amu has a speed of 245 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 31 ?
   - A. 4.24 x 10^1 m/s
   - B. 5.14 x 10^1 m/s
   - **C. 6.22 x 10^1 m/s**
   - D. 7.54 x 10^1 m/s
   - E. 9.13 x 10^1 m/s

a13TemperatureKineticTheoGasLaw Q8

1. If a molecule with atomic mass equal to 9 amu has a speed of 445 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 25 ?
   - A. 1.82 x 10^2 m/s
   - B. 2.2 x 10^2 m/s
   - **C. 2.67 x 10^2 m/s**
   - D. 3.23 x 10^2 m/s
   - E. 3.92 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q9

1. If a molecule with atomic mass equal to 6 amu has a speed of 217 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 30 ?
   - A. 5.46 x 10^1 m/s
   - B. 6.61 x 10^1 m/s
   - C. 8.01 x 10^1 m/s
   - **D. 9.7 x 10^1 m/s**
   - E. 1.18 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q10

1. If a molecule with atomic mass equal to 8 amu has a speed of 475 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 28 ?
   - A. 1.73 x 10^2 m/s
   - B. 2.1 x 10^2 m/s
   - **C. 2.54 x 10^2 m/s**
   - D. 3.08 x 10^2 m/s
   - E. 3.73 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q11

1. If a molecule with atomic mass equal to 4 amu has a speed of 353 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 27 ?
   - A. 7.64 x 10^1 m/s
   - B. 9.26 x 10^1 m/s
   - C. 1.12 x 10^2 m/s
   - **D. 1.36 x 10^2 m/s**
   - E. 1.65 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q12

1. If a molecule with atomic mass equal to 8 amu has a speed of 331 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 27 ?
   - A. 8.36 x 10^1 m/s
   - B. 1.01 x 10^2 m/s
   - C. 1.23 x 10^2 m/s
   - D. 1.49 x 10^2 m/s
   - **E. 1.8 x 10^2 m/s**

a13TemperatureKineticTheoGasLaw Q13

1. If a molecule with atomic mass equal to 9 amu has a speed of 249 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 31 ?

   A. 6.23 x 10^1 m/s

   B. 7.54 x 10^1 m/s

   C. 9.14 x 10^1 m/s

   D. 1.11 x 10^2 m/s

   E. 1.34 x 10^2 m/s

a13TemperatureKineticTheoGasLaw Q14

1. If a molecule with atomic mass equal to 7 amu has a speed of 253 m/s, what is the speed at an atom in the same atmosphere of a molecule with an atomic mass of 26 ?

   A. 1.31 x 10^2 m/s

   B. 1.59 x 10^2 m/s

   C. 1.93 x 10^2 m/s

   D. 2.33 x 10^2 m/s

   E. 2.83 x 10^2 m/s

19 a14HeatTransfer_specifHeatConduct

1. The specific heat of water and aluminum are 4186 and 900, respectively, where the units are J/kg/Celsius. An aluminum container of mass 0.98 kg is filled with 0.23 kg of water. How much heat does it take to raise both from 39.7 C to 88 C? [83]

   A. 8.91 x 10^4 J

   B. 1.05 x 10^5 J

   C. 1.24 x 10^5 J

   D. 1.46 x 10^5 J

   E. 1.72 x 10^5 J

2. The specific heat of water and aluminum are 4186 and 900, respectively, where the units are J/kg/Celsius. An aluminum container of mass 0.98 kg is filled with 0.23 kg of water. What fraction of the heat went into the aluminum? [84]

   A. 2.9 x 10^{-1}

   B. 3.4 x 10^{-1}

   C. 4.1 x 10^{-1}

   D. 4.8 x 10^{-1}

   E. 5.6 x 10^{-1}

3. The specific heat of water and aluminum are 4186 and 900, respectively, where the units are J/kg/Celsius. An aluminum container of mass 0.98 kg is filled with 0.23 kg of water. You are consulting for the flat earth society, a group of people who believe that the acceleration of gravity equals 9.8 m/s/s at all altitudes. Based on this assumption, from what height must the water and container be dropped to achieve the same change in temperature? (For comparison, Earth's radius is 6,371 kilometers) [85]

   A. 5.12 x 10^0 km

   B. 6.2 x 10^0 km

C. 7.51 x 10^0 km

D. 9.1 x 10^0 km

E. 1.1 x 10^1 km

4. A window is square, with a length of each side equal to 0.86 meters. The glass has a thickness of 14 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.46. You also increase the thickness of the glass by a factor of 2.31. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).[86]

A. 4.06 x 10^0 unit

B. 4.92 x 10^0 unit

C. 5.97 x 10^0 unit

D. 7.23 x 10^0 unit

E. 8.76 x 10^0 unit

19.1 Renditions

a14HeatTransfer_specifHeatConduct Q1

1. A window is square, with a length of each side equal to 0.95 meters. The glass has a thickness of 13 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.59. You also increase the thickness of the glass by a factor of 2.84. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

A. 7.18 x 10^0 unit

B. 8.7 x 10^0 unit

C. 1.05 x 10^1 unit

D. 1.28 x 10^1 unit

E. 1.55 x 10^1 unit

a14HeatTransfer_specifHeatConduct Q2

1. A window is square, with a length of each side equal to 0.81 meters. The glass has a thickness of 13 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.24. You also increase the thickness of the glass by a factor of 2.15. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

A. 1.53 x 10^0 unit

B. 1.86 x 10^0 unit

C. 2.25 x 10^0 unit

D. 2.73 x 10^0 unit

E. 3.31 x 10^0 unit

a14HeatTransfer_specifHeatConduct Q3

1. A window is square, with a length of each side equal to 0.78 meters. The glass has a thickness of 11 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.31. You also increase the thickness of the glass by a factor of 2.97. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

A. 2.37×10^0 unit

B. 2.87×10^0 unit

C. 3.47×10^0 unit

D. 4.21×10^0 unit

E. 5.1×10^0 unit

a14HeatTransfer_specifHeatConduct Q4

1. A window is square, with a length of each side equal to 0.79 meters. The glass has a thickness of 15 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.33. You also increase the thickness of the glass by a factor of 2.17. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

   A. 2.16×10^0 unit

   B. 2.62×10^0 unit

   C. 3.17×10^0 unit

   D. 3.84×10^0 unit

   E. 4.65×10^0 unit

a14HeatTransfer_specifHeatConduct Q5

1. A window is square, with a length of each side equal to 0.73 meters. The glass has a thickness of 16 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.27. You also increase the thickness of the glass by a factor of 2. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

   A. 1.5×10^0 unit

   B. 1.81×10^0 unit

   C. 2.2×10^0 unit

   D. 2.66×10^0 unit

   E. 3.23×10^0 unit

a14HeatTransfer_specifHeatConduct Q6

1. A window is square, with a length of each side equal to 0.93 meters. The glass has a thickness of 15 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.55. You also increase the thickness of the glass by a factor of 2.54. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

   A. 4.16×10^0 unit

   B. 5.04×10^0 unit

   C. 6.1×10^0 unit

   D. 7.39×10^0 unit

   E. 8.96×10^0 unit

a14HeatTransfer_specifHeatConduct Q7

1. A window is square, with a length of each side equal to 0.73 meters. The glass has a thickness of 14 mm. To decrease the heat loss, you reduce the size of the window by decreasing the length of each side by a factor of 1.45. You also increase the thickness of the glass by a factor of 2.4. If the inside and outside temperatures are unchanged, by what factor have you decreased the heat flow?. By what factor have you decreased the heat flow (assuming the same inside and outside temperatures).

   A. 5.05 x 10^0 unit

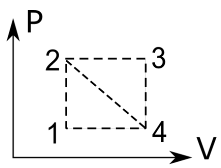
   B. 6.11 x 10^0 unit

   C. 7.41 x 10^0 unit

   D. 8.97 x 10^0 unit

   E. 1.09 x 10^1 unit

20 a15Thermodynamics_heatEngine



1. A 1241 heat cycle uses 2.8 moles of an ideal gas. The pressures and volumes are: P_1= 1.4 kPa, P_2= 2.8 kPa. The volumes are V_1= 2.8m^3 and V_4= 5.1m^3. How much work is done in in one cycle?[87]

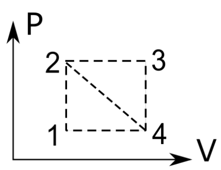
   A. 5.09 x 10^2 J

   B. 1.61 x 10^3 J

   C. 5.09 x 10^3 J

   D. 1.61 x 10^4 J

   E. 5.09 x 10^4 J



2. A 1241 heat cycle uses 2.6 moles of an ideal gas. The pressures and volumes are: P_1= 3 kPa, P_2= 5.9 kPa. The volumes are V_1= 2.5m^3 and V_4= 3.6m^3. How much work is involved between 1 and 4?[88]

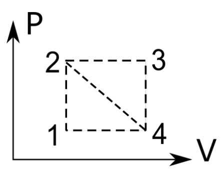
   A. 3.3 x 10^2 J

   B. 1.04 x 10^3 J

   C. 3.3 x 10^3 J

   D. 1.04 x 10^4 J

   E. 3.3 x 10^4 J



3. A 1241 heat cycle uses 2.1 moles of an ideal gas. The pressures and volumes are: P_1= 1.2 kPa, P_2= 4.1 kPa. The volumes are V_1= 3.1m^3 and V_4= 4.3m^3. How much work is involved between 2 and 4?[89]

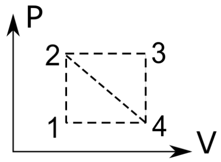
   A. 1.01 x 10^3 J

   B. 3.18 x 10^3 J

C. 1.01 x 10^4 J

D. 3.18 x 10^4 J

E. 1.01 x 10^5 J

4. 

A 1241 heat cycle uses 1.4 moles of an ideal gas. The pressures and volumes are: P_1= 2.2 kPa, P_2= 4 kPa. The volumes are V_1= 1.4m^3 and V_4= 3.3m^3. What is the temperature at step 4?[90]

A. 1.97 x 10^2 K

B. 6.24 x 10^2 K

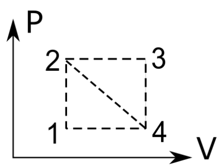
C. 1.97 x 10^3 K

D. 6.24 x 10^3 K

E. 1.97 x 10^4 K

20.1 Renditions

a15Thermodynamics_heatEngine Q1

1. 

A 1241 heat cycle uses 2.5 moles of an ideal gas. The pressures and volumes are: P_1= 2.9 kPa, P_2= 4.9 kPa. The volumes are V_1= 2.5m^3 and V_4= 4.7m^3. What is the temperature at step 4?

A. 2.07 x 10^2 K

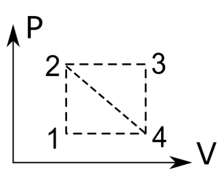
B. 6.56 x 10^2 K

C. 2.07 x 10^3 K

D. 6.56 x 10^3 K

E. 2.07 x 10^4 K

a15Thermodynamics_heatEngine Q2

1. 

A 1241 heat cycle uses 1.3 moles of an ideal gas. The pressures and volumes are: P_1= 1.6 kPa, P_2= 4.3 kPa. The volumes are V_1= 2.9m^3 and V_4= 5.8m^3. What is the temperature at step 4?

A. 8.59 x 10^0 K

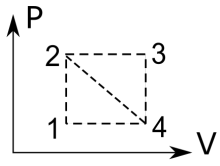
B. 2.71 x 10^1 K

C. 8.59 x 10^1 K

D. 2.71 x 10^2 K

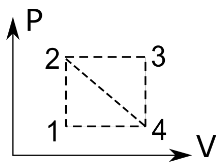
E. 8.59 x 10^2 K

a15Thermodynamics_heatEngine Q3



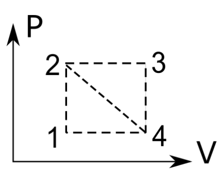
1. A 1241 heat cycle uses 2.5 moles of an ideal gas. The pressures and volumes are: P_1= 2.2 kPa, P_2= 3.8 kPa. The volumes are V_1= 2.9m^3 and V_4= 5.4m^3. What is the temperature at step 4?
   - A. 5.71 x 10^0 K
   - B. 1.81 x 10^1 K
   - C. 5.71 x 10^1 K
   - D. 1.81 x 10^2 K
   - **E. 5.71 x 10^2 K**

a15Thermodynamics_heatEngine Q4



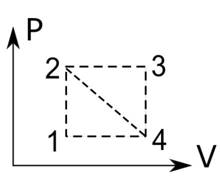
1. A 1241 heat cycle uses 1.5 moles of an ideal gas. The pressures and volumes are: P_1= 2.6 kPa, P_2= 5.7 kPa. The volumes are V_1= 2.7m^3 and V_4= 5.5m^3. What is the temperature at step 4?
   - **A. 1.15 x 10^3 K**
   - B. 3.63 x 10^3 K
   - C. 1.15 x 10^4 K
   - D. 3.63 x 10^4 K
   - E. 1.15 x 10^5 K

a15Thermodynamics_heatEngine Q5



1. A 1241 heat cycle uses 1.6 moles of an ideal gas. The pressures and volumes are: P_1= 1.5 kPa, P_2= 3 kPa. The volumes are V_1= 2.4m^3 and V_4= 4.5m^3. What is the temperature at step 4?
   - A. 1.6 x 10^1 K
   - B. 5.07 x 10^1 K
   - C. 1.6 x 10^2 K
   - **D. 5.07 x 10^2 K**
   - E. 1.6 x 10^3 K

a15Thermodynamics_heatEngine Q6



1. A 1241 heat cycle uses 2 moles of an ideal gas. The pressures and volumes are: P_1= 2.6 kPa, P_2= 4.9 kPa. The volumes are V_1= 1.2m^3 and V_4= 3.5m^3. What is the temperature at step 4?

A. 5.47 x 10^1 K

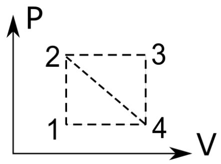
B. 1.73 x 10^2 K

C. 5.47 x 10^2 K

D. 1.73 x 10^3 K

E. 5.47 x 10^3 K

a15Thermodynamics_heatEngine Q7

1. 

A 1241 heat cycle uses 1.9 moles of an ideal gas. The pressures and volumes are: P_1= 2.9 kPa, P_2= 4.7 kPa. The volumes are V_1= 2.7m^3 and V_4= 5.6m^3. What is the temperature at step 4?

A. 1.03 x 10^1 K

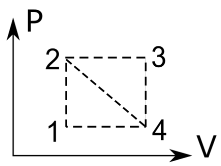
B. 3.25 x 10^1 K

C. 1.03 x 10^2 K

D. 3.25 x 10^2 K

E. 1.03 x 10^3 K

a15Thermodynamics_heatEngine Q8

1. 

A 1241 heat cycle uses 1.4 moles of an ideal gas. The pressures and volumes are: P_1= 1.4 kPa, P_2= 4.1 kPa. The volumes are V_1= 2.1m^3 and V_4= 4.7m^3. What is the temperature at step 4?

A. 1.79 x 10^2 K

B. 5.65 x 10^2 K

C. 1.79 x 10^3 K

D. 5.65 x 10^3 K

E. 1.79 x 10^4 K

21 a16OscillationsWaves_amplitudes

1. A 0.156 kg mass is on a spring that causes the frequency of oscillation to be 95 cycles per second. The maximum velocity is 50.6 m/s. What is the maximum force on the mass?[91]

A. 2.2 x 10^3 N

B. 4.7 x 10^3 N

C. 1 x 10^4 N

D. 2.2 x 10^4 N

E. 4.7 x 10^4 N

2. A spring with spring constant 5.5 kN/m is attached to a 9.8 gram mass. The maximum acelleration is 3.4 m/s^2. What is the maximum displacement?[92]

A. 1.92 x 10^{-7} m

B. 6.06×10^{-7} m

C. 1.92×10^{-6} m

D. 6.06×10^{-6} m

E. 1.92×10^{-5} m

3. A spring of spring constant 9.1 kN/m causes a mass to move with a period of 6.5 ms. The maximum displacement is 8.1 mm. What is the maximum kinetic energy?[93]

    A. 9.44×10^{-3} J

    B. 2.99×10^{-2} J

    C. 9.44×10^{-2} J

    D. 2.99×10^{-1} J

    E. 9.44×10^{-1} J

4. A spring with spring constant 3.1 kN/m undergoes simple harmonic motion with a frequency of 2.9 kHz. The maximum force is 2.3 N. What is the total energy?[94]

    A. 2.7×10^{-4} J

    B. 8.53×10^{-4} J

    C. 2.7×10^{-3} J

    D. 8.53×10^{-3} J

    E. 2.7×10^{-2} J

21.1 Renditions

a16OscillationsWaves_amplitudes Q1

1. A spring with spring constant 1.7 kN/m undergoes simple harmonic motion with a frequency of 3.9 kHz. The maximum force is 8.6 N. What is the total energy?

    A. 2.18×10^{-4} J

    B. 6.88×10^{-4} J

    C. 2.18×10^{-3} J

    D. 6.88×10^{-3} J

    E. 2.18×10^{-2} J

a16OscillationsWaves_amplitudes Q2

1. A spring with spring constant 2.8 kN/m undergoes simple harmonic motion with a frequency of 8.5 kHz. The maximum force is 8.2 N. What is the total energy?

    A. 1.2×10^{-2} J

    B. 3.8×10^{-2} J

    C. 1.2×10^{-1} J

    D. 3.8×10^{-1} J

    E. 1.2×10^{0} J

a16OscillationsWaves_amplitudes Q3

1. A spring with spring constant 2.7 kN/m undergoes simple harmonic motion with a frequency of 3.1 kHz. The maximum force is 6.3 N. What is the total energy?
   - A. 2.32 x 10^{-3} J
   - **B. 7.35 x 10^{-3} J**
   - C. 2.32 x 10^{-2} J
   - D. 7.35 x 10^{-2} J
   - E. 2.32 x 10^{-1} J

a16OscillationsWaves_amplitudes Q4

1. A spring with spring constant 1.2 kN/m undergoes simple harmonic motion with a frequency of 5.3 kHz. The maximum force is 1.5 N. What is the total energy?
   - A. 2.96 x 10^{-5} J
   - B. 9.38 x 10^{-5} J
   - C. 2.96 x 10^{-4} J
   - **D. 9.38 x 10^{-4} J**
   - E. 2.96 x 10^{-3} J

a16OscillationsWaves_amplitudes Q5

1. A spring with spring constant 7.7 kN/m undergoes simple harmonic motion with a frequency of 4.4 kHz. The maximum force is 9.4 N. What is the total energy?
   - A. 5.74 x 10^{-5} J
   - B. 1.81 x 10^{-4} J
   - C. 5.74 x 10^{-4} J
   - D. 1.81 x 10^{-3} J
   - **E. 5.74 x 10^{-3} J**

a16OscillationsWaves_amplitudes Q6

1. A spring with spring constant 1.1 kN/m undergoes simple harmonic motion with a frequency of 8.4 kHz. The maximum force is 3.8 N. What is the total energy?
   - A. 6.56 x 10^{-4} J
   - B. 2.08 x 10^{-3} J
   - **C. 6.56 x 10^{-3} J**
   - D. 2.08 x 10^{-2} J
   - E. 6.56 x 10^{-2} J

22 a17PhysHearing_echoString

1. The temperature is -2 degrees Celsius, and you are standing 0.88 km from a cliff. What is the echo time?[95]
   - A. 4.238 x 10^{0} seconds
   - B. 4.576 x 10^{0} seconds
   - C. 4.941 x 10^{0} seconds

D. 5.335×10^0 seconds

E. 5.761×10^0 seconds

2. While standing 0.88 km from a cliff, you measure the echo time to be 5.069 seconds. What is the temperature?[96]

A. 2.72×10^1Celsius

B. 3.15×10^1Celsius

C. 3.63×10^1Celsius

D. 4.19×10^1Celsius

E. 4.84×10^1Celsius

3. What is the speed of a transverse wave on a string if the string is 1.11 m long, clamped at both ends, and harmonic number 4 has a frequency of 611 Hz?[97]

A. 1.57×10^2 unit

B. 1.91×10^2 unit

C. 2.31×10^2 unit

D. 2.8×10^2 unit

E. 3.39×10^2 unit

22.1 Renditions

a17PhysHearing_echoString Q1

1. What is the speed of a transverse wave on a string if the string is 0.68 m long, clamped at both ends, and harmonic number 3 has a frequency of 756 Hz?

A. 3.43×10^2 unit

B. 4.15×10^2 unit

C. 5.03×10^2 unit

D. 6.09×10^2 unit

E. 7.38×10^2 unit

a17PhysHearing_echoString Q2

1. What is the speed of a transverse wave on a string if the string is 0.94 m long, clamped at both ends, and harmonic number 5 has a frequency of 715 Hz?

A. 1.83×10^2 unit

B. 2.22×10^2 unit

C. 2.69×10^2 unit

D. 3.26×10^2 unit

E. 3.95×10^2 unit

a17PhysHearing_echoString Q3

1. What is the speed of a transverse wave on a string if the string is 1.19 m long, clamped at both ends, and harmonic number 6 has a frequency of 834 Hz?

A. 2.25×10^2 unit

B. 2.73×10^2 unit

C. 3.31×10^2 unit

D. 4.01×10^2 unit

E. 4.86×10^2 unit

a17PhysHearing_echoString Q4

1. What is the speed of a transverse wave on a string if the string is 0.5 m long, clamped at both ends, and harmonic number 4 has a frequency of 316 Hz?

   A. 7.9 x 10^1 unit
   B. 9.57 x 10^1 unit
   C. 1.16 x 10^2 unit
   D. 1.4 x 10^2 unit
   E. 1.7 x 10^2 unit

a17PhysHearing_echoString Q5

1. What is the speed of a transverse wave on a string if the string is 1.13 m long, clamped at both ends, and harmonic number 5 has a frequency of 409 Hz?

   A. 1.26 x 10^2 unit
   B. 1.53 x 10^2 unit
   C. 1.85 x 10^2 unit
   D. 2.24 x 10^2 unit
   E. 2.71 x 10^2 unit

a17PhysHearing_echoString Q6

1. What is the speed of a transverse wave on a string if the string is 1.05 m long, clamped at both ends, and harmonic number 5 has a frequency of 110 Hz?

   A. 3.15 x 10^1 unit
   B. 3.81 x 10^1 unit
   C. 4.62 x 10^1 unit
   D. 5.6 x 10^1 unit
   E. 6.78 x 10^1 unit

a17PhysHearing_echoString Q7

1. What is the speed of a transverse wave on a string if the string is 0.58 m long, clamped at both ends, and harmonic number 4 has a frequency of 543 Hz?

   A. 8.86 x 10^1 unit
   B. 1.07 x 10^2 unit
   C. 1.3 x 10^2 unit
   D. 1.57 x 10^2 unit
   E. 1.91 x 10^2 unit

a17PhysHearing_echoString Q8

1. What is the speed of a transverse wave on a string if the string is 0.45 m long, clamped at both ends, and harmonic number 4 has a frequency of 996 Hz?

   A. 1.53 x 10^2 unit
   B. 1.85 x 10^2 unit
   C. 2.24 x 10^2 unit
   D. 2.72 x 10^2 unit
   E. 3.29 x 10^2 unit

a17PhysHearing_echoString Q9

1. What is the speed of a transverse wave on a string if the string is 1.05 m long, clamped at both ends, and harmonic number 5 has a frequency of 153 Hz?
   - A. 5.3 x 10^{1} unit
   - **B. 6.43 x 10^{1} unit**
   - C. 7.79 x 10^{1} unit
   - D. 9.43 x 10^{1} unit
   - E. 1.14 x 10^{2} unit

23 a18ElectricChargeField_findE

1. What is the magnitude of the electric field at the origin if a 1.8 nC charge is placed at x = 7.9 m, and a 2.1 nC charge is placed at y = 7 m?[98]
   - A. 2.61 x 10^{-1}N/C
   - B. 3.02 x 10^{-1}N/C
   - C. 3.48 x 10^{-1}N/C
   - D. 4.02 x 10^{-1}N/C
   - **E. 4.64 x 10^{-1}N/C**
2. What angle does the electric field at the origin make with the x-axis if a 1.1 nC charge is placed at x = -6.5 m, and a 1.4 nC charge is placed at y = -8.3 m?[99]
   - **A. 3.8 x 10^{1}degrees**
   - B. 4.39 x 10^{1}degrees
   - C. 5.06 x 10^{1}degrees
   - D. 5.85 x 10^{1}degrees
   - E. 6.75 x 10^{1}degrees
3. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the x component of the electric field at (x,y) =(6a, 4a) is β kQ/a^2, where β equals[100]
   - A. 1.33 x 10^{-3}
   - B. 1.61 x 10^{-3}
   - C. 1.95 x 10^{-3}
   - D. 2.37 x 10^{-3}
   - **E. 2.87 x 10^{-3}**
4. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals [101]
   - A. 2.36 x 10^{-1}
   - B. 2.86 x 10^{-1}
   - **C. 3.47 x 10^{-1}**
   - D. 4.2 x 10^{-1}
   - E. 5.09 x 10^{-1}

23.1 Renditions

a18ElectricChargeField_findE Q1

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

   A. 1.61×10^{-1}

   B. 1.95×10^{-1}

   C. 2.36×10^{-1}

   D. 2.86×10^{-1}

   E. 3.47×10^{-1}

a18ElectricChargeField_findE Q2

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

   A. 2.86×10^{-1}

   B. 3.47×10^{-1}

   C. 4.2×10^{-1}

   D. 5.09×10^{-1}

   E. 6.17×10^{-1}

a18ElectricChargeField_findE Q3

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

   A. 3.47×10^{-1} unit

   B. 4.2×10^{-1} unit

   C. 5.09×10^{-1} unit

   D. 6.17×10^{-1} unit

   E. 7.47×10^{-1} unit

a18ElectricChargeField_findE Q4

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

   A. 2.36×10^{-1} unit

   B. 2.86×10^{-1} unit

   C. 3.47×10^{-1} unit

   D. 4.2×10^{-1} unit

   E. 5.09×10^{-1} unit

a18ElectricChargeField_findE Q5

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

   A. 1.61×10^{-1} unit

   B. 1.95×10^{-1} unit

C. 2.36×10^{-1} unit

D. 2.86×10^{-1} unit

E. 3.47×10^{-1} unit

a18ElectricChargeField_findE Q6

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

A. 2.36×10^{-1} unit

B. 2.86×10^{-1} unit

C. 3.47×10^{-1} unit

D. 4.2×10^{-1} unit

E. 5.09×10^{-1} unit

a18ElectricChargeField_findE Q7

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

A. 2.86×10^{-1} unit

B. 3.47×10^{-1} unit

C. 4.2×10^{-1} unit

D. 5.09×10^{-1} unit

E. 6.17×10^{-1} unit

a18ElectricChargeField_findE Q8

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

A. 3.47×10^{-1} unit

B. 4.2×10^{-1} unit

C. 5.09×10^{-1} unit

D. 6.17×10^{-1} unit

E. 7.47×10^{-1} unit

a18ElectricChargeField_findE Q9

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals

A. 1.95×10^{-1} unit

B. 2.36×10^{-1} unit

C. 2.86×10^{-1} unit

D. 3.47×10^{-1} unit

E. 4.2×10^{-1} unit

a18ElectricChargeField_findE Q10

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals
   A. 1.95 x 10^{-1} unit
   B. 2.36 x 10^{-1} unit
   C. 2.86 x 10^{-1} unit
   D. 3.47 x 10^{-1} unit
   E. 4.2 x 10^{-1} unit

a18ElectricChargeField_findE Q11

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals
   A. 1.61 x 10^{-1} unit
   B. 1.95 x 10^{-1} unit
   C. 2.36 x 10^{-1} unit
   D. 2.86 x 10^{-1} unit
   E. 3.47 x 10^{-1} unit

a18ElectricChargeField_findE Q12

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals
   A. 1.95 x 10^{-1} unit
   B. 2.36 x 10^{-1} unit
   C. 2.86 x 10^{-1} unit
   D. 3.47 x 10^{-1} unit
   E. 4.2 x 10^{-1} unit

a18ElectricChargeField_findE Q13

1. A dipole at the origin consists of charge Q placed at x = 0.5a, and charge of -Q placed at x = -0.5a. The absolute value of the y component of the electric field at (x,y) =(1.1a, 1.2a) is β kQ/a^2, where β equals
   A. 1.95 x 10^{-1} unit
   B. 2.36 x 10^{-1} unit
   C. 2.86 x 10^{-1} unit
   D. 3.47 x 10^{-1} unit
   E. 4.2 x 10^{-1} unit

24 a19ElectricPotentialField_Capacitance

1. A parallel plate capacitor has both plates with an area of 1.05 m^2. The separation between the plates is 0.63mm. Applied to the plates is a potential difference of 2.85 kV. What is the capacitance?[102]
   A. 8.44 nF.
   B. 9.7 nF.

C. 11.16 nF.

D. 12.83 nF.

E. 14.76 nF.

2. Consider a parallel plate capacitor with area 1.05 m^2, plate separation 0.63mm, and an applied voltage of 2.85 kV. How much charge is stored?[103]

A. 24.05 µ C.

B. 27.65 µ C.

C. 31.8 µ C.

D. 36.57 µ C.

E. 42.06 µ C.

3. A 0.8 Farad capacitor is charged with 1.5 Coulombs. What is the value of the electric field if the plates are 0.7 mm apart?[104]

A. 1.76 kV/m.

B. 2.03 kV/m.

C. 2.33 kV/m.

D. 2.68 kV/m.

E. 3.08 kV/m.

4. A 0.8 Farad capacitor is charged with 1.5 Coulombs. What is the energy stored in the capacitor if the plates are 0.7 mm apart?[105]

A. 0.8 J.

B. 0.92 J.

C. 1.06 J.

D. 1.22 J.

E. 1.41 J.

5. A 0.8 Farad capacitor is charged with 1.5 Coulombs. What is the force between the plates if they are 0.7 mm apart?[106]

A. 2009 N.

B. 2310 N.

C. 2657 N.

D. 3055 N.

E. 3514 N.

24.1 Renditions

a19ElectricPotentialField_Capacitance Q1

1. A 0.6 Farad capacitor is charged with 1.5 Coulombs. What is the force between the plates if they are 0.8 mm apart?

A. 1772 N.

B. 2038 N.

C. 2344 N.

D. 2695 N.

E. 3100 N.

a19ElectricPotentialField_Capacitance Q2

1. A 0.9 Farad capacitor is charged with 1.1 Coulombs. What is the force between the plates if they are 0.3 mm apart?
   - A. 1473 N.
   - B. 1694 N.
   - C. 1948 N.
   - **D. 2241 N.**
   - E. 2577 N.

a19ElectricPotentialField_Capacitance Q3

1. A 0.5 Farad capacitor is charged with 1.6 Coulombs. What is the force between the plates if they are 0.7 mm apart?
   - A. 3180 N.
   - **B. 3657 N.**
   - C. 4206 N.
   - D. 4837 N.
   - E. 5562 N.

a19ElectricPotentialField_Capacitance Q4

1. A 1.4 Farad capacitor is charged with 2.3 Coulombs. What is the force between the plates if they are 0.6 mm apart?
   - A. 2381 N.
   - B. 2738 N.
   - **C. 3149 N.**
   - D. 3621 N.
   - E. 4164 N.

a19ElectricPotentialField_Capacitance Q5

1. A 1.2 Farad capacitor is charged with 1.6 Coulombs. What is the force between the plates if they are 0.4 mm apart?
   - A. 2319 N.
   - **B. 2667 N.**
   - C. 3067 N.
   - D. 3527 N.
   - E. 4056 N.

a19ElectricPotentialField_Capacitance Q6

1. A 1.4 Farad capacitor is charged with 1.1 Coulombs. What is the force between the plates if they are 0.6 mm apart?
   - A. 412 N.
   - B. 474 N.
   - C. 545 N.
   - D. 626 N.
   - **E. 720 N.**

a19ElectricPotentialField_Capacitance Q7

1. A 1.3 Farad capacitor is charged with 1.9 Coulombs. What is the force between the plates if they are 0.3 mm apart?

   A. 4025 N.

   B. 4628 N.

   C. 5322 N.

   D. 6121 N.

   E. 7039 N.

a19ElectricPotentialField_Capacitance Q8

1. A 0.5 Farad capacitor is charged with 1.3 Coulombs. What is the force between the plates if they are 0.7 mm apart?

   A. 1826 N.

   B. 2099 N.

   C. 2414 N.

   D. 2776 N.

   E. 3193 N.

a19ElectricPotentialField_Capacitance Q9

1. A 0.8 Farad capacitor is charged with 1.7 Coulombs. What is the force between the plates if they are 0.5 mm apart?

   A. 2065 N.

   B. 2375 N.

   C. 2732 N.

   D. 3141 N.

   E. 3613 N.

25 a19ElectricPotentialField_KE_PE

1. How fast is a 2642 eV electron moving?[107]

   A. 3 x 10^7 m/s.

   B. 4.6 x 10^7 m/s.

   C. 6.9 x 10^7 m/s.

   D. 1 x 10^8 m/s.

   E. 1.5 x 10^8 m/s.

2. A proton is accelerated (at rest) from a plate held at 45.3 volts to a plate at zero volts. What is the final speed?[108]

   A. 2.8 x 10^4 m/s.

   B. 4.1 x 10^4 m/s.

   C. 6.2 x 10^4 m/s.

   D. 9.3 x 10^4 m/s.

   E. 1.4 x 10^5 m/s.

3. What voltage is required accelerate an electron at rest to a speed of 9.4 x 10^6 m/s?[109]
   - A. 7.4 x 10^1 volts
   - B. 1.1 x 10^2 volts
   - C. 1.7 x 10^2 volts
   - **D. 2.5 x 10^2 volts**
   - E. 3.8 x 10^2 volts
4. What voltage is required to stop a proton moving at a speed of 8.5 x 10^4 m/s?[110]
   - A. 7.4 x 10^0 volts
   - B. 1.1 x 10^1 volts
   - C. 1.7 x 10^1 volts
   - D. 2.5 x 10^1 volts
   - **E. 3.8 x 10^1 volts**

25.1 Renditions

a19ElectricPotentialField_KE_PE Q1

1. What voltage is required to stop a proton moving at a speed of 3 x 10^4 m/s?
   - A. 1.4 x 10^0 volts
   - B. 2.1 x 10^0 volts
   - C. 3.1 x 10^0 volts
   - **D. 4.7 x 10^0 volts**
   - E. 7 x 10^0 volts

a19ElectricPotentialField_KE_PE Q2

1. What voltage is required to stop a proton moving at a speed of 8.1 x 10^6 m/s?
   - A. 2.3 x 10^5 volts
   - **B. 3.4 x 10^5 volts**
   - C. 5.1 x 10^5 volts
   - D. 7.7 x 10^5 volts
   - E. 1.2 x 10^6 volts

a19ElectricPotentialField_KE_PE Q3

1. What voltage is required to stop a proton moving at a speed of 3.9 x 10^3 m/s?
   - A. 3.5 x 10^{-2} volts
   - B. 5.3 x 10^{-2} volts
   - **C. 7.9 x 10^{-2} volts**
   - D. 1.2 x 10^{-1} volts
   - E. 1.8 x 10^{-1} volts

a19ElectricPotentialField_KE_PE Q4

1. What voltage is required to stop a proton moving at a speed of 7.6 x 10^6 m/s?
   - **A. 3 x 10^5 volts**
   - B. 4.5 x 10^5 volts
   - C. 6.8 x 10^5 volts
   - D. 1 x 10^6 volts
   - E. 1.5 x 10^6 volts

a19ElectricPotentialField_KE_PE Q5

1. What voltage is required to stop a proton moving at a speed of 4.2 x 10^3 m/s?
   - A. 6.1 x 10^{-2} volts
   - **B. 9.2 x 10^{-2} volts**
   - C. 1.4 x 10^{-1} volts
   - D. 2.1 x 10^{-1} volts
   - E. 3.1 x 10^{-1} volts

a19ElectricPotentialField_KE_PE Q6

1. What voltage is required to stop a proton moving at a speed of 8 x 10^7 m/s?
   - **A. 3.3 x 10^7 volts**
   - B. 5 x 10^7 volts
   - C. 7.5 x 10^7 volts
   - D. 1.1 x 10^8 volts
   - E. 1.7 x 10^8 volts

a19ElectricPotentialField_KE_PE Q7

1. What voltage is required to stop a proton moving at a speed of 1.6 x 10^4 m/s?
   - A. 4 x 10^{-1} volts
   - B. 5.9 x 10^{-1} volts
   - C. 8.9 x 10^{-1} volts
   - **D. 1.3 x 10^0 volts**
   - E. 2 x 10^0 volts

a19ElectricPotentialField_KE_PE Q8

1. What voltage is required to stop a proton moving at a speed of 8.1 x 10^4 m/s?
   - **A. 3.4 x 10^1 volts**
   - B. 5.1 x 10^1 volts
   - C. 7.7 x 10^1 volts
   - D. 1.2 x 10^2 volts
   - E. 1.7 x 10^2 volts

a19ElectricPotentialField_KE_PE Q9

1. What voltage is required to stop a proton moving at a speed of 5.2 x 10^7 m/s?
   - A. 9.4 x 10^6 volts
   - **B. 1.4 x 10^7 volts**
   - C. 2.1 x 10^7 volts
   - D. 3.2 x 10^7 volts
   - E. 4.8 x 10^7 volts

26 a20ElectricCurrentResistivityOhm_PowerDriftVel

1. A 4 volt battery moves 27 Coulombs of charge in 2.6 hours. What is the power?[111]
   - A. 7.86 x 10^{-3} W
   - B. 9.52 x 10^{-3} W
   - **C. 1.15 x 10^{-2} W**
   - D. 1.4 x 10^{-2} W
   - E. 1.69 x 10^{-2} W

2. The diameter of a copper wire is 5.5 mm, and it carries a current of 76 amps. What is the drift velocity if copper has a density of 8.8E3 kg/m^3 and an atomic mass of 63.54 g/mol? (1 mol = 6.02E23 atoms, and copper has one free electron per atom.)[112]
   - A. 1.35 x 10^{-4}m/s
   - B. 1.63 x 10^{-4}m/s
   - C. 1.98 x 10^{-4}m/s
   - **D. 2.39 x 10^{-4}m/s**
   - E. 2.9 x 10^{-4}m/s

3. A 168 Watt DC motor draws 0.3 amps of current. What is effective resistance?[113]
   - **A. 1.87 x 10^3 Ω**
   - B. 2.26 x 10^3 Ω
   - C. 2.74 x 10^3 Ω
   - D. 3.32 x 10^3 Ω
   - E. 4.02 x 10^3 Ω

4. A power supply delivers 113 watts of power to a 104 ohm resistor. What was the applied voltage?[114]
   - A. 5.03 x 10^1 volts
   - B. 6.1 x 10^1 volts
   - C. 7.39 x 10^1 volts
   - D. 8.95 x 10^1 volts
   - **E. 1.08 x 10^2 volts**

26.1 Renditions

a20ElectricCurrentResistivityOhm_PowerDriftVel Q1

1. A power supply delivers 149 watts of power to a 153 ohm resistor. What was the applied voltage?
   - A. 8.49 x 10^1 volts
   - B. 1.03 x 10^2 volts
   - C. 1.25 x 10^2 volts
   - **D. 1.51 x 10^2 volts**
   - E. 1.83 x 10^2 volts

a20ElectricCurrentResistivityOhm_PowerDriftVel Q2

1. A power supply delivers 101 watts of power to a 219 ohm resistor. What was the applied voltage?
   - **A. 1.49 x 10^2 volts**
   - B. 1.8 x 10^2 volts
   - C. 2.18 x 10^2 volts
   - D. 2.64 x 10^2 volts
   - E. 3.2 x 10^2 volts

a20ElectricCurrentResistivityOhm_PowerDriftVel Q3

1. A power supply delivers 145 watts of power to a 132 ohm resistor. What was the applied voltage?
   - A. 6.42 x 10^1 volts
   - B. 7.78 x 10^1 volts
   - C. 9.43 x 10^1 volts
   - D. 1.14 x 10^2 volts
   - **E. 1.38 x 10^2 volts**

a20ElectricCurrentResistivityOhm_PowerDriftVel Q4

1. A power supply delivers 145 watts of power to a 244 ohm resistor. What was the applied voltage?
   - **A. 1.88 x 10^2 volts**
   - B. 2.28 x 10^2 volts
   - C. 2.76 x 10^2 volts
   - D. 3.34 x 10^2 volts
   - E. 4.05 x 10^2 volts

a20ElectricCurrentResistivityOhm_PowerDriftVel Q5

1. A power supply delivers 138 watts of power to a 206 ohm resistor. What was the applied voltage?
   - A. 1.39 x 10^2 volts
   - **B. 1.69 x 10^2 volts**
   - C. 2.04 x 10^2 volts
   - D. 2.47 x 10^2 volts
   - E. 3 x 10^2 volts

a20ElectricCurrentResistivityOhm_PowerDriftVel Q6

1. A power supply delivers 187 watts of power to a 287 ohm resistor. What was the applied voltage?
   - **A. 2.32 x 10^2 volts**
   - B. 2.81 x 10^2 volts
   - C. 3.4 x 10^2 volts
   - D. 4.12 x 10^2 volts
   - E. 4.99 x 10^2 volts

a20ElectricCurrentResistivityOhm_PowerDriftVel Q7

1. A power supply delivers 169 watts of power to a 219 ohm resistor. What was the applied voltage?
   - A. 8.93 x 10^1 volts
   - B. 1.08 x 10^2 volts
   - C. 1.31 x 10^2 volts
   - D. 1.59 x 10^2 volts
   - **E. 1.92 x 10^2 volts**

a20ElectricCurrentResistivityOhm_PowerDriftVel Q8

1. A power supply delivers 110 watts of power to a 299 ohm resistor. What was the applied voltage?
   - A. 8.42 x 10^1 volts
   - B. 1.02 x 10^2 volts
   - C. 1.24 x 10^2 volts
   - D. 1.5 x 10^2 volts
   - **E. 1.81 x 10^2 volts**

a20ElectricCurrentResistivityOhm_PowerDriftVel Q9

1. A power supply delivers 114 watts of power to a 294 ohm resistor. What was the applied voltage?
   - A. 1.25 x 10^2 volts
   - B. 1.51 x 10^2 volts
   - **C. 1.83 x 10^2 volts**
   - D. 2.22 x 10^2 volts
   - E. 2.69 x 10^2 volts

27 a21CircuitsBioInstDC_circAnalQuiz1

1. 3 amps flow through a 1 Ohm resistor. What is the voltage?[115]
   - **A.** $3V$
   - B. $1V$
   - C. $\frac{1}{3}V$
   - D. None these are correct.
2. A 1 ohm resistor has 5 volts DC across its terminals. What is the current (I) and the power consumed?[116]
   - A. I = 5A & P = 3W.

B. I = 5A & P = 5W.

C. I = 5A & P = 25W.

D. I = 5A & P = 9W

3. The voltage across two resistors in series is 10 volts. One resistor is twice as large as the other. What is the voltage across the larger resistor? What is the voltage across the smaller one? [117]

A. $V_{Big-Resistor} = 3.33V$ and$V_{small-Resistor} = 6.67V$.

B. $V_{small-Resistor} = 5V$ and $V_{Big-Resistor} = 5V$.

C. $V_{Big-Resistor} = 6.67V$ **and** $V_{small-Resistor} = 3.33V$**.**

D. None of these are true.

4. A 1 ohm, 2 ohm, and 3 ohm resistor are connected in series. What is the total resistance?[118]

A. $R_{Total} = 0.5454\Omega$.

B. $R_{Total} = 3\Omega$.

C. $R_{Total} = 6\Omega$**.**

D. None of these are true.

5. Two identical resistors are connected in series. The voltage across both of them is 250 volts. What is the voltage across each one?[119]

A. $R_1 = 150V$ and $R_2 = 100V$.

B. None of these are true.

C. $R_1 = 125V$ **and** $R_2 = 125V$**.**

D. $R_1 = 250V$ and $R_2 = 0V$.

6. A 1 ohm, 2 ohm, and 3 ohm resistor are connected in "parallel". What is the total resistance?[120]

A. $\frac{11}{6}\Omega$.

B. $\frac{3}{6}\Omega$.

C. $\frac{6}{11}\Omega$**.**

D. $\frac{6}{3}\Omega$.

7. A 5 ohm and a 2 ohm resistor are connected in parallel. What is the total resistance?[121]

A. $\frac{6}{10}\Omega$.

B. $\frac{7}{10}\Omega$.

C. $\frac{10}{6}\Omega$.

D. $\frac{10}{7}\Omega$**.**

8. A 7 ohm and a 3 ohm resistor are connected in parallel. What is the total resistance?[122]

A. $\frac{21}{10}\Omega$**.**

B. $\frac{11}{7}\Omega$.

C. $\frac{7}{11}\Omega$.

D. $\frac{10}{21}\Omega$.

9. Three 1 ohm resistors are connected in parallel. What is the total resistance?[123]

A. 3Ω.

B. $\frac{1}{3}\Omega$**.**

C. $\frac{3}{2}\Omega$.

D. $\frac{2}{3}\Omega$.

10. If you put an infinite number of resistors in parallel, what would the total resistance be?[124]

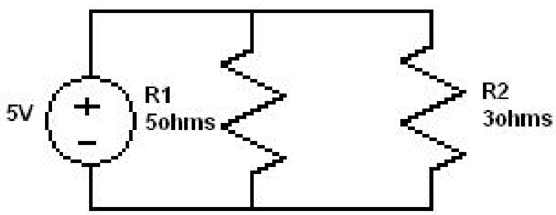
A. R_{total} would approach Zero as The No. of Resistors In parallel Approaches Infinity.

B. None of these are true.

C. R_{total} would approach 1 as The No. of Resistors In parallel Approaches Infinity

D. It is not possible to connect that Number of Resistors in parallel.

11. What is the current through R1 and R2 in the figure shown?



[125]

A. $I_1 = 0.1A$ and $I_2 = 0.1667A$.

B. $I_1 = 10A$ and $I_2 = 16.67A$.

C. $I_1 = 1A$ and $I_2 = 25A$.

D. $I_1 = 1A$ and $I_2 = 1.667A$.

12. Why do we say the "voltage across" or "the voltage with respect to?" Why can't we just say voltage?[126]

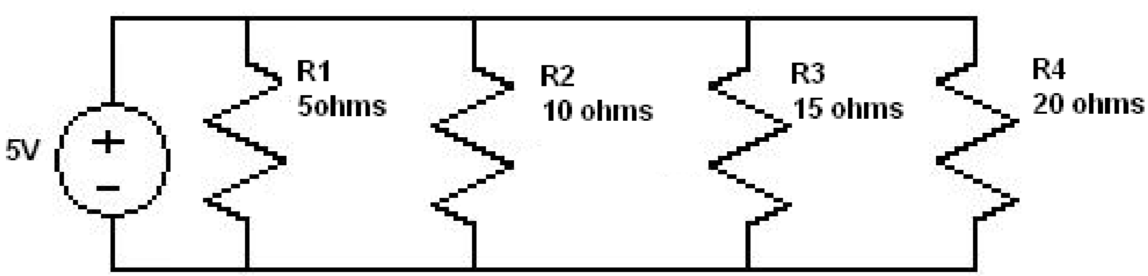
A. It's an Electrical "Cliche".

B. The other point could be Negative or positive.

C. None these are correct

D. Voltage is a measure of Electric Potential difference between two electrical points.

13. What is the current through R1, R2, R3, and R4 in the figure shown?



[127]

A. $I_1 = 10A$; $I_2 = 50A$; $I_3 = 33A$; $I_4 = 25A$..

B. $I_1 = 1A$; $I_2 = 5A$; $I_3 = 3.3A$; $I_4 = 2.5A$.

C. $I_1 = 1A$; $I_2 = 0.5A$; $I_3 = 0.33A$; $I_4 = 0.25A$.

D. $I_1 = 0.25A$; $I_2 = 0.33A$; $I_3 = 0.5A$; $I_4 = 0.1A$.

14. Two resistors are in parallel with a voltage source. How do their voltages compare?[128]

A. The voltage across both resistors is the same as the source.

B. None of these are true.

C. One has full voltage, the other has none.

D. The voltage across both resistors is half the voltage of the source.

15. A resistor consumes 5 watts, and its current is 10 amps. What is its voltage?[129]

    A. 2V.

    B. 10V.

    C. 0.5V.

    D. 15V.

16. A resistor has 10 volts across it and 4 amps going through it. What is its resistance?[130]

    A. None of these are true.

    B. 3.5Ω.

    C. 4.5Ω.

    D. 2.5Ω.

17. If you plot voltage vs. current in a circuit, and you get a linear line, what is the significance of the slope? [131]

    A. Power.

    B. Resistance.

    C. Discriminant.

    D. None of these are true.

18. A resistor has 3 volts across it. Its resistance is 1.5 ohms. What is the current?[132]

    A. 12A

    B. 3A

    C. 2A

    D. 1.5A

19. A resistor has 8 volts across it and 3 Amps going through it. What is the power consumed?[133]

    A. 2.2W

    B. 24W

    C. 8W

    D. 3W

20. A resistor has a voltage of 5 volts and a resistance of 15 ohms. What is the power consumed? [134]

    A. None of these are ture.

    B. 11.67 Joules

    C. 1.67 Watts

    D. 2.5 Watts

21. A resistor is on for 5 seconds. It consumes power at a rate of 5 watts. How many joules are used?[135]

    A. 25 Joules

    B. 3 Joules

    C. 5 Joules

    D. None of these are true

28 a21CircuitsBioInstDC_circuits

1. An ideal 5.2 V voltage source is connected to two resistors in parallel. One is 1.2$k\Omega$, and the other is 2.8 $k\Omega$. What is the current through the larger resistor?[136]

   A. 0.7 mA.

   B. 0.9 mA.

   C. 1.1 mA.

   D. 1.3 mA.

   E. 1.5 mA.

2. A 7.7 ohm resistor is connected in series to a pair of 5.8 ohm resistors that are in parallel. What is the net resistance?[137]

   A. 6.1 ohms.

   B. 7 ohms.

   C. 8 ohms.

   D. 9.2 ohms.

   E. 10.6 ohms.

3. Two 8 ohm resistors are connected in parallel. This combination is then connected in series to a 6.6 ohm resistor. What is the net resistance?[138]

   A. 9.2 ohms.

   B. 10.6 ohms.

   C. 12.2 ohms.

   D. 14 ohms.

   E. 16.1 ohms.

4. An ideal 7.9 volt battery is connected to a 0.09 ohm resistor. To measure the current an ammeter with a resistance of 20$m\Omega$ is used. What current does the ammeter actually read?[139]

   A. 71.8 A.

   B. 82.6 A.

   C. 95 A.

   D. 109.2 A.

   E. 125.6 A.

5. A battery has an emf of 5.3 volts, and an internal resistance of 326 $k\Omega$. It is connected to a 3 $M\Omega$ resistor. What power is developed in the 3 $M\Omega$ resistor?[140]

   A. 5.01 μW.

   B. 5.76 μW.

   C. 6.62 μW.

   D. 7.62 μW.

   E. 8.76 μW.

28.1 Renditions

a21CircuitsBioInstDC_circuits Q1

1. A battery has an emf of 6.1 volts, and an internal resistance of 366 $k\Omega$. It is connected to a 3.6 $M\Omega$ resistor. What power is developed in the 3.6 $M\Omega$ resistor?

   A. 6.44 μW.

   B. 7.41 μW.

   C. 8.52 μW.

   D. 9.79 μW.

   E. 11.26 μW.

a21CircuitsBioInstDC_circuits Q2

1. A battery has an emf of 6.5 volts, and an internal resistance of 446 $k\Omega$. It is connected to a 3.5 $M\Omega$ resistor. What power is developed in the 3.5 $M\Omega$ resistor?

   A. 8.26 μW.

   B. 9.5 μW.

   C. 10.92 μW.

   D. 12.56 μW.

   E. 14.44 μW.

a21CircuitsBioInstDC_circuits Q3

1. A battery has an emf of 5.6 volts, and an internal resistance of 295 $k\Omega$. It is connected to a 4.1 $M\Omega$ resistor. What power is developed in the 4.1 $M\Omega$ resistor?

   A. 3.81 μW.

   B. 4.38 μW.

   C. 5.03 μW.

   D. 5.79 μW.

   E. 6.66 μW.

a21CircuitsBioInstDC_circuits Q4

1. A battery has an emf of 5.3 volts, and an internal resistance of 428 $k\Omega$. It is connected to a 2.3 $M\Omega$ resistor. What power is developed in the 2.3 $M\Omega$ resistor?

   A. 4.96 μW.

   B. 5.71 μW.

   C. 6.56 μW.

   D. 7.55 μW.

   E. 8.68 μW.

a21CircuitsBioInstDC_circuits Q5

1. A battery has an emf of 5.5 volts, and an internal resistance of 296 $k\Omega$. It is connected to a 3.3 $M\Omega$ resistor. What power is developed in the 3.3 $M\Omega$ resistor?

   A. 7.72 μW.

   B. 8.88 μW.

C. 10.21 μW.

D. 11.74 μW.

E. 13.5 μW.

a21CircuitsBioInstDC_circuits Q6

1. A battery has an emf of 7.8 volts, and an internal resistance of 351 $k\Omega$. It is connected to a 4.2 $M\Omega$ resistor. What power is developed in the 4.2 $M\Omega$ resistor?

    A. 12.34 μW.

    B. 14.19 μW.

    C. 16.32 μW.

    D. 18.76 μW.

    E. 21.58 μW.

a21CircuitsBioInstDC_circuits Q7

1. A battery has an emf of 5.6 volts, and an internal resistance of 450 $k\Omega$. It is connected to a 2.7 $M\Omega$ resistor. What power is developed in the 2.7 $M\Omega$ resistor?

    A. 4.88 μW.

    B. 5.61 μW.

    C. 6.45 μW.

    D. 7.42 μW.

    E. 8.53 μW.

a21CircuitsBioInstDC_circuits Q8

1. A battery has an emf of 6.7 volts, and an internal resistance of 348 $k\Omega$. It is connected to a 3.8 $M\Omega$ resistor. What power is developed in the 3.8 $M\Omega$ resistor?

    A. 9.91 μW.

    B. 11.4 μW.

    C. 13.11 μW.

    D. 15.08 μW.

    E. 17.34 μW.

a21CircuitsBioInstDC_circuits Q9

1. A battery has an emf of 7.1 volts, and an internal resistance of 246 $k\Omega$. It is connected to a 3.3 $M\Omega$ resistor. What power is developed in the 3.3 $M\Omega$ resistor?

    A. 10 μW.

    B. 11.5 μW.

    C. 13.23 μW.

    D. 15.21 μW.

    E. 17.5 μW.

a21CircuitsBioInstDC_circuits Q10

1. A battery has an emf of 5.6 volts, and an internal resistance of 460 $k\Omega$. It is connected to a 2.4 $M\Omega$ resistor. What power is developed in the 2.4 $M\Omega$ resistor?

   A. 6.05 μW.

   B. 6.96 μW.

   C. 8 μW.

   D. 9.2 μW.

   E. 10.58 μW.

a21CircuitsBioInstDC_circuits Q11

1. A battery has an emf of 7 volts, and an internal resistance of 357 $k\Omega$. It is connected to a 2.9 $M\Omega$ resistor. What power is developed in the 2.9 $M\Omega$ resistor?

   A. 13.4 μW.

   B. 15.4 μW.

   C. 17.72 μW.

   D. 20.37 μW.

   E. 23.43 μW.

a21CircuitsBioInstDC_circuits Q12

1. A battery has an emf of 6.5 volts, and an internal resistance of 244 $k\Omega$. It is connected to a 4 $M\Omega$ resistor. What power is developed in the 4 $M\Omega$ resistor?

   A. 7.09 μW.

   B. 8.16 μW.

   C. 9.38 μW.

   D. 10.79 μW.

   E. 12.41 μW.

29 a21CircuitsBioInstDC_RCdecaySimple

1. A 621 mF capacitor is connected in series to a 628 kΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[141]

   A. 1.17 x 10^5 s.

   B. 3.7 x 10^5 s.

   C. 1.17 x 10^6 s.

   D. 3.7 x 10^6 s.

   E. 1.17 x 10^7 s.

2. A 784 µ F capacitor is connected in series to a 543 kΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[142]

   A. 4.04 x 10^1 s.

   B. 1.28 x 10^2 s.

   C. 4.04 x 10^2 s.

   D. 1.28 x 10^3 s.

E. 4.04 x 10^3 s.

3. A 354 mF capacitor is connected in series to a 407 MΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[143]

A. 4.32 x 10^7 s.

B. 1.37 x 10^8 s.

C. 4.32 x 10^8 s.

D. 1.37 x 10^9 s.

E. 4.32 x 10^9 s.

4. A 10 F capacitor is connected in series to a 9Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)[144]

A. 3.6 x 10^2 s.

B. 1.14 x 10^3 s.

C. 3.6 x 10^3 s.

D. 1.14 x 10^4 s.

E. 3.6 x 10^4 s.

29.1 Renditions

a21CircuitsBioInstDC_RCdecaySimple Q1

1. A 5 F capacitor is connected in series to a 8Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)

A. 1.6 x 10^1 s.

B. 5.06 x 10^1 s.

C. 1.6 x 10^2 s.

D. 5.06 x 10^2 s.

E. 1.6 x 10^3 s.

a21CircuitsBioInstDC_RCdecaySimple Q2

1. A 10 F capacitor is connected in series to a 10Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)

A. 4 x 10^0 s.

B. 1.26 x 10^1 s.

C. 4 x 10^1 s.

D. 1.26 x 10^2 s.

E. 4 x 10^2 s.

30 a22Magnetism_forces

1. A 621 mF capacitor is connected in series to a 628 kΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[145]

A. 1.17 x 10^5 s.

B. 3.7 x 10^5 s.

C. 1.17 x 10^6 s.

D. 3.7×10^6 s.

E. 1.17×10^7 s.

2. A 784 µ F capacitor is connected in series to a 543 kΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[146]

A. 4.04×10^1 s.

B. 1.28×10^2 s.

C. 4.04×10^2 s.

D. 1.28×10^3 s.

E. 4.04×10^3 s.

3. A 354 mF capacitor is connected in series to a 407 MΩ resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^3? (where e =2.7...)[147]

A. 4.32×10^7 s.

B. 1.37×10^8 s.

C. 4.32×10^8 s.

D. 1.37×10^9 s.

E. 4.32×10^9 s.

4. A 10 F capacitor is connected in series to a 9Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)[148]

A. 3.6×10^2 s.

B. 1.14×10^3 s.

C. 3.6×10^3 s.

D. 1.14×10^4 s.

E. 3.6×10^4 s.

30.1 Renditions

a22Magnetism_forces Q1

1. A 5 F capacitor is connected in series to a 8Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)

A. 1.6×10^1 s.

B. 5.06×10^1 s.

C. 1.6×10^2 s.

D. 5.06×10^2 s.

E. 1.6×10^3 s.

a22Magnetism_forces Q2

1. A 10 F capacitor is connected in series to a 10Ω resistor. If the capacitor is discharged, how long does it take to fall by a factor of e^4? (where e =2.7...)

A. 4×10^0 s.

B. 1.26×10^1 s.

C. 4×10^1 s.

D. 1.26×10^2 s.

E. 4×10^2 s.

31 a23InductionACcircuits_Q1

1. Two orbiting satellites are orbiting at a speed of 85 km/s perpendicular to a magnetic field of 56 µ T. They are connected by a cable that is 29 km long. A voltmeter is attached between a satellite and one end of the cable. The voltmeter's internal impedance far exceeds the net resistance through the ionosphere that completes the circuit. What is the measured voltage?[149]
   - A. 7.76 x 10^4 volts.
   - B. 9.4 x 10^4 volts.
   - C. 1.14 x 10^5 volts.
   - **D. 1.38 x 10^5 volts.**
   - E. 1.67 x 10^5 volts.
2. An loop of wire with 25 turns has a radius of 0.85 meters, and is oriented with its axis parallel to a magetic field of 0.58 Tesla. What is the induced voltage if this field is reduced to 49
   - A. 9.24 x 10^0 volts
   - **B. 1.12 x 10^1 volts**
   - C. 1.36 x 10^1 volts
   - D. 1.64 x 10^1 volts
   - E. 1.99 x 10^1 volts

31.1 Renditions

a23InductionACcircuits_Q1 Q1

1. An loop of wire with 26 turns has a radius of 0.26 meters, and is oriented with its axis parallel to a magetic field of 0.75 Tesla. What is the induced voltage if this field is reduced to 13
   - **A. 2 x 10^0 volts**
   - B. 2.42 x 10^0 volts
   - C. 2.94 x 10^0 volts
   - D. 3.56 x 10^0 volts
   - E. 4.31 x 10^0 volts

a23InductionACcircuits_Q1 Q2

1. An loop of wire with 92 turns has a radius of 0.39 meters, and is oriented with its axis parallel to a magetic field of 0.97 Tesla. What is the induced voltage if this field is reduced to 16
   - **A. 2.56 x 10^1 volts**
   - B. 3.1 x 10^1 volts
   - C. 3.76 x 10^1 volts
   - D. 4.55 x 10^1 volts
   - E. 5.51 x 10^1 volts

a23InductionACcircuits_Q1 Q3

1. An loop of wire with 80 turns has a radius of 0.52 meters, and is oriented with its axis parallel to a magetic field of 0.15 Tesla. What is the induced voltage if this field is reduced to 19
   - A. 1.06 x 10^0 volts

B. 1.29×10^{0} volts

C. 1.56×10^{0} volts

D. 1.89×10^{0} volts

E. 2.29×10^{0} volts

a23InductionACcircuits_Q1 Q4

1. An loop of wire with 43 turns has a radius of 0.27 meters, and is oriented with its axis parallel to a magetic field of 0.68 Tesla. What is the induced voltage if this field is reduced to 36

   A. 6.34×10^{-1} volts

   B. 7.68×10^{-1} volts

   C. 9.31×10^{-1} volts

   D. 1.13×10^{0} volts

   E. 1.37×10^{0} volts

a23InductionACcircuits_Q1 Q5

1. An loop of wire with 54 turns has a radius of 0.8 meters, and is oriented with its axis parallel to a magetic field of 0.86 Tesla. What is the induced voltage if this field is reduced to 46

   A. 1.43×10^{1} volts

   B. 1.73×10^{1} volts

   C. 2.1×10^{1} volts

   D. 2.55×10^{1} volts

   E. 3.08×10^{1} volts

a23InductionACcircuits_Q1 Q6

1. An loop of wire with 31 turns has a radius of 0.9 meters, and is oriented with its axis parallel to a magetic field of 0.83 Tesla. What is the induced voltage if this field is reduced to 35

   A. 2.07×10^{1} volts

   B. 2.5×10^{1} volts

   C. 3.03×10^{1} volts

   D. 3.67×10^{1} volts

   E. 4.45×10^{1} volts

a23InductionACcircuits_Q1 Q7

1. An loop of wire with 33 turns has a radius of 0.55 meters, and is oriented with its axis parallel to a magetic field of 0.74 Tesla. What is the induced voltage if this field is reduced to 32

   A. 5.43×10^{0} volts

   B. 6.58×10^{0} volts

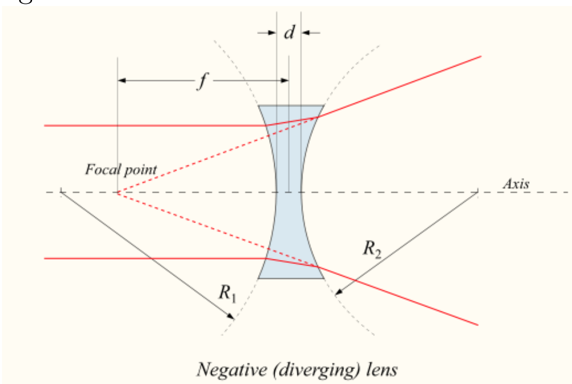
   C. 7.97×10^{0} volts

   D. 9.65×10^{0} volts

   E. 1.17×10^{1} volts

32 a25GeometricOptics_image

1. figure:



Shown is a corrective lens by a person who needs glasses. This ray diagram illustrates[150]

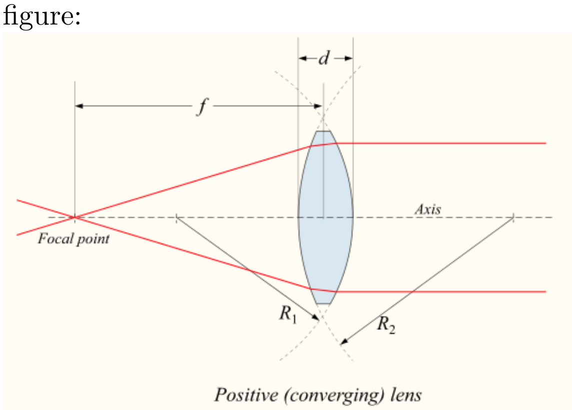
A. how a nearsighted person might see a distant object

B. how a nearsighted person might see an object that is too close for comfort

C. how a farsighted person might see an object that is too close for comfort

D. how a farsighted person might see a distant object

2. figure:



Shown is a corrective lens by a person who needs glasses. This ray diagram illustrates[151]

A. how a nearsighted person might see a distant object

B. how a farsighted person might see a distant object

C. how a farsighted person might see an object that is too close for comfort

D. how a nearsighted person might see an object that is too close for comfort

3. In optics, "'normal"' means[152]

A. to the left of the optical axis

B. parallel to the surface

C. perpendicular to the surface

D. to the right of the optical axis

4. The law of reflection applies to[153]

A. only light in a vacuum

B. telescopes but not microscopes

C. curved surfaces

D. both flat and curved surfaces

E. flat surfaces

5. When light passes from air to glass[154]
   A. the frequency decreases
   B. the frequency increases
   C. it bends away from the normal
   D. it bends towards the normal
   E. it does not bend

6. When light passes from glass to air[155]
   A. it does not bend
   B. the frequency decreases
   C. the frequency increases
   D. it bends towards the normal
   E. it bends away from the normal

7. An important principle that allows fiber optics to work is[156]
   A. the invariance of the speed of light
   B. total internal reflection
   C. total external refraction
   D. partial internal absorption
   E. the Doppler shift

8. The focal point is where[157]
   A. rays meet whenever they pass through a lens
   B. rays meet if they were parallel to the optical axis before striking a lens
   C. rays meet whenever they are forming an image
   D. rays meet if they are parallel to each other
   E. the center of the lens

33 a25GeometricOptics_thinLenses

1. An object is placed 5.8 cm to the left of a diverging lens with a focal length of 4.9 cm. How far is the image from the lens?[158]
   A. 4.72 x 10^{-1} cm
   B. 8.4 x 10^{-1} cm
   C. 1.49 x 10^{0} cm
   D. 2.66 x 10^{0} cm
   E. 4.72 x 10^{0} cm

2. An object is placed 6.05 cm to the left of a converging lens with a focal length of 5.4 cm. How far is the image from the lens?[159]
   A. 5.03 x 10^{1} cm
   B. 8.94 x 10^{1} cm
   C. 1.59 x 10^{2} cm

D. 2.83×10^{2} cm

E. 5.03×10^{2} cm

3. An object of height 0.59 cm is placed 149 cm behind a diverging lens with a focal length of 57 cm. What is the height of the image?[160]

   A. 1.63×10^{-1} cm

   B. 1.96×10^{-1} cm

   C. 2.35×10^{-1} cm

   D. 2.82×10^{-1} cm

   E. 3.39×10^{-1} cm

4. An object is placed 12.1 cm to the left of a diverging lens with a focal length of 15.4 cm. On the side, at a distance of 6.5 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?16.65[161]

   A. 5.72×10^{0} cm

   B. 1.81×10^{1} cm

   C. 5.72×10^{1} cm

   D. 1.81×10^{2} cm

   E. 5.72×10^{2} cm

33.1 Renditions

a25GeometricOptics_thinLenses Q1

1. An object is placed 13.2 cm to the left of a diverging lens with a focal length of 17.1 cm. On the side, at a distance of 5.1 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 1.86×10^{-1} cm

   B. 5.87×10^{-1} cm

   C. 1.86×10^{0} cm

   D. 5.87×10^{0} cm

   E. 1.86×10^{1} cm

a25GeometricOptics_thinLenses Q2

1. An object is placed 10.8 cm to the left of a diverging lens with a focal length of 15.6 cm. On the side, at a distance of 5.7 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 5.98×10^{-1} cm

   B. 1.89×10^{0} cm

   C. 5.98×10^{0} cm

   D. 1.89×10^{1} cm

   E. 5.98×10^{1} cm

a25GeometricOptics_thinLenses Q3

1. An object is placed 12.1 cm to the left of a diverging lens with a focal length of 16.9 cm. On the side, at a distance of 6.7 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 5.64 x 10^{0} cm

   B. 1.78 x 10^{1} cm

   C. 5.64 x 10^{1} cm

   D. 1.78 x 10^{2} cm

   E. 5.64 x 10^{2} cm

a25GeometricOptics_thinLenses Q4

1. An object is placed 13.7 cm to the left of a diverging lens with a focal length of 17.7 cm. On the side, at a distance of 5.5 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 5.73 x 10^{-2} cm

   B. 1.81 x 10^{-1} cm

   C. 5.73 x 10^{-1} cm

   D. 1.81 x 10^{0} cm

   E. 5.73 x 10^{0} cm

a25GeometricOptics_thinLenses Q5

1. An object is placed 10.2 cm to the left of a diverging lens with a focal length of 16.6 cm. On the side, at a distance of 5.6 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 6.02 x 10^{-1} cm

   B. 1.9 x 10^{0} cm

   C. 6.02 x 10^{0} cm

   D. 1.9 x 10^{1} cm

   E. 6.02 x 10^{1} cm

a25GeometricOptics_thinLenses Q6

1. An object is placed 10.9 cm to the left of a diverging lens with a focal length of 16.4 cm. On the side, at a distance of 6.8 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?

   A. 1.81 x 10^{-1} cm

   B. 5.71 x 10^{-1} cm

   C. 1.81 x 10^{0} cm

   D. 5.71 x 10^{0} cm

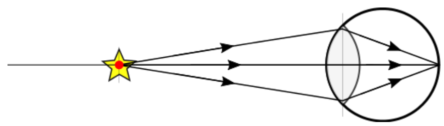
   E. 1.81 x 10^{1} cm

a25GeometricOptics_thinLenses Q7

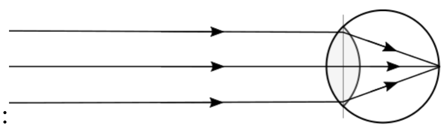
1. An object is placed 10.9 cm to the left of a diverging lens with a focal length of 16.3 cm. On the side, at a distance of 5.7 cm from the diverging lens is a converging lens with focal length equal to 4 cm. How far is the final image from the converging lens?
   - A. 1.88×10^{0} cm
   - **B. 5.94×10^{0} cm**
   - C. 1.88×10^{1} cm
   - D. 5.94×10^{1} cm
   - E. 1.88×10^{2} cm

34 a25GeometricOptics_vision

1. Which lens has the shorter focal length?[162]

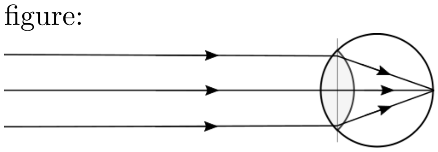


   - **A. This lens:**



   - B. This lens:
   - C. Both lenses have the same the same focal length

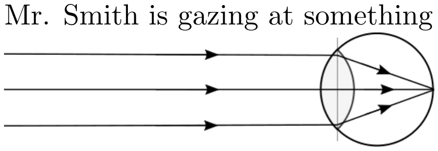
2. figure:



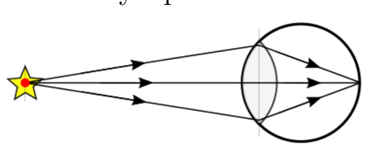
   If this represents the eye looking at an object, where is this object?[163]
   - A. One focal length in front of the eye
   - **B. Very far away**
   - C. One focal length behind the eye
   - D. at the eye's cornea
   - E. at eye's retina

3. The focal point is where the rays from an object meet after they have passed through a lens.[164]
   - **A. False**
   - B. True

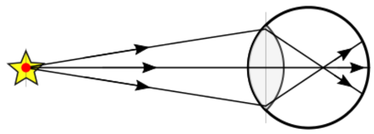
4. Mr. Smith is gazing at something as shown in the figure:

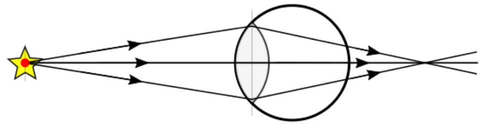


   Suppose the object is suddenly moved closer, but for some reason Mr. Smith does not refocus his eyes. which drawing below best depicts the rays' paths.[165]



   - A. This drawing:

B. This drawing: 

C. This drawing: 

35 AstroApparentRetroMotion

1. ____ motion is in the usual direction, and _______ is motion that has temporarily reversed itself. [166]
   - A. direct; elliptical
   - B. elliptical; retrograde
   - **C. direct; retrograde**
   - D. indirect; direct
   - E. retrograde; direct
2. Under what conditions would a planet not seem to rise in the east and set in the west? [167]
   - A. if the planet is in retrograde motion
   - **B. if the observer is near the north or south poles**
   - C. if the planet is in direct motion
   - D. if the planet is in elliptical motion
   - E. if the observer is below the equator
3. When the faster moving Earth overtakes a slower planet outside Earth's orbit[168]
   - **A. retrograde motion occurs**
   - B. two of these are true
   - C. all of these are true
   - D. tidal forces can be observed on Earth
   - E. tidal forces can be observed on the planet
4. Which planet spends more days in a given retrograde? [169]
   - **A. Saturn**
   - B. It depends on the season
   - C. They are all equal
   - D. Earth
   - E. Mars
5. Which planet has more days between two consecutive retrogrades? [170]
   - A. Earth
   - **B. Mars**
   - C. It depends on the season
   - D. They are all equal
   - E. Saturn

6. A planet that is very, very far from the Sun would be in retrograde for approximately ___ months.[171]
   - A. 1
   - **B. 6**
   - C. 24
   - D. 12
   - E. 3
7. If a planet that is very, very far from the Sun begins a retrograde, how many months must pass before it begins the next retrograde? [172]
   - **A. 12**
   - B. 1
   - C. 24
   - D. 6
   - E. 3
8. "Planet" comes from the Greek word for 'wanderer'. [173]
   - **A. true**
   - B. false
9. We know that Galileo saw Neptune, but is not credited with its discovery because[174]
   - A. he never published his drawing
   - B. none of these are true
   - C. he thought it was a moon of Saturn
   - **D. it was in a transition between retrograde and direct motion**
   - E. it was too faint to be worth drawing

36 AstroAtmosphericLoss

1. It is important to distinguish between molecules (collectively) in a gas and one individual molecule. This question is about an individual molecule. For a planet with a given mass, size, and density, which has the greater escape velocity? [175]
   - A. the heavier molecule has the greater escape velocity
   - B. the lighter molecule has the greater escape velocity
   - **C. all molecules have the same escape velocity**
   - D. no molecules have escape velocity
   - E. all molecules move at the escape velocity
2. It is important to distinguish between molecules (collectively) in a gas and one individual molecule. This question is about a typical molecule in the gas. For a planet with a given mass, size, and density, which type of gas is more likely to escape? [176]
   - **A. atoms in a hotter gas is more likely to escape**
   - B. atoms in a denser gas are more likely to escape
   - C. atoms in a gas with more atomic mass are more likely to escape
   - D. all types of gas are equally likely to escape
   - E. atoms in a colder gas are more likely to escape

3. Which type of gas is likely to have the faster particles?[177]

    A. a hot gas with low mass atoms

    B. a hot gas with high mass atoms

    C. a cold gas with low mass atoms

    D. a cold gas with high mass atoms

    E. all gasses on a given planet have the same speed

4. What is it about the isotopes of Argon-36 and Argon-38 that causes their relative abundance to be so unusual on Mars?[178]

    A. different half-life

    B. different speed

    C. different chemical properties

    D. identical mass

    E. identical abundance

5. In the formula, $\frac{1}{2}m_{\text{atom}}v_{\text{escape}}^2 = G_{\text{Newton}}\frac{M_{\text{planet}}m_{\text{atom}}}{r_{\text{planet}}}$, which of the following is FALSE?[179]

    A. v_{escape} is independent of m_{atom}

    B. the formula is valid for all launch angles

    C. the formula is valid only if the particle is launched from the surface of planet of radius r_{planet}

    D. the formula can be used to estimate how fast an atom must move before exiting the planet

    E. the particle is assumed to have been launched vertically

6. What statement is FALSE about $\frac{1}{2}m_{\text{atom}}\langle v_{\text{atom}}^2\rangle_{ave} = \frac{1}{2}k_{\text{B}}T$?[180]

    A. The kinetic energy is directly proportional to temperature.

    B. The average speed of a low mass particle is higher than the average speed of a high mass particle

    C. Temperature is measured in Kelvins

    D. Temperature is measured in Centigrades

    E. This equation does not involve the size or mass of the planet.

7. $\frac{1}{2}m_{\text{atom}}\langle v_{\text{atom}}^2\rangle_{ave} = \frac{1}{2}k_{\text{B}}T$, where "T" is temperature on the Kelvin scale. This formula describes:[181]

    A. The speed an atom needs to escape the planet, where m is the mass of the atom.

    B. The speed of a typical atom, where m is the mass of the atom.

    C. The the speed an atom needs to escape the planet, where m is the mass planet.

    D. The speed of a typical atom, where m is the mass of the planet.

    E. The speed an atom needs to orbit the planet, where m is the mass of the atom.

37 AstroChasingPluto

1. The trip by "New Horizons" from Earth to Pluto took almost a[182]

    A. week

    B. month

    C. year

    D. decade

    E. century

2. The ”Chasing Pluto” video showed a stellar occultation that was observed in order to learn something about Pluto’s[183]

   A. mass

   B. atmosphere

   C. size

3. The ”Chasing Pluto” video showed a stellar occultation that was observed[184]

   A. from the Keck Observatory in 1994

   B. from the 200 inch Hale Telescope in 1968

   C. from the Hubble Space Telescope in 1998

   D. from a cargo plane in 1988

4. A stellar occultation occurs when a planet passes in front of a star[185]

   A. true

   B. false

5. A stellar occultation occurs when the north or south pole of a planet is aligned with a star[186]

   A. true

   B. false

6. Stellar occultation tells something about a planet because[187]

   A. blocking the nearby stars allows a better view of the planet

   B. the star acts as a light source for the detection of planetary spectral lines that are absorption lines

   C. the star acts as a light source for the detection of planetary spectral lines that are emission lines

   D. the orientation of the planet’s rotation about its axis can be precisely determined

7. Silicon carbide was used to construct the telescope ”LORRI” because this material is[188]

   A. strong

   B. light

   C. not prone to warp at low temperature

   D. all of these

8. The darker portions of Pluto are believe to be from ”snowflakes” of[189]

   A. silicates

   B. water

   C. hydrocarbons

   D. nitrogen

9. ”Pepssi”, ”Rex”, ”Swap”, ”Lorri”, ”Alice” and ”Ralf” are[190]

   A. named after friends of the cartoon charactor ’Pluto’

   B. instruments on the ”New Horizon”

   C. asteroids discovered by ”New Horizon”

   D. the people responsible for calculating the orbit of ”New Horizon”

   E. Kuiper objects discovered by ”New Horizon”

10. What was the concern about taking a telescope/camera to the cold environment near Pluto?[191]

    A. the telescope might bend

    B. the the mirror might crack

    C. the plates might crack

    D. the electronics might fail

11. As "New Horizon's" approaches Jupiter, it was essential that [192]

    A. it approach Jupiter closely enough for Jupiter's gravity to pull "New Horizons" to a 20

    B. avoid hitting the moons of Jupiter

    C. avoid going into the rings of Jupiter

12. The time to reach ______ was shortened from 9 days to 3 hours due to the speed of the rocket that delivered "New Horizons"[193]

    A. the Moon

    B. Mars

    C. the asteroid belt

    D. Jupiter

13. While close to Jupiter, "New Horizons" the most spectacular image was of[194]

    A. the great red spot

    B. Jupiter's rings

    C. a newly discovered moon

    D. a live volcano

14. The Kuiper belt has been described as a ______ made of ______[195]

    A. deep freeze ... rock and metal

    B. mystery band ... rock and ice

    C. mystery band ... rock and metal

    D. deep freeze ... rock and ice

15. For most of its nine-year journey, it was asleep, but once a week, the "New Horizon's" spacecraft [196]

    A. photographed EARTH

    B. photographed PLUTO

    C. called MOM

    D. adjusted the ORBIT

16. Clyde Tombaugh, who discovered Pluto back in the 1930s[197]

    A. privately funded the Lowell observatory

    B. was self educated

    C. had resigned from a position at Yale to focus his efforts on discovering "Planet X"

17. Clyde Tombaugh's reward for discovering Pluto was[198]

    A. a Nobel prize

    B. a college education

    C. an invitation to teach at Yale

18. The "blink comparator" compared[199]

   A. the atmosphere around an object with the object itself
   B. the size of two different objects
   C. the location of an object on two different days

19. A typical average radio station uses 50,000 watts to transmit a signal. The transmitter on "New Horizons" used [200]

   A. 5 thousand times less power
   B. 5 thousand times more power
   C. 5 times less power
   D. 5 times more power
   E. almost the same amount of power

20. Mike Brown's search for another Pluto-like object eventually led to the discovery of [[w:Eris—]] in 2005. What was the first clue that Eris was larger than Pluto?[201]

   A. It was brighter in the sky than Pluto
   B. it was surprisingly bright for an object moving that quickly
   C. it was surprisingly bright for an object moving that slowly
   D. it had a surprisingly large influence on Pluto's orbit

21. Pluto ceased to be called a planet in 2006, after the International Astronomical Union defined a planet of our Sun as an object that is (1) in orbit around the Sun, (2) roughly spherical due to it's mass, and (3): [202]

   A. lies in the same plane as the other nine planets
   B. has cleared the neighborhood around its orbit.
   C. has a nearly circular orbit
   D. is larger than Earth's moon
   E. is more massive than Mercury

22. The influence of Jupiter's gravity on Pluto is that Jupiter gradually pushes Pluto away [203]

   A. true
   B. false

23. When the discovery of the "ninth planet" was made in 1930, the name "Pluto" was chosen after a cartoon that was a common childhood experience shared by most astronomers of the day[204]

   A. true
   B. false

24. The influence of Jupiter's gravity on Pluto is that Jupiter gradually brings Pluto closer[205]

   A. true
   B. false

25. Which was NOT listed as one of the three things commonly considered necessary for the formation of life?[206]

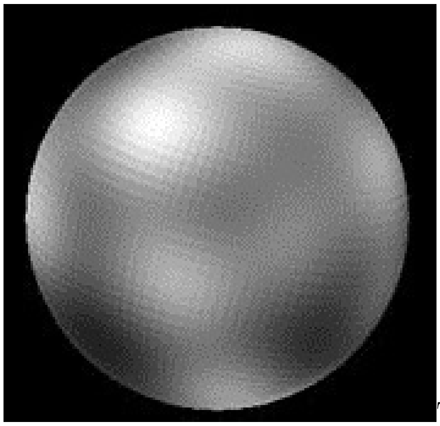
   A. sunlight
   B. water
   C. energy
   D. organic matter

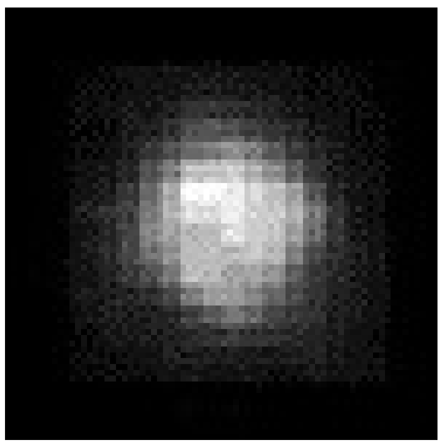
26. As "New Horizon" approached Jupiter, it looked for new Moons, and the ground crew was glad that[207]

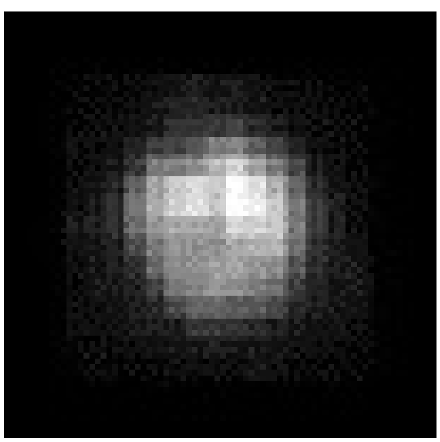
A. the "New Horizon" discovered three new moons

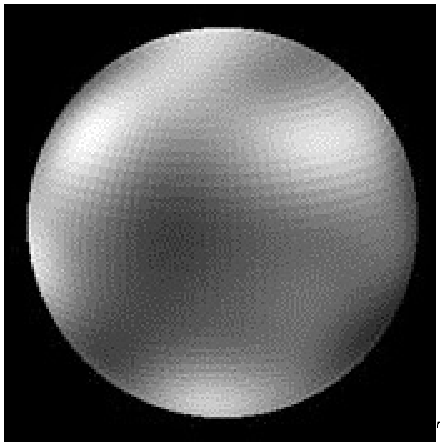
B. there were no new moons because moons are debris generators

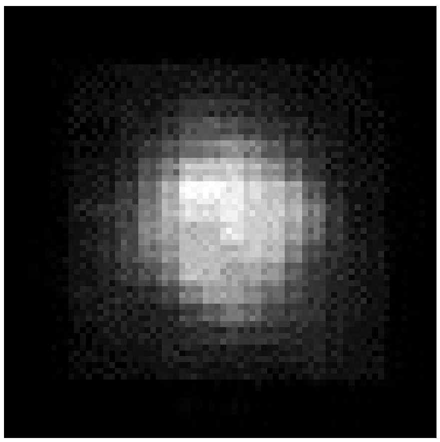
C. there were no new moons because moons are capable of capturing spacecraft

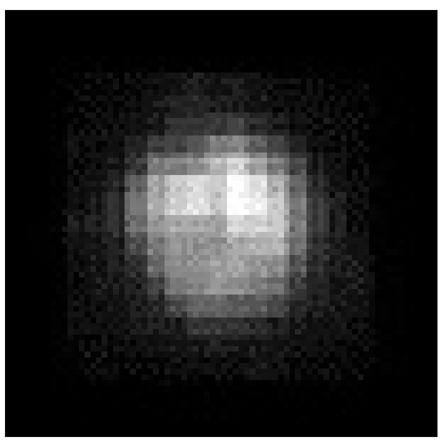
27.  This corresponds to [208]

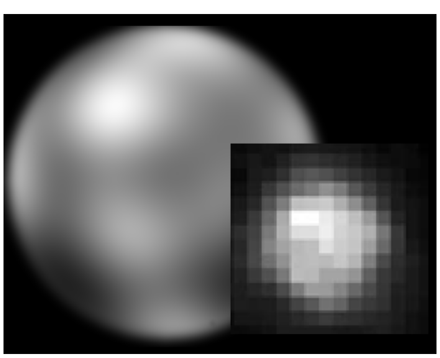
A. This image 

B. This image 

28.  This image corresponds to [209]

A. This image 

B. This image 

29.  These two images of Pluto represent:[210]

A. a land-based telescope and the "Hubble Space Telescope"

B. raw and processed images

C. "New Horizon" near Earth and mid-way to Pluto

D. "New Horizon" mid-way to Pluto and near Pluto
E. "New Horizon" and the "Hubble Space Telescope"

30. The atmosphere of Pluto[211]
    A. emerges when the surface thaws as it approaches the Sun
    B. emerges when the surface thaws due to tidal heating from the Moons
    C. emerges when the surface thaws due to tidal heating from Jupiter
    D. emerges when the surface thaws due to tidal heating from Neptune
    E. is mostly oxygen

31. Energy for the "New Horizon" is provided by[212]
    A. lithium batteries
    B. fuel cells
    C. solar power
    D. nuclear power

32. As it approached Pluto, "New Horizon" was slightly larger than[213]
    A. a grand piano
    B. the Hubble Space Telescope
    C. a 10 story building

38 AstroGalileanMoons

1. How does the density of a Galilean moon depend on its distance from Jupiter? [214]
    A. all the moons have nearly the same density
    B. the more dense moon is closer to Jupiter (always)
    C. the density of the moons is unknown
    D. the less dense moon is closer to Jupiter (always)
    E. the most dense moon is neither the closest nor the most distant

2. How does the mass of a Galilean moon depend on its distance from the central body? [215]
    A. the less massive moon is closer to Jupiter (always)
    B. the mass of the moons is unknown
    C. the most massive moon is neither the closest nor the most distant
    D. the more massive moon is closer to Jupiter (always)
    E. all the moons have nearly the same mass

3. Does Jupiter's moon Io have craters? [216]
    A. no, the surface is too new
    B. yes, from impacts
    C. yes, from volcanoes
    D. no, the surface is too old
    E. yes, about half from impacts and the others from volcanoes

4. The mechanism that heats the cores of the Galilean moons is [217]

A. radiation from the Sun and from Jupiter

B. tides from Jupiter

C. radioactive decay of heavy elements

D. tides from the other moons and Jupiter

E. radiation from the Sun

5. Immediately after publication of Newton's laws of physics (Principia), it was possible to "calculate" the mass of Jupiter. What important caveat applied to this calculation? [218]

A. The different moons yielded slightly different values for the mass of Jupiter.

B. The different moons yielded vastly different values for the mass of Jupiter.

C. Only the mass of Jupiter relative to that of the Sun could be determined.

D. tides from the other moons and Jupiter.

E. They needed to wait over a decade for Jupiter to make approximately one revolution around the Sun.

6. Ganymede, Europa, and Io have ratios in ________ that are 1:2:4. [219]

A. orbital period

B. Argon isotope abundance

C. Two other answers are correct (making this the only true answer).

D. density

E. rotational period

7. Which of Jupiter's moons has an anhydrous core? [220]

A. Europa

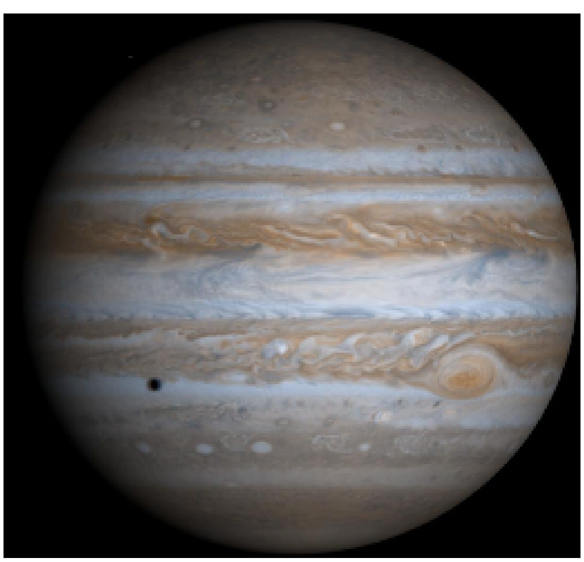
B. Ganymede

C. Two other answers are correct (making this the only true answer).

D. Io

E. Ganymede

39 AstroJupiter

1.  The black spot in this image of Jupiter is[221]

A. an electric storm
B. a solar eclipse
C. Two other answers are correct (making this the only true answer).
D. the shadow of a moon
E. a magnetic storm

2. Although there is some doubt as to who discovered Jupiter's great red spot, it is generally credited to[222]
   A. Tycho in
   B. Galileo in 1605
   C. Newton in 1668
   D. Cassini in 1665
   E. Messier in 1771

3. The bands in the atmosphere of Jupiter are associated with a patter of alternating wind velocities that are[223]
   A. easterly and westerly
   B. updrafts and downdrafts
   C. both of these

4. As one descends down to Jupiter's core, the temperature[224]
   A. increases
   B. decreases
   C. stays about the same

5. Which of the following statements is FALSE?[225]
   A. Jupiter has four large moons and many smaller ones
   B. The Great Red Spot is a storm that has raged for over 300 years
   C. Jupiter emits more energy than it receives from the Sun
   D. Jupiter is the largest known planet
   E. Jupiter has a system of rings

6. What is the mechanism that heats the interior of Jupiter? [226]
   A. rain
   B. tides
   C. radioactivity
   D. magnetism
   E. electricity

7. Why is Jupiter an oblate spheroid?[227]
   A. tides from other gas planets
   B. tides from the Sun
   C. tides from the Jupiter's moons
   D. rotation about axis
   E. revolution around Sun

8. What statement best describes the Wikipedia's explanation of the helium (He) content of Jupiter's upper atmosphere (relative to the hydrogen (H) content)?[228]

- **A. Jupiter's atmosphere has only 80**
- B. Jupiter's atmosphere has 80
- C. Jupiter's atmosphere has only 80
- D. Jupiter's atmosphere has 80
- E. Jupiter and the Sun have nearly the same ratio of He to H.

9. Where is the Sun-Jupiter barycenter?[229]
   - **A. Just above the Sun's surface**
   - B. Just above Jupiter's surface
   - C. At the center of the Sun
   - D. At the center of Jupiter
   - E. The question remains unresolved

10. The barycenter of two otherwise isolated celestial bodies is?[230]
    - A. a place where two bodies exert equal and opposite gravitational forces
    - **B. the focal point of two elliptical orbital paths**
    - C. both of these are true

11. Knowing the barycenter of two stars is useful because it tells us the total mass[231]
    - A. TRUE
    - **B. FALSE**

12. Knowing the barycenter of two stars is useful because it tells us the ratio of the two masses[232]
    - **A. TRUE**
    - B. FALSE

40 AstroKepler

1. Kepler began his career as a teacher of[233]
   - **A. mathematics**
   - B. history
   - C. philosophy
   - D. theology
   - E. astronomy

2. As a child, Kepler's interest in astronomy grew as a result of [234]
   - **A. two of these**
   - B. watching his uncle make a telescope
   - C. a solar eclipse
   - D. a lunar eclipse
   - E. a comet

3. When Kepler's studies at the university were over, what he really wanted to do was [235]
   - **A. become a minister**
   - B. work with Newton

C. visit Athens

D. visit Rome

E. work with Tycho

4. Which of the following is NOT associated with Kepler's Laws[236]

A. Earth orbits the sun

B. planets speed up as they approach the sun

C. circular motions with epicycles

D. planets farther from the Sun have longer orbital periods.

E. elliptical paths for the planets

5. As a planet orbits the Sun, the Sun is situated at one focal point of the ellipse[237]

A. true

B. false

6. As a planet orbits the Sun, the Sun is situated midway between the two focal points of the ellipse[238]

A. true

B. false

7. Newton was able to use the motion of the Moon to calculate the universal constant of gravity, G [239]

A. true

B. false

8. The force of (gravitational) attraction between you and a friend is small because neither of you possess significant mass [240]

A. true

B. false

9. Cavendish finally measured G by carefully weighing the force between[241]

A. Earth and Sun

B. Sun and Moon

C. Jupiter and moons

D. two lead balls

E. Earth and Moon

10. Kepler is also known for his improvements to[242]

A. a perpetual motion machine

B. the telescope

C. translations of the Bible

D. the abacus

E. Ptolemy's star charts

11. In Kepler's era, astronomy was usually considered a part of natural philosophy[243]

A. true

B. false

12. In Kepler's era, astronomy was usually considered a part of mathematics[244]

A. true

B. false

13. In Kepler's era, astronomy closely linked to astrology[245]

A. true

B. false

14. In Kepler's era, physics (how and why things moved) was usually considered a part of natural philosophy[246]

A. true

B. false

15. Kepler incorporated religious arguments and reasoning into his work[247]

A. true

B. false

16. Kepler avoided religious arguments and reasoning in his work[248]

A. true

B. false

17. How would one describe the status of Kepler's family when he was a child?[249]

A. neither wealthy nor of noble birth

B. of noble birth, but in poverty

C. his father and grandfather were scientists

D. wealth and of noble birth

E. wealthy but not of noble birth

41 AstroLunarphasesAdvancedB

1. At 6am a waning crescent moon would be[250]

A. eastern horizon

B. below the western horizon

C. below the eastern horizon

D. high in western sky

E. high in eastern sky

2. At 3pm a third quarter moon would be[251]

A. high in eastern sky

B. below the western horizon

C. nadir

D. overhead

E. eastern horizon

3. At noon a waning crescent moon would be[252]

A. overhead

B. high in eastern sky

C. nadir

D. high in western sky
E. eastern horizon

4. At 9pm a waxing crescent moon would be[253]
   A. below the western horizon
   B. overhead
   C. eastern horizon
   D. high in eastern sky
   E. western horizon

5. At 9am a waxing crescent moon would be[254]
   A. eastern horizon
   B. high in eastern sky
   C. overhead
   D. below the western horizon
   E. nadir

6. At 3am a waxing crescent moon would be[255]
   A. below the eastern horizon
   B. below the western horizon
   C. overhead
   D. high in western sky
   E. nadir

7. At 3am a waning gibbous moon would be[256]
   A. nadir
   B. overhead
   C. eastern horizon
   D. high in western sky
   E. western horizon

8. At 9am a third quarter moon would be[257]
   A. high in eastern sky
   B. high in western sky
   C. nadir
   D. western horizon
   E. below the eastern horizon

9. At 9pm a 1st quarter moon would be[258]
   A. high in eastern sky
   B. overhead
   C. high in western sky
   D. eastern horizon
   E. below the western horizon

10. At 3pm a new moon would be[259]
    A. below the eastern horizon
    B. high in western sky
    C. high in eastern sky
    D. nadir
    E. overhead
11. At 3pm a waning crescent moon would be[260]
    A. nadir
    B. below the eastern horizon
    C. high in western sky
    D. high in eastern sky
    E. western horizon
12. At 9pm a waxing gibbous moon would be[261]
    A. below the western horizon
    B. overhead
    C. high in western sky
    D. nadir
    E. below the eastern horizon
13. At 3pm a waxing gibbous moon would be[262]
    A. below the eastern horizon
    B. below the western horizon
    C. high in western sky
    D. eastern horizon
    E. high in eastern sky
14. At midnight a waning gibbous moon would be[263]
    A. high in eastern sky
    B. high in western sky
    C. western horizon
    D. eastern horizon
    E. below the western horizon
15. At 6am a waxing crescent moon would be[264]
    A. overhead
    B. below the western horizon
    C. eastern horizon
    D. below the eastern horizon
    E. nadir
16. At 9pm a new moon would be[265]
    A. western horizon
    B. high in western sky

C. below the western horizon
D. below the eastern horizon
E. nadir

17. At 9pm a waning gibbous moon would be[266]
A. eastern horizon
B. high in eastern sky
C. high in western sky
D. below the western horizon
E. nadir

18. At 3am a 1st quarter moon would be[267]
A. nadir
B. eastern horizon
C. high in eastern sky
D. below the western horizon
E. high in western sky

19. At 3pm a waxing crescent moon would be[268]
A. nadir
B. overhead
C. eastern horizon
D. high in eastern sky
E. below the eastern horizon

20. At 9am a new moon would be[269]
A. overhead
B. high in western sky
C. high in eastern sky
D. below the western horizon
E. eastern horizon

21. At 9am a waning crescent moon would be[270]
A. overhead
B. eastern horizon
C. below the eastern horizon
D. western horizon
E. nadir

22. At 9am a waxing gibbous moon would be[271]
A. western horizon
B. high in eastern sky
C. nadir
D. high in western sky
E. eastern horizon

23. At 3am a waning crescent moon would be[272]
   A. overhead
   B. nadir
   C. high in eastern sky
   D. eastern horizon
   E. western horizon

24. At midnight a waning crescent moon would be[273]
   A. below the western horizon
   B. western horizon
   C. overhead
   D. below the eastern horizon
   E. nadir

25. At 9pm a full moon would be[274]
   A. overhead
   B. nadir
   C. high in eastern sky
   D. below the western horizon
   E. eastern horizon

26. At 6am a waning gibbous moon would be[275]
   A. nadir
   B. below the western horizon
   C. high in western sky
   D. below the eastern horizon
   E. eastern horizon

27. At 3pm a full moon would be[276]
   A. below the western horizon
   B. nadir
   C. high in eastern sky
   D. below the eastern horizon
   E. western horizon

28. At midnight a waxing gibbous moon would be[277]
   A. below the western horizon
   B. below the eastern horizon
   C. overhead
   D. high in western sky
   E. high in eastern sky

29. At 9am a waning gibbous moon would be[278]
   A. nadir
   B. overhead

C. western horizon
D. high in western sky
E. high in eastern sky

30. At 3am a waxing gibbous moon would be[279]
    A. below the eastern horizon
    B. nadir
    C. western horizon
    D. overhead
    E. high in western sky

31. At 6pm a waning crescent moon would be[280]
    A. eastern horizon
    B. nadir
    C. western horizon
    D. below the western horizon
    E. below the eastern horizon

32. At 3am a new moon would be[281]
    A. overhead
    B. eastern horizon
    C. nadir
    D. below the eastern horizon
    E. high in eastern sky

33. At noon a waxing gibbous moon would be[282]
    A. overhead
    B. below the eastern horizon
    C. high in western sky
    D. nadir
    E. high in eastern sky

34. At 9am a 1st quarter moon would be[283]
    A. western horizon
    B. below the eastern horizon
    C. below the western horizon
    D. nadir
    E. high in western sky

35. At 3pm a waning gibbous moon would be[284]
    A. nadir
    B. high in western sky
    C. western horizon
    D. overhead
    E. eastern horizon

36. At 9am a full moon would be[285]

A. overhead

B. eastern horizon

C. western horizon

D. below the eastern horizon

E. below the western horizon

37. At 6pm a waxing gibbous moon would be[286]

A. high in eastern sky

B. eastern horizon

C. western horizon

D. below the western horizon

E. nadir

38. At 9pm a third quarter moon would be[287]

A. high in western sky

B. high in eastern sky

C. nadir

D. below the eastern horizon

E. below the western horizon

39. At 9pm a waning crescent moon would be[288]

A. eastern horizon

B. high in eastern sky

C. high in western sky

D. nadir

E. below the eastern horizon

40. At noon a waxing crescent moon would be[289]

A. nadir

B. eastern horizon

C. high in western sky

D. overhead

E. high in eastern sky

41. At 3am a third quarter moon would be[290]

A. below the eastern horizon

B. nadir

C. high in eastern sky

D. below the western horizon

E. eastern horizon

42. At 3am a full moon would be[291]

A. below the western horizon

B. nadir

C. high in eastern sky

D. high in western sky

E. western horizon

43. At 6pm a waxing crescent moon would be[292]

A. high in western sky

B. overhead

C. nadir

D. eastern horizon

E. western horizon

44. At 3pm a 1st quarter moon would be[293]

A. below the western horizon

B. high in eastern sky

C. western horizon

D. below the eastern horizon

E. high in western sky

45. At noon a waning gibbous moon would be[294]

A. western horizon

B. below the western horizon

C. overhead

D. nadir

E. high in western sky

46. At midnight a waxing crescent moon would be[295]

A. eastern horizon

B. high in eastern sky

C. below the western horizon

D. high in western sky

E. overhead

47. At 6am a waxing gibbous moon would be[296]

A. nadir

B. high in eastern sky

C. below the eastern horizon

D. below the western horizon

E. eastern horizon

48. At 6pm a waning gibbous moon would be[297]

A. below the eastern horizon

B. western horizon

C. high in western sky

D. below the western horizon

E. high in eastern sky

42 AstroLunarphasesSimple

1. At midnight a new moon would be [298]

    A. western horizon

    B. eastern horizon

    C. overhead

    D. below the horizon

2. At midnight a full moon would be [299]

    A. below the horizon

    B. overhead

    C. eastern horizon

    D. western horizon

3. At 6pm a third quarter moon would be [300]

    A. overhead

    B. eastern horizon

    C. western horizon

    D. below the horizon

4. At 6am a 1st quarter moon would be [301]

    A. eastern horizon

    B. western horizon

    C. overhead

    D. below the horizon

5. At noon a full moon would be [302]

    A. western horizon

    B. below the horizon

    C. eastern horizon

    D. overhead

6. At 6pm a full moon would be [303]

    A. western horizon

    B. overhead

    C. below the horizon

    D. eastern horizon

7. At 6pm a 1st quarter moon would be [304]

    A. below the horizon

    B. overhead

    C. western horizon

    D. eastern horizon

8. At 6am a full moon would be [305]

    A. overhead

B. western horizon

C. below the horizon

D. eastern horizon

9. At noon a third quarter moon would be [306]

A. overhead

B. western horizon

C. below the horizon

D. eastern horizon

10. At noon a 1st quarter moon would be [307]

A. western horizon

B. eastern horizon

C. overhead

D. below the horizon

11. At noon a new moon would be [308]

A. below the horizon

B. overhead

C. western horizon

D. eastern horizon

12. At 6pm a new moon would be [309]

A. eastern horizon

B. western horizon

C. overhead

D. below the horizon

13. At 6am a third quarter moon would be[310]

A. overhead

B. eastern horizon

C. western horizon

D. below the horizon

14. At midnight a third quarter moon would be [311]

A. below the horizon

B. eastern horizon

C. western horizon

D. overhead

15. At midnight a 1st quarter moon would be [312]

A. below the horizon

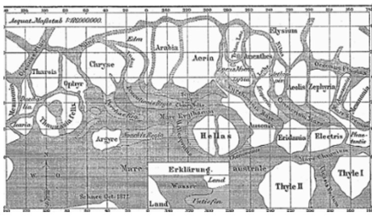
B. overhead

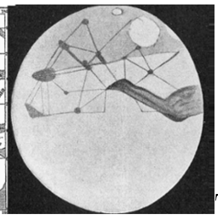
C. eastern horizon

D. western horizon

16. At 6am a new moon would be [313]
    - A. overhead
    - B. western horizon
    - **C. eastern horizon**
    - D. below the horizon

43 AstroMars

1. 

These drawings by Schiaparelli and Lowell were ultimately shown to be:[314]
    - A. slip faults
    - B. subduction zones
    - C. rilles
    - **D. optical illusions**
    - E. rift valleys
2. Antipodal to the Tharsis bulge is[315]
    - **A. What Wikipedia contends IS an impact basin**
    - B. What Wikipedia contends MIGHT BE an impact basin
    - C. What Wikipedia contends IS an active volcano
    - D. What Wikipedia contends MIGHT BE an active volcano
    - E. the northern lowlands
3.  The lobate feature shown in the figure is evidence of [316]
    - A. dust storms
    - B. plate tectonics
    - C. water flow
    - **D. lava flow**
    - E. wind erosion
4. The Martian dichotomy separates[317]
    - A. Valles Marineris from Olympus Mons

B. the rift valley from the volcanoes

C. the highlands from the lowlands

D. the Tharsus buldge from Hellas basin

E. the crust from the mantle

5. According to Wikipedia, ______ was formed due to swelling of the Tharsis bulge which caused the crust to collapse[318]

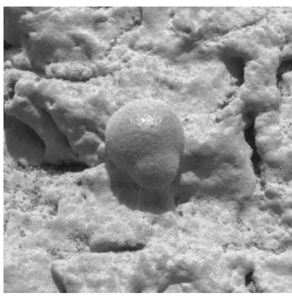
A. Valles Marineris

B. Elysium

C. the southern lowlands

D. Hellas basin

E. the northern lowlands

6.  What is this hematite?[319]

A. evidence that Mars once had oceans

B. irrefutable evidence that Mars once had life

C. controversial evidence that Mars once had life

D. evidence that Mars once had active volcanoes

E. evidence that Mars now has active volcanoes

7. The polar ice caps on Mars are ___[320]

A. caused by geysers

B. actually clouds above the surface of Mars

C. a nearly equal mix of water and carbon dioxide

D. mostly water

E. mostly carbon dioxide

8. Liquid water cannot exist on Mars due to ___[321]

A. high pressure

B. low pressure

C. high temperature

D. low temperature

E. the solar wind

9.  What is at the center of this magnified image of a Martian meteorite?[322]

A. evidence that Mars once had oceans

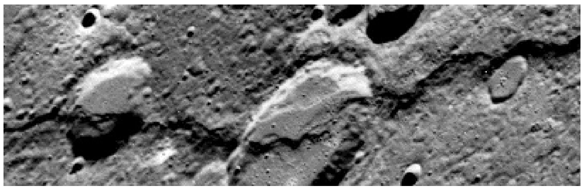
B. irrefutable evidence that Mars once had life

C. controversial evidence that Mars once had life

D. evidence that Mars once had active volcanoes

E. evidence that Mars now has active volcanoes

44 AstroMercury

1.  The horizontal crack along the center of figure is a[323]

   A. antipodal

   B. propodal

   C. meander

   D. scarp

   E. rille

2. Antipodal to Caloris Basin is[324]

   A. an iron/nickel deposit

   B. weird terrain

   C. a scarp

   D. a water deposits

   E. a silicon deposits

3. A volatile is a substance that [325]

   A. reacts violently with acids

   B. reacts violently with water

   C. reacts violently with oxygen

   D. melts or evaporates at high temperature

   E. melts or evaporates at low temperature

4. The four smaller inner planets, Mercury, Venus, Earth and Mars, also called the terrestrial planets, are primarily composed of ___ and ___. [326]

   A. ice and gas

   B. carbon and oxygen

   C. ice and water

   D. ice and rock

   E. metal and rock

5. If the universe is mostly hydrogen, why aren't terrestrial planets made of mostly hydrogen?[327]

   A. thermonuclear fusion in the protosun turned the hydrogen into helium

   B. These planets lie inside the frost line for hydrogen

   C. tidal forces from the Sun prevented accretion

D. tidal forces between the terrestrial planets prevented accretion
E. tidal forces from Jupiter prevented accretion

6. Mercury's atmosphere consists mostly of[328]
   A. hydrogen
   B. helium
   C. oxygen
   D. nitrogen
   E. carbon dioxide

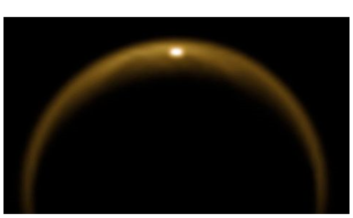
7. In what sequence did Mercury's weird terrain and Caloris basin form?[329]
   A. The were formed at exactly the same time
   B. The weird terrain was formed almost immediately after the Caloris basin
   C. The weird terrain was formed a few millions years after the Caloris basin
   D. The weird terrain was formed approximately 2 billion years after the Caloris basin
   E. The weird terrain was formed approximately 2 billion years before the Caloris basin

45 AstroMirandaTitan

1. The 1982 Voyager flyby of Miranda (a moon of Uranus) established that _____ [330]
   A. Miranda has the largest active volcano in the solar system
   B. Miranda has geysers.
   C. Miranda probably has an iron core
   D. Two other answers are correct (making this the only true answer).
   E. inspired a theory a previous incarnation was destroyed by a collision

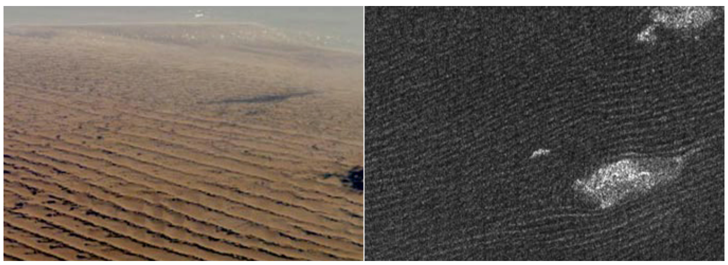
2. It has been suggested that Miranda's "racetrack" [331]
   A. is antipodal to an impact crater
   B. Two other answers are correct (making this the only true answer).
   C. is associated with tidal heating
   D. is an impact crater
   E. is a series of rifts created by an upwelling of warm ice

3. According to Wikipedia, the largest lakes on Titan are probably fed by [332]
   A. rivers from the highlands
   B. methane rain
   C. geysers
   D. liquid water rain
   E. underground aquifers

4.  The bright spot on Saturn's moon Titan is [333]

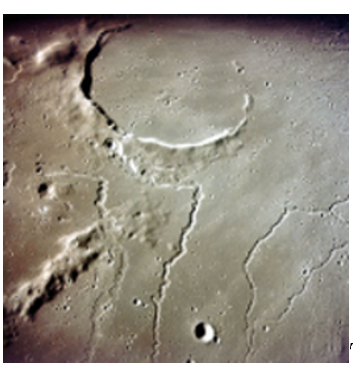
A. a volcano
B. lightening
C. aurora borealis (northern lights)
D. a lake
E. solar wind particles striking the atmosphere

5. One "year" on Saturn's largest moon Titan lasts [334]
A. 3 hours
B. 3 years
C. 30 hours
D. 30 years
E. 300 days

6.  The photographs compare [335]
A. summer windstorms and winter doldrums
B. northern and southern hemispheres
C. winter windstorms and summer doldrums
D. Titan and Earth
E. wet and dry seasons

7. The liquid water ocean of Saturn's largest moon Titan, [336]
A. Two answers are correct
B. is less than one meter in depth
C. explains how the elevation of a smooth planet seems to rise and fall
D. is postulated to cover 15-30
E. is known to contain life

46 AstroPlanetaryScience

1.  The incomplete rims seen in the figure are caused by:[337]
A. meteorite erosion

B. micrometeorite erosion

C. rilles

D. vulcanism

E. low surface gravity

2. Rilles are caused by[338]

A. meteors

B. meteorites

C. water

D. impacts

E. lava

3. In the Wikipedia excerpt on "Planetary Astronomy" the mechanism by which a meander grows over time was discussed. Which of the the following is best describes why meanders grow? (Pick only one best answer) [339]

A. a combination of deposition and erosion

B. combination of deposition and underlying bedrock strength

C. combination of erosion and underlying bedrock strength

D. occasional periods of intense flooding

E. wind erosion

47 AstroPluto and planetary mass

1. Which of the following is NOT used to measure the mass of a planet[340]

A. the rotation of the planet about its axis

B. the motion of an artificial satellite

C. the motion of a moon

D. the motion of a neighboring planet

E. all of these have been used

2. What is unusual about calculations of the mass of Pluto made in the early part of the 20th century?[341]

A. The estimates were correct to within less than 10

B. The estimates were too low. Pluto was actually more massive than they thought.

C. The estimates were high. Pluto was less massive than they calculated

D. It was the first time a moon was used to calculate the mass of a planet

E. It was the first time a planet's period of orbit around the sun was used to calculate the planet's mass

3. Why was the discovery of Pluto peculiar?[342]

A. It was discovered during a survey looking for stars

B. It was seen by Galileo, who thought it was a star

C. It was discovered by a calculation based on flawed assumptions

D. It was seen by Halley, who was looking for comets

E. It was the first time a planet's period of orbit around the sun was used to calculate the planet's mass

4. Which of the following is NOT used to measure the mass of a planet[343]

A. the motion of an artificial satellite

B. the motion of a moon

C. the motion of a neighboring planet

D. all of these have been used

5. Which statement describes the relation between Pluto and Neptune[344]

A. Pluto's orbit lies outside Neptune's orbit

B. Pluto's orbit intersects Neptune's orbit an the two bodies will eventually collide

C. Pluto's orbit intersects Neptune's orbit but they avoid each other because Pluto's mass is too small

D. Pluto's orbit intersects Neptune's orbit but they don't collide because of an orbital resonance between the two

48 AstroPtolCopTycho

1. The Ptolemaic system was geocentric.[345]

A. TRUE

B. FALSE

2. An argument used to support the geocentric model held that heavenly bodies, while perhaps large, were able to move quickly.[346]

A. TRUE

B. FALSE

3. Tycho tended to favor religious arguments over scientific arguments when justifying his opinions about the geocentric/heliocentric controversy.[347]

A. TRUE

B. FALSE

4. Tycho was the first to propose an earth-orbiting sun had planets in orbit around the Sun.[348]

A. TRUE

B. FALSE

5. The Ptolemaic system was heliocentric.[349]

A. TRUE

B. FALSE

6. Most ancient Roman and most medieval scholars thought the Earth was flat.[350]

A. TRUE

B. FALSE

7. Evidence for the Copernican system is that the Earth does not seem to move.[351]

A. TRUE

B. FALSE

8. The ancient Greeks believed in circular orbits, causing them to devise the epicycle and the deferent.[352]

A. TRUE

B. FALSE

9. Copernicus was a university-trained Catholic priest dedicated to astronomy.[353]

A. TRUE

B. FALSE

10. In the late 16th century, Tycho Brahe invented his system to resolve philosophical and what he called 'physical' problems with the geocentric theory.[354]

A. TRUE

B. FALSE

11. Copernicus shared his heliocentric theory with colleagues decades before he died.[355]

A. TRUE

B. FALSE

12. In the late 16th century, Tycho Brahe invented his system to resolve philosophical and what he called 'physical' problems with the heliocentric theory.[356]

A. TRUE

B. FALSE

49 AstroSizeWhitdwrfNeutstarQSO

1. At the center of the Crab nebula is [357]

A. a) all of these is correct

B. b) a pulsar

C. c) none of these is correct

D. d) a neutron star

E. e) the remnants of a supernova

2. One way to determine the distance to a nebula or small cluster of clouds is to compare the angular expansion to the spectroscopic Doppler shift. Two clusters (A and B) have the same spectroscopically measured velocity. Cluster A is moving towards the observer and exhibits the greater angular expansion. Which cluster is closer? [358]

A. cluster A, because it exhibits greater angular expansion

B. cluster B, because it exhibits less angular expansion

C. cluster A, because it exhibits a blue Doppler shift

D. cluster B, because it exhibits a red Doppler shift

E. either cluster might be more distant

3. What causes the "finger-like" filamentary structure in the Crab nebula?[359]

A. cyclotron motion, causing the electrons to strike oxygen molecules

B. a heavy (high density) fluid underneath a light (low density) fluid, like a lava lamp

C. a light(low density) fluid underneath a heavy(high density) fluid, like a lava lamp

D. electrons striking oxygen molecules, like a lava lamp

E. electrons striking hydrogen molecules, like a lava lamp

4. $KE = \frac{4\pi^2}{5}\frac{MR^2}{P^2}$ is the kinetic energy of a solid rotating ball, where M is mass, R is radius, and P is period. And, $power = \frac{energy}{time}$. You are banging espressos in a little coffeehouse with your astronomy friends, talking about a new SN remnant that closely resembles the Crab. You have observed the pulsar, and wonder what the total power output of the nebula might be. You know both the period of the pulsar, as well as τ, which represents the amount of time you think the pulsar will continue pulsing if it continues slowing down at its present rate. What formula do you write on your napkin?[360]

A. $power = \frac{4\tau\pi^2}{5}\frac{MR^2}{P^2}$

B. $power = \frac{4\pi^2}{5\tau}\frac{MR^2}{P^2}$

C. $power = \frac{5}{4\tau\pi^2}\frac{MR^2}{P^2}$

D. $power = \frac{4\pi^2}{5\tau^2}\frac{MR^2}{P^2}$

E. $power = \frac{4\pi^2}{5}\frac{MR^2}{P^2}\tau^4$

5. In one respect, the universie is arguably ”young”, considering how much complexity it contains. This is often illustrated by a calculation of[361]

   A. recalibration of supernovae luminosity

   B. recalibration of supernovae relative magnitude

   C. cosmic expansion

   D. chimps typing Shakespeare

   E. cosmic redshift

6. Comparing Hubble's original (1929) plot of redshift versus distance with the later one in 2007, the latter extends farther into space by a factor of[362]

   A. 10

   B. 100

   C. 1000

   D. 10,000

   E. 100,000

7. The course materials present two cosmic expansion plots. Hubble's original (1929) plot used[363]

   A. Cepheid variables

   B. red giants

   C. novae

   D. supernovae

   E. entire galaxies

8. The course materials present two cosmic expansion plots. The more recent (2007) plot used[364]

   A. Cepheid variables

   B. red giants

   C. novae

   D. supernovae

   E. entire galaxies

9. Place yourself in an expanding raisinbread model of Hubble expansion. A raisin originally situated at a distance of 4 cm expands out to 12 cm. To what distance would a raisin originally situated at a distance of 2 cm expand?[365]

   A. 2

   B. 3

   C. 4

   D. 6

   E. 8

10. You at the center raisin of an expanding raisinbread model of Hubble expansion, and from your location a raisin originally situated at a distance of 1 cm expands out to a distance of 4 cm. The nearest raisin with intelligent life is situated exactly halfway between your (central) location and the edge. How would this second "intelligent" raisin view an expansion of a raisin 1 cm away?[366]

   A. expansion from 1 cm to 8 cm (twice yours).

   B. expansion from 1 cm to 4 cm (just like yours).

   C. expansion from 1 cm to 2 cm (half of yours)

   D. expansion from 1 cm to 3 cm (since 3-1=2)

   E. expansion from 1 cm to 9 cm (since 5-1=4)

11. Place yourself in an expanding raisinbread model of Hubble expansion. A raisin originally situated at a distance of 2 cm expands out to 4 cm. To what distance would a raisin originally situated at a distance of 4 cm expand?[367]

   A. 2

   B. 3

   C. 4

   D. 6

   E. 8

12. Aside from its location on the HR diagram, evidence that the white dwarf has a small radius can be found from[368]

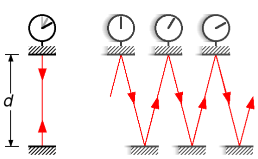
   A. the expansion of the universe

   B. the mass as measured by Kepler's third law (modified by Newton)

   C. the doppler shift

   D. the temperature

   E. the gravitational redshift

13. 

This light clock is associated with [369]

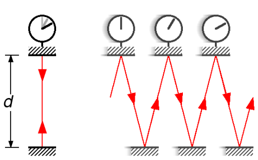
   A. all of these are true

   B. gravitational shift

   C. doppler shift

   D. special relativity

   E. general relativity

14. 

Suppose the light clock involved a ball being tossed back and forth on a train going just under the speed of sound. In contrast to the situation for light reflecting back and forth on a train going just under the speed of light, there is virtually no time dilation. Why?[370]

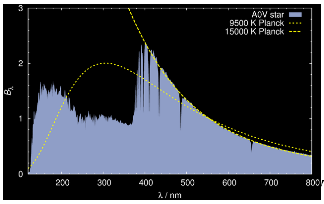
   A. The observer on the ground would perceive the width the train to be greater.

   B. The observer on the ground would perceive the ball to be travelling faster.

   C. The observer on the ground would perceive the ball to be travelling more slowly.

D. The observer on the ground would perceive the width the train to be smaller.

E. Special relativity is valid only for objects travelling in a vacuum.

15. 

This spectrum of the star Vega suggests that[371]

A. it is an approximate black body

B. if is not really a black body

C. all of these are true

D. it's surface can be associated with a range of temperatures

E. it can be associated with an "effective" temperature

16. Which of the following is NOT an essential piece of a a strong argument that a white dwarf is not only the size of the earth, but typically has the same mass as the Sun. [372]

A. the wobble of Sirius A

B. the distance to Sirius A

C. all of these are true

D. the "color" (spectral class) of Sirius B

E. the relative magnitude of Sirius B

17. The course materials presented three arguments suggesting that a white dwarf is roughly the size of the earth. Which best summarizes them?[373]

A. doppler-shift...period-of-pulsation...temperature-luminosity

B. temperature-luminosity...redshift...quantum-theory-of-solids

C. x-ray-emmission...doppler-shift...rotation-rate

D. HR-diagram-location...X-ray-emmision...spectral-lines

E. all of these are true

18. As of 2008, the percent uncertainty in the distance to the Crab nebula is approximately, [374]

A. 0.1

B. 1

C. 10

D. 25

E. 100

19. What was Messier doing when he independently rediscovered the Crab in 1758? [375]

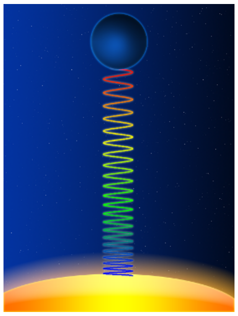
A. Trying to measure the orbital radius of a planet

B. Looking for a comet that he knew would be appearing in that part of the sky.

C. Looking for lobsters

D. Attempting one of the first star charts

E. Attempting to count asteroids

20.  What best explains this figure?[376]

A. The photon loses energy, not speed. By c=fλ , it loses frequency, and by E=hf it increases wavelength and turns red.

B. The photon slows down, by the Doppler shift, E=hf, and therefore by c=fλ it turns red.

C. The photon slows down, by the Doppler shift, c=fλ , and therefore by E=hf it turns red.

D. The photon slows down as it goes uphill, and by c=fλ it increases wavelength therefore by E=hf, it turns red.

E. The photon loses energy, not speed. By E=hf, it loses frequency, and by c=fλ it increases wavelength and turns red.

21. What causes the blue glow of the Crab nebula?[377]

A. the curving motion of electrons in a magnetic field; such motion resembles a radio antenna

B. the same emission found in a Lava lamp (ultra-violet)

C. the curving motion of electrons in a magnetic field; such motion traps ultra-violet and blue light

D. the Doppler blue shift

E. the Gravitational blue shift

50 AstroStarCluster

1. A grouping with 100 thousand stars would probably be a[378]

A. elliptical galaxy

B. dwarf galaxy

C. A-B association

D. open cluster

E. globular cluster

2. Many stars in a typical open cluster are nearly as old as the universe[379]

A. True

B. False

3. Many stars in a typical globular cluster are nearly as old as the universe[380]

A. True

B. False

4. The number of globular clusters in the Milky way galaxy is about[381]

A. 1,500

B. 150

C. 15 thousand

D. 15 million

5. The location of open clusters can be described as[382]
   A. uniformly distributed in a sphere centered at the Milky Way's center
   B. in the spiral arms
   C. between the spiral arms
   D. uniformly distributed within the galactic disk

6. Stars can "evaporate" from a cluster. What does this mean?[383]
   A. The gravitational attraction between stars evaporates the gas from stars
   B. The solar wind from neighboring stars blows the atmosphere away
   C. Close encounters between 3 or more cluster members gives one star enough speed to leave the cluster

7. A grouping with a hundred stars is probably a[384]
   A. elliptical galaxy
   B. dwarf galaxy
   C. A-B association
   D. open cluster
   E. globular cluster

8. I gravity is what holds stars in a cluster together, what is the most important process that causes them to spread apart?[385]
   A. random motion
   B. solar wind
   C. magnetism
   D. anti-gravity
   E. supernovae

9. Members of an open cluster feel significant forces only due to gravitational interaction with each other[386]
   A. True
   B. False

10. Members of an open cluster feel significant forces from nearby giant molecular clouds[387]
    A. True
    B. False

11. Members of a globular cluster tend to be[388]
    A. young
    B. old
    C. of all ages

12. Members of a globular cluster tend to have[389]
    A. low mass
    B. high mass
    C. a wide range of masses

13. In 1917, the astronomer Harlow Shapley was able to estimate the Sun's distance from the galactic centre using[390]

    A. open clusters

    B. goblular clusters

    C. a combination of open and globular clusters

14. Most globular clusters that we see in the sky orbit _____ and have ______ orbits[391]

    A. the center of the Milky way ... nearly circular

    B. the center of the Milky way ... elliptic orbits

    C. within the disk of the Milky way ... nearly circular

    D. within the disk of the Milky way ... elliptic orbits

51 AstroStellarMeasurements

1. Stellar parallax is [392]

    A. an annual change in angular position of a star as seen from Earth

    B. an astronomical object with known luminosity.

    C. the total amount of energy emitted per unit time.

    D. a numerical measure of brightness as seen from Earth

    E. a numerical measure of brightness as seen from a distance of approximately 33 light-years

2. A star that is increasing it's temperature while maintaining constant luminosity is[393]

    A. getting smaller in size

    B. turning red

    C. in the process of dying

    D. on the verge of becoming a supernovae

    E. getting larger in size

3. The range of wavelength for visible light is between[394]

    A. 400 and 700 nanometers

    B. 1 and 10 nanometers

    C. 600 and 1200 nanometers

    D. 0.1 and 10 nanometers

    E. 5000 and 6000 nanometers

4. Based on the HR diagrams and images in stars shown in the materials, a very large red supergiant has a diameter that is about ____ greater than a small white dwarf.[395]

    A. $3x10^3$

    B. $3x10^9$

    C. $3x10^{11}$

    D. $3x10^7$

    E. $3x10^5$

5. Luminosity is [396]

    A. an annual change in angular position of a star as seen from Earth

B. an astronomical object with known luminosity.

C. the total amount of energy emitted per unit time.

D. a numerical measure of brightness as seen from Earth

E. a numerical measure of brightness as seen from a distance of approximately 33 light-years

6. A standard candle is[397]

A. an annual change in angular position of a star as seen from Earth

B. an astronomical object with known luminosity.

C. the total amount of energy emitted per unit time.

D. a numerical measure of brightness as seen from Earth

E. a numerical measure of brightness as seen from a distance of approximately 33 light-years

7. Absolute magnitude is [398]

A. an annual change in angular position of a star as seen from Earth

B. an astronomical object with known luminosity.

C. the total amount of energy emitted per unit time.

D. a numerical measure of brightness as seen from Earth

E. a numerical measure of brightness as seen from a distance of approximately 33 light-years

8. Relative magnitude is[399]

A. an annual change in angular position of a star as seen from Earth

B. an astronomical object with known luminosity.

C. the total amount of energy emitted per unit time.

D. a numerical measure of brightness as seen from Earth

E. a numerical measure of brightness as seen from a distance of approximately 33 light-years

9. In 1989 the Hipparcos satellite was launched primarily for obtaining parallaxes and proper motions allowing measurements of stellar parallax for stars up to about 500 parsecs away, which is about ____ times the diameter of the Milky Way Galaxy.[400]

A. .015

B. 0.15

C. 1.5

D. 15

E. 150

10. An object emits thermal (blackbody) radiation with a peak wavelength of 250nm. How does its temperature compare with the Sun? [401]

A. The temperature is the same

B. 2 times colder than the Sun

C. 2 times hotter than the Sun

D. 5 times colder than the Sun

E. 5 times hotter than the Sun

11. Let us define the 'normalized intensity' of a Sun-like star situated one parsec from Earth to be $4\pi I = 1$. What is $4\pi I$ for a star with 100 times the Sun's energy output that is situated 10pc from Earth? (In other words, by what factor does intensity change if a stars energy output increases by a factor of 100 as it is moved 10 times farther away?)[402]

    A. 10^{-2}
    B. 10^{-3}
    C. 10^{-1}
    D. 10^{-4}
    E. 1

12. An orbiting satellite makes a circular orbit 5 AU from the Sun. It measures a parallax angle of 0.2 of an arcsecond (each way from the average position). What is the star's distance? [403]

    A. 10 parsecs
    B. 25 parsecs
    C. 5 parsecs
    D. 1 parsec
    E. 50 parsecs

52 AstroVenus

1. When imaged in visible light Venus appears like ______ rather than ______.[404]

    A. an asteroid ... a terrestrial planet
    B. a gas dwarf ... a rocky planet
    C. Mars ... Venus
    D. Venus ... Mars

2. The clouds on Venus are made of[405]

    A. water
    B. steam
    C. carbon dioxide
    D. nitrogen
    E. sulfuric acid

3. The geology of Venus is predominantly[406]

    A. Basalt
    B. Andesite
    C. Picrite

4. Basalt is what type of rock?[407]

    A. Igneous
    B. Sedimentary
    C. Metamorphic

5. The rocks on Venus are mostly[408]

    A. from volcanoes

B. from the seabed of a now non-existent ocean
C. associated with plate tectonics

6. The rocky surface of the planet Venus can be detected when Venus is observed using infrared astronomy.[409]
A. TRUE
B. FALSE

7. When Venus is viewed in the ultraviolet, its color appears brownish.[410]
A. TRUE
B. FALSE

8. Moldavite is a mineral that may be associated with what radiation astronomy phenomenon?[411]
A. lightening strikes
B. meteorite impacts and fireballs
C. evidence that Venus was once a comet
D. predicting when currently dormant volcanoes will erupt

9. According to Wikipedia, a "mineral" is a naturally occurring solid that[412]
A. is heterogeneous
B. has useful value
C. is by a chemical formula
D. contains carbon
E. does not contain carbon

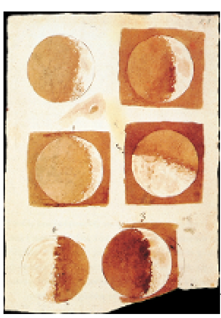
10. Which types of radiation astronomy directly observe the rocky-object surface of Venus?[413]
A. X-ray astronomy
B. ultraviolet astronomy
C. visual astronomy
D. infrared astronomy
E. radio astronomy

11. One reason that Venus's atmosphere has more carbon dioxide than Earth's is that[414]
A. the mass of Venus is slightly higher
B. Venus was too hot for oceans that could absorb the carbon dioxide
C. Venus is exposed to a stronger solar wind strips away the other gasses
D. Venus has a lower magnetic field that disassociates carbon dioxide

12. The surface temperature of Venus is about[415]
A. 850 Fahrenheit (730 Kelvin or 230 Celsius)
B. 450 Fahrenheit (500 Kelvin or 66 Celsius)
C. 150 Fahrenheit (340 Kelvin or 66 Celsius)

13. The Venetian atmosphere consists of mostly carbon dioxide and[416]
A. oxygen
B. helium
C. hydrogen
D. nitrogen
E. sulfuric acid

53 AstroWikipediaAstronomy

1. When did astronomy split between theoretical and observational branches?[417]
   - A. In the 19th century
   - **B. In the 20th century**
   - C. After Galileo
   - D. In the last decade
   - E. In the 18th century
2. According to the Wikipedia Astronomy article, the first known efforts in the mathematical and scientific study of Astronomy began[418]
   - **A. among the Babylonians**
   - B. among the Chinese
   - C. in south America
   - D. in ancient Greece
   - E. in central America
3. How many years did it take before Europe made a device as sophisticated as Antikythera?[419]
   - A. 300 years
   - B. 3000 years
   - C. 30 years
   - **D. 1500 years**
   - E. 15,000 years
4. The saro cycle was about repeating cycles of[420]
   - A. planets
   - **B. eclipses**
   - C. seasons
5. Who drew these sketches?[421]
   - A. Kepler
   - B. Aristotle
   - C. Ptolemy
   - **D. Galileo**
   - E. Copernicus
6. In what century was parallax first used to measure the distance to a Star (other than our Sun)?[422]
   - A. 17th century
   - **B. 19th century**

C. 18th century
D. 20th century
E. 16th century

7. The largest galaxy in the local group is[423]
   A. ant-galexy
   B. Andromeda
   C. M52
   D. Milky way
   E. M-31

8. What two names are associated with the first new planet found (after those known by the ancients using the naked eye)[424]
   A. Neptune and the Alabama Streaker
   B. Mercury and Friendship
   C. Uranus and George's Star
   D. Mars and the Candy Bar
   E. Pluto and Goofy

9. The historical record shows that in 1066 AD a supernovae was discovered by astronomers in _____ and _____[425]
   A. China and South America
   B. Greece and North America
   C. Greece and China
   D. Greece and Central America
   E. Egypt and China

10. What does the Wikipedia 'Astronomy' call astrology? [426]
   A. the study of planetary cores
   B. the belief that all people should learn astronomy
   C. the belief system which claims that human affairs are correlated with the positions of celestial objects.
   D. the study of planetary atmospheres
   E. the study of comets and asteroids

11. Cosmology is the study of[427]
   A. the universe as a whole
   B. the birth and death of stars
   C. the oceans
   D. the formation of the solar system
   E. planetary atmospheres

12. What does the Wikipedia 'Astronomy' article say about astronomy and astrophysics[428]
   A. They are often in conflict
   B. They must be in agreement or the result cannot be trusted
   C. They often yield different results

D. They are often considered to be synonymous

E. They are often considered to be opposites

13. The goecentric theory put the Sun[429]

A. orbiting around the Moon

B. none of the above or below are true

C. at the center of the universe

D. at the center of the solar system

E. in orbit around Earth

14. In the 3rd century BC, Aristarchus of Samos estimated the size of [430]

A. the Moon and Sun

B. the Sun

C. Earth and the Sun

D. Earth and the Moon

E. the Moon

15. In the 19th century Fraunhoffer and Kirchoff studied light from the Sun and found[431]

A. Mercury's shadow

B. a wobble that led to the discovery of new planets

C. spectral lines and concluded that they were caused by the elements

D. sunspots and the sunspot cycle

E. a golden ring

16. The ancient Greeks discovered (named) most of the constellations[432]

A. in the southern hemisphere

B. in the northern hemisphere

C. in both all hemispheres

D. in the western hemisphere

E. in the eastern hemisphere

17. When did astronmers establish that the Milky way is only one of many billions of galaxies in the universe?[433]

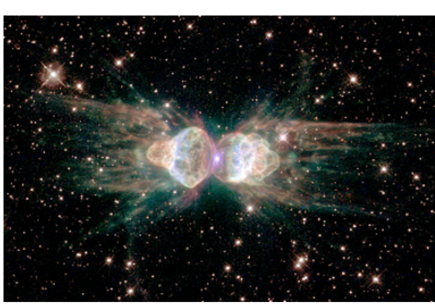
A. 14th century

B. 18th century

C. 20th century

D. 16th century

54 AstroWikipediaAstronomy2

1. What is this? [434]

A. the magnetic field of Venus

B. colliding galaxies

C. a supernovae remnant

D. the magnetic field of Saturn

E. a dying star

2. An active galaxy is emitting a significant amount of its energy from _____[435]

A. magnetism

B. gravity

C. nuclear fusion

D. nuclear fission

E. exploding stars

3. Wihlem Conrad Rontgen, a pioneer in X-rays is famous for his photo of [436]

A. a double star

B. his wife

C. Barnard's star

D. The Sun

E. a supernovae

4. Earth based infrared observatories tend to be located in[437]

A. underground

B. where the air is cold

C. where the air is dry

D. near the equator

E. near the north and south poles

5. The shortest wavelength of electromagnetic radiation is associated with[438]

A. X-rays

B. blue light

C. infrared

D. gamma rays

E. ultra violet

6. What are the blue things in this figure?[439]

A. a globular cluster

B. an open cluster of stars

C. a cluster of galaxy

D. one galaxy

E. none of these is correct

7. Most of the ______ that astronomers observe from Earth is seen in the form of synchrotron radiation, which is produced when electrons oscillate around magnetic fields.[440]

A. meteors

B. photons

C. radio waves

D. energy

E. meteorites

8. Most gamma rays are[441]

A. in bursts

B. from cold stars

C. from the Sun

D. the Andromeda galaxy

E. from hot stars

9. Studies in the infrared are useful for objects that are[442]

A. associated with supernovae

B. in our own galaxy

C. cold

D. inside the solar system

E. in other galaxies

10. The best place to observe neutrinos is [443]

A. underground

B. near the north and south poles

C. near the equator

D. where the air is dry

E. where the air is cold

55 AstroWikipSidereNunc

1. The Wikipedia article 'Sidereus Nuncius' suggests that the inventor of the telescope was likely to be[444]

A. a lensmaker

B. a Chinese scientist

C. Galileo

D. A Greek scholar

E. none of these

2. When the German astronomy Marius provided evidence that he (Marius) had first seen the moons of Jupiter, Galileo[445]
   - **A. won the argument using his knowledge of calendars**
   - B. pointed out that the telescope Marius was using could not have seen the Moons
   - C. used his political contacts to ensure that he (Galileo) would get credit
   - D. appealed to the Pope
   - E. didn't care; he was a true scientist
3. Prior to the publication of Sidereus Nuncius, the Church [446]
   - A. had outlawed all discussion of the Copernican heliocentric system
   - B. had given Galileo a commission to look into the Copernican heliocentric system
   - C. was unaware of any controversy concerning the Copernican heliocentric system
   - **D. accepted the Copernican heliocentric system as strictly mathematical and hypothetical**
   - E. none of these are true (according to the Wikpedia permalink to 'Sidereus Nuncius'.)
4. Galileo called his telescope [447]
   - A. a mistake
   - B. a double magnifying glass
   - C. the magic eye
   - D. the liberator
   - **E. an optical cannon**
5. The "terminator" for Galileo was [448]
   - A. the equator
   - **B. sunrise or sunset**
   - C. the division between east and west
   - D. the most distant star he could see
   - E. his trial for heresy
6. Galileo used the terminator to[449]
   - A. deduce the color beneath the dust layer
   - **B. correlate color with whether the region had mountains**
   - C. compensate for stellar parallax
   - D. observe the wobble of the Moon's orbit
   - E. none of these
7. Galileo used the terminator to [450]
   - A. correlate dark and light regions with terrain
   - B. measure the height of mountains
   - C. compensate for stellar parallax
   - D. publicize his ideas
   - **E. two of these**
8. What statement is FALSE about Galileo and the Median Stars [451]
   - A. they were lined up

B. they were described by Aristotle

C. they are actually moons

D. motion could be observed after observing a moon for just one hour

E. Galileo named them after a famous and wealthy family

9. The title of Galileo's book, 'Sidereus Nuncius', is often translated as ____, but it is probably more proper to translate it as _______ [452]

A. the motion of the earth - - the location of the earth

B. Starry messenger - - Starry message

C. the motion of the stars - - the location of the stars

D. the Moon close up - - the Moon through a telescope

E. the moons of Jupiter

10. The Wikipedia article, 'Sidereus Nuncius', points out that what the ancient Greek scientist thought was a cloudy star was really [453]

A. a planetary nebula

B. a supernovae remnant

C. the rings of Saturn

D. a comet

E. many faint stars

11. Galileo's naming of the "Medicean Stars"[454]

A. caused his house arrest

B. was controversial because stars were supposed to be named after Roman gods

C. might have earned him a promotion

D. broke an agreement he made with the Pope to stop writing about astronomy

E. two of these are true

56 AstroWikipSolSys1

1. Very far from the sun, the heliosphere[455]

A. becomes the magnetosphere

B. reverses direction

C. becomes weaker than the interstellar wind

D. spins in the opposite direction

E. never ends

2. According to Wikipedia, if all the mass of the asteroid belt were combined to one object, it's mass would _______ times less than Earth's mass.[456]

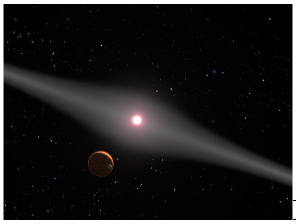
A. 1

B. 10

C. 100

D. 1,000

E. 10,000

3. In this hypothetical image of a sun-like star we see a bright band of dust that we on Earth call zodiacal light. It is due to sunlight reflecting off dust in the[457]

   A. magnetic sun's magnetic field
   B. Oort Cloude
   C. Kuiper belt
   D. Van Allen belt
   E. ecliptic plane

4. In planetary science, the frost line refers to a distance away from [458]

   A. the star in the middle
   B. the north pole of a planet
   C. the south pole of a planet
   D. either pole of a planet
   E. ecliptic plane

5. Oort's cloud was hypothesized to explain the source of [459]

   A. planets
   B. asteroids
   C. comets
   D. water inside the frost line
   E. water outside the frost line

6. According to Wikipedia _______ and ______ are referred to as volatiles. [460]

   A. electrons and protons
   B. ices and gasses
   C. acids and bases
   D. planets and moons
   E. asteroids and terrestrial planets

7. Which of the following list is properly ranked, starting with objects closest to the Sun?[461]

   A. Kuiper belt, Oort's cloud, Asteroid belt
   B. Oort's cloud, Asteroid belt, Kuiper belt
   C. Asteroid belt, Kuiper belt, Oort's cloud
   D. Asteroid belt, Oort's cloud, Kuiper belt
   E. Kuiper belt, Asteroid belt, Oort's cloud

8. When the sun turns into a red giant, [462]

   A. surface temperature decreases; energy output increases
   B. surface temperature increases; energy output increases
   C. surface temperature decreases; energy output decreases

D. surface temperature increases; energy output decreases

E. The sun will not turn into a red giant

9. A volatile is a substance that[463]

A. reacts violently with acids

B. reacts violently with water

C. reacts violently with oxygen

D. melts or evaporates at high temperature

E. melts or evaporates at low temperature

10. All planets lie within a nearly flat disc called the ________ plane[464]

A. interstellar

B. retrograde

C. ecliptic

D. angular

E. fissile

11. The AU is[465]

A. a measure of the brightness of a planet

B. the size of Oort's cloud

C. the most distant Kuiper object from the Sun

D. the distance from Earth to the Moon

E. the distance from the Sun to Earth

12. The Sun and Earth are about[466]

A. 5 million years old

B. 50 million years old

C. 500 million years old

D. 5 billion years old

E. 50 billion years old

13. The universe is about[467]

A. 15 million years old

B. 150 million years old

C. 1.5 billion years old

D. 15 billion years old

E. 150 billion years old

14. Roughly how much bigger is a gas planet than a terrestrial planet?[468]

A. 3

B. 10

C. 30

D. 100

E. 300

15. Roughly how much bigger is a the Sun than a gas planet?[469]

   A. 3
   B. 10
   C. 30
   D. 100
   E. 300

57 AstroWikipSolSys2

1. In astrophysics, what is accretion? [470]

   A. the growth of a massive object by gravitationally attracting more matter
   B. the growth in size of a massive star as its outer atmosphere expands
   C. the growth of a comet's tail as it comes close to the Sun
   D. the increase in temperature and pressure of a star as it collapses from its own gravity
   E. the condensation of volatiles as a gas cools

2. Dwarf planets are defined as objects orbiting the Sun and smaller than planets, that? [471]

   A. have been rounded by their own gravity
   B. possess an atmosphere
   C. lack an atmosphere
   D. are too far from the Sun to be planets
   E. lie in the asteroid belt

3. Dwarf planets have no natural satellites, [472]

   A. true
   B. false

4. Pluto is classified as [473]

   A. a dwarf planet and a trans-Neptunian object.
   B. an asteroid belt object
   C. a dwarf planet with no natural satellites
   D. a natural satellite of Neptune
   E. a natural satellite of Uranus

5. How many of the outer planets have rings? [474]

   A. 4
   B. 3
   C. 2
   D. 1

6. Currently there are approximately 8 billion people on Earth. For every person on Earth there will are approximately ___ stars in the Milky Way galaxy. [475]

   A. 20
   B. 2
   C. 200

D. 2000

7. The revolution of Haley's comet around the Sun is nearly circular. [476]

A. true

B. false

8. The revolution of Haley's comet around the Sun is opposite that of the 8 planets.[477]

A. true

B. false

9. The frost line is situated approximately [478]

A. 5 times as far from the Sun as the Earth is from the Sun

B. 10 times as far from the Sun as the Earth is from the Sun

C. 5 times as far from the Earth as the Earth's surface is from its center

D. 10 times as far from the Earth as the Earth's surface is from its center

58 AstroWikipStar

1. Why is a star made of plasma? [479]

A. it is so hot that electrons are stripped away from the protons

B. the intense gravity liquefies the substance, just as red blood cells liquefy plasma in the body

C. the interstellar gas was mostly plasma

D. plasma is always present when there are strong magnetic fields

E. plasma is generic word for "important"

2. Premain sequence stars are often surrounded by a protoplanetary disk and powered mainly by [480]

A. the fission of Carbon from Helium

B. the fusion of Helium to Carbon

C. the release of gravitational energy

D. collisions between protoplanets

E. chemical reactions

3. Stars that begin with more than 50 solar masses will typically lose _______ while on the main sequence. [481]

A. 1% their mass

B. 50% their mass

C. 10% of their magnetic field

D. 10% their mass

E. all of their magnetic field

4. The Hayashi and Henyey tracks refer to how T Tauri of different masses will move [482]

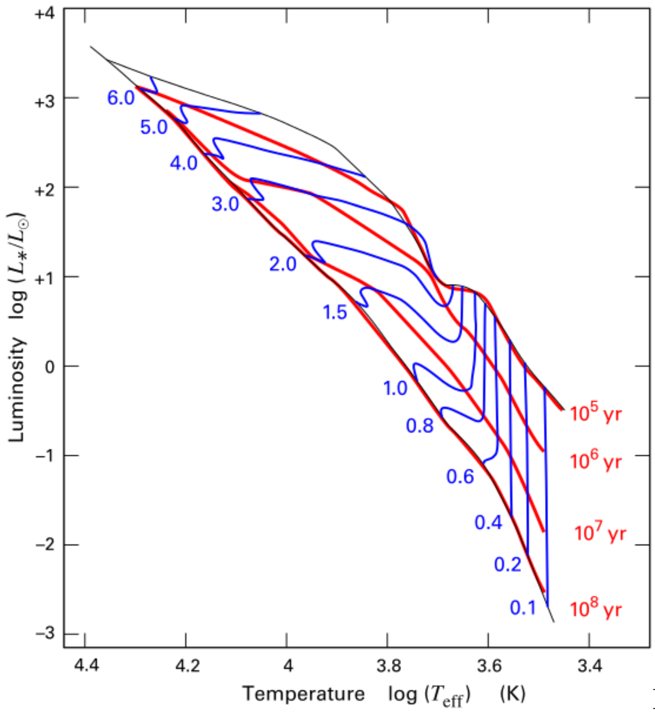
A. through an HR diagram as they die

B. through a cluster as they die

C. through a cluster as they are born

D. Two of these are true

E. through an HR diagram as they are born

5. 

How do low-mass stars change as they are born?[483]

A. Increasing temperature with no change in luminosity
B. Increasing luminosity with no change in temperature
C. Decreasing temperature and increasing luminosity
D. Decreasing temperature with no change in luminosity
E. Decreasing luminosity with no change in temperature

6. When a star with more than 10 solar masses ceases fuse hydrogen to helium, it [484]

A. it fuses helium to carbon to iron (and other elements), then continues to release more energy by fusing the iron to heavier elements such as uranium.
B. it fuses elements up to uranium, and continues to produce energy by the fission of uranium.
C. it fuses helium to carbon and other elements up to iron and then ceases to produce more energy
D. it fuses helium to carbon and then ceases to produce more energy
E. ceases to convert nuclear energy.

7. Many supernovae begin as a shock wave in the core that was caused by [485]

A. electrons being driven into protons to form neutrons
B. all of these processes contribute to the shock wave
C. iron fusing into heavier elements such as uranium
D. the conversion of carbon into diamonds,
E. carbon and other elements fusing into iron

8. A dying star with more than 1.4 solar masses becomes a ______, and those with more than 5 solar masses becomes a _____ [486]

A. neutron star....black hole
B. white dwarf....black hole
C. white dwarf....neutron star
D. blue giant....red giant

E. white dwarf...red dwarf

9. According to Wikipedia, a star with over 20 solar masses converts its Hyrogen to Helium in about 8 billion years, but the conversion of Oxygen to heavier elements take about _____ [487]

   A. 1 thousand years

   B. 1 year

   C. 1 billion years

   D. 1 million years

   E. 10 billion years

10. What is the difference between a constellation and an asterism? [488]

    A. constellations represent regions of the sky, like state boundaries on a map of the USA

    B. asterisms are smaller than constellations

    C. asterisms are larger than constellations

    D. none of these is correct

    E. constellations consist of never more than ten stars.

11. Stellar parallax is [489]

    A. None of these is correct.

    B. Two of these is correct

    C. Triangulation to deduce the distance to nearby stars

    D. Using spectral lines to deduce the distance to nearby stars

    E. Using changes in the angular position of a star to deduce the starś distance

12. Giant molecular clouds with sufficient conditions to form a star cluster would have formed them long ago. Any stellar births in the past couple of billions years probably resulted from _____ between clouds. [490]

    A. None of these is correct.

    B. collisions

    C. photon exchange

    D. ion exchange

    E. Two of these are correct

13. A starburst galaxy. [491]

    A. All of these are correct

    B. Two of these are correct

    C. has only dead or dying stars

    D. is a region of active stellar birth

    E. usually is a result of collisions between galaxies

14. Which of the following expresses Jeanś criterion for the collapse of a giant molecular cloud of mass, M, radius, R, and temperature T, and pressure P? (Here β is a constant) [492]

    A. $P > \beta MT$

    B. $\mathbf{M > \beta RT}$

    C. $R > \beta MT$

    D. $P > \beta MR$

E. T > βRM

15. Which of the following changes in the properties of a giant molecular cloud might cause it to collapse? [493]

    A. Decrease mass at fixed temperature and size

    B. Increase size at fixed pressure and mass

    C. Two of these are correct

    D. Increase temperature at fixed mass and size

    E. Increase mass at fixed temperature and size

16. What happens if you increase the size of a giant molecular cloud while keeping temperature and mass fixed? [494]

    A. It is less likely to collapse because temperature can never be kept fixed

    B. It is more likely to collapse because this will increase the temperature

    C. It is more likely to collapse because larger things have more gravity

    D. It is less likely to collapse spreading it out weakens the force of gravity

    E. It is equally likely to collapse because size is not part of the Jean's criterion.

17. What is a Bok globule in the formation of stellar systems? [495]

    A. A supernovae precurser that attracts more gas atoms

    B. A cluster of giant molecular clouds that coalesce to form a solar system

    C. A small planet that formed before any stars have formed

    D. A black hole that enters a cloud and triggers the collapse

    E. A small portion of a giant cloud that collapses

59 b_antikythera

1. A mechanical analog computer uses pulleys, levers, wheels or some other motion to solve problems of a mathematical nature.[496]

    A. true

    B. false

2. As the Sun, Moon, and planets seem to move around the Earth, they remain close to a circle, called the ecliptic, that can be drawn on paper or imagined in the sky. The Babylonians divided this circle into 12 equal sections of 30 degrees each, and labeled the sections after the zodiacal constellations.[497]

    A. true

    B. false

3. As the Sun, Moon, and planets seem to move around the Earth, they remain close to a circle, called the ecliptic, that can be drawn on paper or imagined in the sky. The Babylonians divided this circle into 12 unequal sections of approximately 30 degrees each, and labeled the sections after the zodiacal constellations.[498]

    A. true

    B. false

4. Sothic calendar was an Egyptian calendar with twelve months of 30 days plus five intercalary days to keep the year synchronous with the four seasons. [499]

    A. true

    B. false

5. Sothic calendar was an Egyptian calendar with twelve months of 30 days plus five intercalary days to keep the year synchronous with the Saros cycle.[500]

   A. true

   B. false

6. Sothic calendar was an Egyptian calendar with twelve months of 30 days plus five intercalary days to keep the year synchronous with the Lunar phases.[501]

   A. true

   B. false

7. The Sothic calendar of 365 days did not include an extra day every four years. As a consequence, it advanced by _____ days in 12 years[502]

   A. 3

   B. 1

   C. 2

   D. 4

8. The Sothic calendar of 365 days did not include an extra day every four years. As a consequence, it advanced by _____ days in 8 years[503]

   A. 3

   B. 1

   C. 2

   D. 4

9. The months of the Antikythera device are labeled with Egyptian names "transcribed" into Greek[504]

   A. true

   B. false

10. The months of the Antikythera device are labeled with Greek names "transcribed" into Egyptian hieroglyphs.[505]

   A. true

   B. false

11. Eclipse seasons last for approximately ______ and repeat just short of ______[506]

   A. 34 days; six months

   B. 7 days; one month

   C. six months; 18 years

   D. one month; 18 years

   E. six months; 54 years

12. How many years did it take before Europe made a device as sophisticated as the Antikythera mechanism?[507]

   A. 300 years

   B. 3000 years

   C. 30 years

   D. 1500 years

   E. 15,000 years

13. A ___________ has teeth that projects at right angles to the face of the wheel.[508]

    A. crown gear

    B. spiral bevel gear

    C. epicycle gear

14. Evidence suggests that it was not possible to set the Antikythera device without referring to a written table to ascertain the dial settings for a given date.[509]

    A. true

    B. false

15. How did the Antikythera mechanism compensate for leap years?[510]

    A. Two concentric dials were independently adjusted by hand; one dial marked a 365 day calendar, and the other marked the position of the Sun with respect to the ecliptic.

    B. Two concentric dials were independently adjusted by a differential gear; one dial marked a 365 day calendar, and the other marked the position of the Sun with respect to the ecliptic.

    C. There was no need to compensate for the leap year because the Sothic calendar included a leap year every four years.

16. The Antikythera device was dated to approximately[511]

    A. 100-150 BC

    B. 300-350 BC

    C. 300-350 AD

    D. 500-550 BC

17. The Antikythera wreck was situated closer to Rome than to Greece.[512]

    A. true

    B. false

18. The Antikythera wreck was discovered by _________ in ________.[513]

    A. sponge divers; 1900

    B. Jacques-Yves Cousteau; 1976

19. What clue is cited to suggest that the Antikythera device was not the first of its kind?[514]

    A. The quality of its manufacture.

    B. Other boxes in the wreck seemed to have held similar devices.

    C. Chemical analysis of the bronze.

    D. Instructions for making other devices were found at the wreck site.

20. Bronze is an alloy consisting primarily of ______, with other metals included ______[515]

    A. copper; to make it hard.

    B. copper; to make it withstand corrosion.

    C. iron; as impurities that served little or no purpose.

    D. copper; as impurities that served little or no purpose.

21. Chemical analysis of the bronze used in the gears of the Antikythera device [516]

    A. was not possible due to the degree of corrosion.

    B. suggested that Roman technology was used.

C. suggested that Greek technology was used.

D. suggested that a number of such devices had been produced.

22. Which of the following was NOT used as evidence in an effort to guess where the Antikythera device originated?[517]

   A. Some of the astronomical events associated with the device could have only have been seen from Corinth, a region associated with Archimedes.

   B. Coins at the site seemed to originate from Pergamon, where an important library was situated.

   C. The Library of Alexandria, where Ptolemy would later work, would have been a likely destination or origin for the ship.

   D. Vases found at the site suggest an origin near the trading port of Rhodes, where Hipparchus was believed to have worked.

60 b_busyBeaver

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [518]

1. If the machine is at A: 000$\underline{0}$00, what's next?

   A. B: 000$\underline{0}$10

   B. B: 0001$\underline{0}$0

   C. A: 0001$\underline{0}$0

   D. A: 0000$\underline{1}$0

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [519]

2. If the machine is at B: 0001$\underline{0}$0, what's next?

   A. B: 000$\underline{1}$10

   B. A: 001$\underline{1}$00

   C. B: 0001$\underline{1}$0

   D. A: 000$\underline{1}$10

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [520]

3. If the machine is at A: 000$\underline{1}$10, what's next?

   A. B: 0011$\underline{0}$0

   B. B: 00$\underline{0}$110

   C. A: 00$\underline{0}$110

   D. A: 0011$\underline{1}$0

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [521]

4. If the machine is at B: 000110 , what's next?
   A. B: 000111
   B. B: 001110
   C. A: 001110
   D. A: 001110

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [522]

5. If the machine is at A: 001110, what's next?
   A. B: 011110
   B. H: 011110
   C. A: 011110
   D. H: 011110

R=right L=left
A & B are states

	A	B
0	1RB	1LA
1	1LB	1RH

H = halt [523]

6. If the machine is at B: 011110, what's next?
   A. B: 011110
   B. H: 011110
   C. A: 011110
   D. H: 011110

61 b_ComputerWikipedia

1. The first English-language usage of the word "computer" referred to[524]
   A. counting rods
   B. an abacus
   C. Roman numerals
   D. a person

2. The Turing machine permitted a solution to the halting problem[525]
   A. true
   B. false

3. The Turing machine could not have been invented until after the halting problem was solved.[526]
   A. true

B. false

4. The Turing machine was a(n)_____ device[527]
   A. digital
   B. electromechanical
   C. prototype
   D. conceptual
   E. analog
5. This algorithm halts if it starts at 0:
   * Add 3
   * If the number is divisible by 10, divide by 10
   * Stop if the number exceeds 100
   * Go to top[528]
   A. true
   B. false
6. This algorithm halts if it starts at 0:
   * Add 3
   * If the number is divisible by 10, add 10
   * Stop if the number exceeds 100
   * Go to top[529]
   A. true
   B. false
7. In London (circa 1935) thousands of vacuum tubes were used to[530]
   A. calculate the value of π
   B. control a telephone exchange
   C. count votes in an election
   D. control a textile mill
8. The Bombe was a(n) _____ device used (circa 1940) to defeat the Enigma machine in World War II.[531]
   A. mechanical
   B. electric digital programmable
   C. Turing-complete
   D. electromechanical
9. The Colossus, used to defeat the German Enigma machine during World War II in 1944, was[532]
   A. Turing-complete
   B. mechanical
   C. electric digital programmable
   D. electromechanical
10. The chronological order by which electronic computers advanced is:[533]
    A. transistors, integrated circuits, and then tubes
    B. tubes, transistors, and then integrated circuits
    C. integrated circuits, tubes, and then transistors

D. tubes, integrated circuits and then transistors

11. Babbage's account of the origin of the difference engine in the 1820s was that he was working to satisfy the Astronomical Society's desire to improve The Nautical Almanac.[534]

    A. true

    B. false

12. Babbage's account of the origin of the difference engine in the 1820s was that he was working to satisfy the Astronomical Society's desire to predict lunar eclipses[535]

    A. true

    B. false

13. Babbage's use of punch cards in the 1930s to solve a problem posed by the Astronomical Society was later adopted to the Jacquard loom.[536]

    A. true

    B. false

14. Babbage's use of punch cards in the 1930s to solve a problem posed by the Astronomical Society was preceded by such use on the Jacquard loom.[537]

    A. true

    B. false

15. A system that uses levers, pulleys, or other mechanical device to perform calculations is called an analog computer[538]

    A. true

    B. false

16. A system that uses tables of numbers is called an analog computer[539]

    A. true

    B. false

17. Analog computers were phased out by the dawn of the twentieth century (circa 1900)[540]

    A. true

    B. false

18. Analog computers continued to be developed into the twentieth century[541]

    A. true

    B. false

62 b_ecliptic_quiz1

1. The ecliptic is the set of all points on the celestial sphere[542]

    A. occupied by the Moon over the course of one month.

    B. occupied by the Sun and Moon during eclipse season.

    C. occupied by the Sun over the course of a year.

    D. occupied by the Sun over the course of one day.

    E. occupied by the Moon over the course of one day.

2. $\frac{360\,\text{degrees}}{30\,\text{days}} = \frac{36}{3}$, calculates that the Moon moves approximately 13 ____ [543]
   A. degrees per hour across the sky
   B. degrees per hour compared to the fixed stars
   C. degrees per day compared to the fixed stars
   D. degrees per day across the sky

3. Two great circles on a sphere meet at ____ point(s)[544]
   A. 0
   B. 1
   C. 2
   D. 3
   E. 4

4. A star in any of the 12 [[w:zodiac—zodiacal]] constellations rises and sets near where the Sun rises and sets, except that the cycle is repeated every 24 hours minus approximately 4 minutes.[545]
   A. true
   B. false

5. Four minutes times 365 is approximately one[546]
   A. day
   B. year
   C. month
   D. week

6. As the Sun rises and sets it typically spends 4 minutes in each constellation of the Zodiac[547]
   A. true
   B. false

7. One minute of arc describes and angle 60 times smaller than one degree, which is NOT equal to the observed angular motion of a star in one minute.[548]
   A. true
   B. false

8. One minute of arc describes and angle 60 times smaller than one degree, which nearly equals the observed angular motion of a star in one minute.[549]
   A. true
   B. false

9. In the course of a year, the Sun is always in or near one of the 12 zodiacal constellations[550]
   A. true
   B. false

10. $\frac{360}{24} = \frac{36\cdot 10}{12\cdot 2} = \frac{12\cdot 3\cdot 5\cdot 2}{12\cdot 2}$, calculates that the Sun moves 15[551]
    A. degrees per day compared to the fixed stars
    B. degrees per hour across the sky
    C. degrees per hour compared to the fixed stars
    D. degrees per day across the sky

63 b_globalWarming_1

1. A graph of the "Global Land Ocean Temperature Index (1880-2013)" would show little or no temperature rise over the last ____ years[552]
   A. 30
   B. 3
   C. 100
   D. 10
   E. 300

2. The lede's graph of CO2 Emissions per Year (1990-2010) shows solid straight lines that represent[553]
   A. estimates made in the year 2000 of what would happen in the future
   B. estimates of the contributions from everything except fossil fuels
   C. estimates of the contributions from fossil fuels alone
   D. estimates of the impact on land temperatures

3. In climate science, mitigation refers to:[554]
   A. climate engineering
   B. adaptation to the effects of global warming
   C. reduction of green house emissions
   D. building systems resilient to the effects of global warming

4. Anthropogenic means something that[555]
   A. humans can repair
   B. human caused
   C. humans cannot repair
   D. will hurt humans

5. Since 1971, 90
   A. sea; in the top kilometer
   B. sea; in the bottom kilometer
   C. land; near the poles
   D. land; near the equators
   E. air; in the water vapor

6. The lede's graph of the "Global Land Ocean Temperature Index (1880-2013)" shows that since 1920, there has never been a decade of overall cooling[556]
   A. true
   B. false

7. The largest temperature increases (from 2000-2009) have occurred [557]
   A. on the ocean surface
   B. near the poles
   C. near the equator
   D. in the western hemisphere

8. The 2007 IPCC report stated that most global warming was likely being caused by increasing concentrations of greenhouse gases produced by human activities. Among the science academies of the major industrialized nations, this finding was recognized by[558]

    A. 90

    B. all of the academies of science

    C. all but the US academy of science

    D. 60

9. in 2013, the IPCC stated that the largest driver of global warming is carbon dioxide (CO2) emissions from fossil fuel combustion. Other important sources of CO2 are[559]

    A. population growth and waste disposal

    B. cement production and waste disposal

    C. cement production and land use changes

    D. population growth

10. The lede's graphs of the " Land Ocean Temperature Index (1880-2013)" indicates that from 1960 to 2012 the average temperature increased by approximately[560]

    A. 16° Celsius

    B. 0.6° Celsius

    C. 0.06° Celsius

    D. 0.16° Celsius

    E. 1.6° Celsius

11. Which statement is FALSE about the lede's map of the temperature anomaly (2000-2009)? [561]

    A. all portions of Antarctica have warmed

    B. Northern Asia has warmed more than southern Asia

    C. Central Europe has warmed more than the continental United States

    D. The United States has warmed more than Australia

12. The lede's "CO2 Emissions per Year" graph (1990-2010) shows dips and rises that are caused by changes in[562]

    A. worldwide efforts to curtail emissions

    B. the earth's distance from the sun

    C. the sun's energy output

    D. the world economy

64 b_globalWarming_2

1. A graph of the "Global Land Ocean Temperature Index (1880-2013)" would show little or no temperature rise over the last ____ years[563]

    A. 30

    B. 3

    C. 100

    D. 10

    E. 300

2. The lede's graph of CO2 Emissions per Year (1990-2010) shows solid straight lines that represent[564]

A. estimates made in the year 2000 of what would happen in the future
B. estimates of the contributions from everything except fossil fuels
C. estimates of the contributions from fossil fuels alone
D. estimates of the impact on land temperatures

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    A. climate engineering
    B. adaptation to the effects of global warming
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    A. humans can repair
    B. human caused
    C. humans cannot repair
    D. will hurt humans

5. Since 1971, 90
    A. sea; in the top kilometer
    B. sea; in the bottom kilometer
    C. land; near the poles
    D. land; near the equators
    E. air; in the water vapor

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    A. true
    B. false

7. The largest temperature increases (from 2000-2009) have occurred [568]
    A. on the ocean surface
    B. near the poles
    C. near the equator
    D. in the western hemisphere

8. The 2007 IPCC report stated that most global warming was likely being caused by increasing concentrations of greenhouse gases produced by human activities. Among the science academies of the major industrialized nations, this finding was recognized by[569]
    A. 90
    B. all of the academies of science
    C. all but the US academy of science
    D. 60

9. in 2013, the IPCC stated that the largest driver of global warming is carbon dioxide (CO2) emissions from fossil fuel combustion. Other important sources of CO2 are[570]
    A. population growth and waste disposal

B. cement production and waste disposal

C. cement production and land use changes

D. population growth

10. The lede's graphs of the " Land Ocean Temperature Index (1880-2013)" indicates that from 1960 to 2012 the average temperature increased by approximately[571]

A. 16° Celsius

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11. Which statement is FALSE about the lede's map of the temperature anomaly (2000-2009)? [572]

A. all portions of Antarctica have warmed

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D. The United States has warmed more than Australia

12. The lede's "CO2 Emissions per Year" graph (1990-2010) shows dips and rises that are caused by changes in[573]

A. worldwide efforts to curtail emissions

B. the earth's distance from the sun

C. the sun's energy output

D. the world economy

65 b_globalWarming_3

1. The "Greenhouse effect schematic" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed by the earth's atmosphere.[574]

A. true

B. false

2. Emissions scenarios are[575]

A. estimates of changes in future emission levels of greenhouse gases

B. estimates of how greenhouse gasses are absorbed and emitted by nature

C. estimates of how greenhouse gasses are absorbed and emitted by the world's oceans

D. estimates of how greenhouse gasses are absorbed and emitted by agriculture

3. It is expected that carbon emissions will begin to diminish in the 21st century as fossil fuel reserves begin to dwindle.[576]

A. true

B. false

4. The carbon cycle[577]

A. is a proposal to trade carbon credits.

B. describes how carbon is absorbed and emitted by the oceans, soil, plants, etc.

C. is an effort to store carbon in underground caves.

5. Global dimming, caused by air-born particulates produced by volcanoes and human made pollutants[578]
   A. exerts a heating effect by absorbing infra-red radiation from earth's surface
   B. is more related to the ozone problem than to global warming
   C. exerts a cooling effect by increasing the reflection of incoming sunlight
6. Soot tends to warm the earth when it accumulates in atmospheric brown clouds.[579]
   A. true
   B. false
7. Soot tends to cool the earth when it accumulates in atmospheric brown clouds.[580]
   A. true
   B. false
8. In the arctic, soot tends to cool the earth.[581]
   A. true
   B. false
9. In the arctic, soot tends to warm the earth.[582]
   A. true
   B. false
10. Approximately what percent of global warming can be attributed to a long-term trend (since 1978) in the sun's energy?[583]
    A. 50
    B. 0
    C. 10
    D. 30
11. Greenhouse warming acts to cool the stratosphere[584]
    A. true
    B. false
12. The "Greenhouse effect schematic" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed at the earth's surface.[585]
    A. true
    B. false
13. Greenhouse warming acts to warm the stratosphere[586]
    A. true
    B. false
14. The distinction between the urban heat island effect and land use changes is that the latter involves the earth's average temperature while the former involves only the temperature near weather stations where the measurements are made[587]
    A. true
    B. false
15. Depleting the ozone layer cools the stratosphere because ozone allows UV radiation to penetrate.[588]

A. true

B. false

16. Depleting the ozone layer cools the stratosphere because ozone absorbs UV energy from the sun that heats the stratosphere.[589]

A. true

B. false

17. Which external force plays the smallest role in current efforts to model global warming?[590]

A. greenhouse gasses

B. solar luminosity (i.e. variations in energy from the sun)

C. volcanic eruptions

D. orbital cycles

18. "External forcings" refer to effects that can increase, but not decrease, the Earth's temperature.[591]

A. true

B. false

19. "External forcings" refer to effects that can either increase or decrease, the Earth's temperature.[592]

A. true

B. false

20. Water vapor contributes more to the greenhouse effect than does carbon dioxide.[593]

A. true

B. false

21. Carbon dioxide contributes more to the greenhouse effect than does water vapor.[594]

A. true

B. false

22. The Keeling curve shows that carbon dioxide concentrations[595]

A. show a steady rise in CO2 levels, with increasing slope, and regular and predictable annual fluctuations

B. show a steady rise in CO2 levels, at constant slope, and regular and predictable annual fluctuations

C. show a steady rise in CO2 levels, at constant slope, and irregular fluctuations due associated with El Ninos and La Ninas.

23. The climate change community is divided between those who believe the goal should be to eliminate the earth's greenhouse effect altogether, and those who argue that we should attempt to minimize earth's greenhouse effect.[596]

A. true

B. false

66 b_globalWarming_4

1. The "Greenhouse effect schematic" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed by the earth's atmosphere.[597]
   A. true
   B. false
2. Emissions scenarios are[598]
   A. estimates of changes in future emission levels of greenhouse gases
   B. estimates of how greenhouse gasses are absorbed and emitted by nature
   C. estimates of how greenhouse gasses are absorbed and emitted by the world's oceans
   D. estimates of how greenhouse gasses are absorbed and emitted by agriculture
3. It is expected that carbon emissions will begin to diminish in the 21st century as fossil fuel reserves begin to dwindle.[599]
   A. true
   B. false
4. The carbon cycle[600]
   A. is a proposal to trade carbon credits.
   B. describes how carbon is absorbed and emitted by the oceans, soil, plants, etc.
   C. is an effort to store carbon in underground caves.
5. Global dimming, caused by air-born particulates produced by volcanoes and human made pollutants[601]
   A. exerts a heating effect by absorbing infra-red radiation from earth's surface
   B. is more related to the ozone problem than to global warming
   C. exerts a cooling effect by increasing the reflection of incoming sunlight
6. Soot tends to warm the earth when it accumulates in atmospheric brown clouds.[602]
   A. true
   B. false
7. Soot tends to cool the earth when it accumulates in atmospheric brown clouds.[603]
   A. true
   B. false
8. In the arctic, soot tends to cool the earth.[604]
   A. true
   B. false
9. In the arctic, soot tends to warm the earth.[605]
   A. true
   B. false
10. Approximately what percent of global warming can be attributed to a long-term trend (since 1978) in the sun's energy?[606]
    A. 50
    B. 0

C. 10

D. 30

11. Greenhouse warming acts to cool the stratosphere[607]

A. true

B. false

12. The ”Greenhouse effect schematic” in the section on ”Temperature changes...” indicates that most of the energy from the Sun is absorbed at the earth’s surface.[608]

A. true

B. false

13. Greenhouse warming acts to warm the stratosphere[609]

A. true

B. false

14. The distinction between the urban heat island effect and land use changes is that the latter involves the earth’s average temperature while the former involves only the temperature near weather stations where the measurements are made[610]

A. true

B. false

15. Depleting the ozone layer cools the stratosphere because ozone allows UV radiation to penetrate.[611]

A. true

B. false

16. Depleting the ozone layer cools the stratosphere because ozone absorbs UV energy from the sun that heats the stratosphere.[612]

A. true

B. false

17. Which external force plays the smallest role in current efforts to model global warming?[613]

A. greenhouse gasses

B. solar luminosity (i.e. variations in energy from the sun)

C. volcanic eruptions

D. orbital cycles

18. ”External forcings” refer to effects that can increase, but not decrease, the Earth’s temperature.[614]

A. true

B. false

19. ”External forcings” refer to effects that can either increase or decrease, the Earth’s temperature.[615]

A. true

B. false

20. Water vapor contributes more to the greenhouse effect than does carbon dioxide.[616]

A. true

B. false

21. Carbon dioxide contributes more to the greenhouse effect than does water vapor.[617]

    A. true

    B. false

22. The Keeling curve shows that carbon dioxide concentrations[618]

    A. show a steady rise in CO2 levels, with increasing slope, and regular and predictable annual fluctuations

    B. show a steady rise in CO2 levels, at constant slope, and regular and predictable annual fluctuations

    C. show a steady rise in CO2 levels, at constant slope, and irregular fluctuations due associated with El Ninos and La Ninas.

23. The climate change community is divided between those who believe the goal should be to eliminate the earth's greenhouse effect altogether, and those who argue that we should attempt to minimize earth's greenhouse effect.[619]

    A. true

    B. false

67 b_industrialRevolution

1. The "Greenhouse effect schematic" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed by the earth's atmosphere.[620]

    A. true

    B. false

2. Emissions scenarios are[621]

    A. estimates of changes in future emission levels of greenhouse gases

    B. estimates of how greenhouse gasses are absorbed and emitted by nature

    C. estimates of how greenhouse gasses are absorbed and emitted by the world's oceans

    D. estimates of how greenhouse gasses are absorbed and emitted by agriculture

3. It is expected that carbon emissions will begin to diminish in the 21st century as fossil fuel reserves begin to dwindle.[622]

    A. true

    B. false

4. The carbon cycle[623]

    A. is a proposal to trade carbon credits.

    B. describes how carbon is absorbed and emitted by the oceans, soil, plants, etc.

    C. is an effort to store carbon in underground caves.

5. Global dimming, caused by air-born particulates produced by volcanoes and human made pollutants[624]

    A. exerts a heating effect by absorbing infra-red radiation from earth's surface

    B. is more related to the ozone problem than to global warming

    C. exerts a cooling effect by increasing the reflection of incoming sunlight

6. Soot tends to warm the earth when it accumulates in atmospheric brown clouds.[625]

    A. true

B. false

7. Soot tends to cool the earth when it accumulates in atmospheric brown clouds.[626]

    A. true

    B. false

8. In the arctic, soot tends to cool the earth.[627]

    A. true

    B. false

9. In the arctic, soot tends to warm the earth.[628]

    A. true

    B. false

10. Approximately what percent of global warming can be attributed to a long-term trend (since 1978) in the sun's energy?[629]

    A. 50

    B. 0

    C. 10

    D. 30

11. Greenhouse warming acts to cool the stratosphere[630]

    A. true

    B. false

12. The "Greenhouse effect schematic" in the section on "Temperature changes..." indicates that most of the energy from the Sun is absorbed at the earth's surface.[631]

    A. true

    B. false

13. Greenhouse warming acts to warm the stratosphere[632]

    A. true

    B. false

14. The distinction between the urban heat island effect and land use changes is that the latter involves the earth's average temperature while the former involves only the temperature near weather stations where the measurements are made[633]

    A. true

    B. false

15. Depleting the ozone layer cools the stratosphere because ozone allows UV radiation to penetrate.[634]

    A. true

    B. false

16. Depleting the ozone layer cools the stratosphere because ozone absorbs UV energy from the sun that heats the stratosphere.[635]

    A. true

    B. false

17. Which external force plays the smallest role in current efforts to model global warming?[636]
    A. greenhouse gasses
    B. solar luminosity (i.e. variations in energy from the sun)
    C. volcanic eruptions
    D. orbital cycles
18. "External forcings" refer to effects that can increase, but not decrease, the Earth's temperature.[637]
    A. true
    B. false
19. "External forcings" refer to effects that can either increase or decrease, the Earth's temperature.[638]
    A. true
    B. false
20. Water vapor contributes more to the greenhouse effect than does carbon dioxide.[639]
    A. true
    B. false
21. Carbon dioxide contributes more to the greenhouse effect than does water vapor.[640]
    A. true
    B. false
22. The Keeling curve shows that carbon dioxide concentrations[641]
    A. show a steady rise in CO2 levels, with increasing slope, and regular and predictable annual fluctuations
    B. show a steady rise in CO2 levels, at constant slope, and regular and predictable annual fluctuations
    C. show a steady rise in CO2 levels, at constant slope, and irregular fluctuations due associated with El Ninos and La Ninas.
23. The climate change community is divided between those who believe the goal should be to eliminate the earth's greenhouse effect altogether, and those who argue that we should attempt to minimize earth's greenhouse effect.[642]
    A. true
    B. false

68 b_motionSimpleArithmetic

1. Mr. Smith starts from rest and accelerates to 4 m/s in 3 seconds. How far did he travel?[643]
    A. 3.0 meters
    B. 4.0 meters
    C. 5.0 meters
    D. 6.0 meters
    E. 7.0 meters
2. Mr. Smith starts from rest and accelerates to 4 m/s in 5 seconds. How far did he travel?[644]
    A. 7.0 meters
    B. 8.0 meters

C. 9.0 meters

D. 10.0 meters

E. 11.0 meters

3. Mr. Smith is driving at a speed of 7 m/s, when he slows down to a speed of 5 m/s, when he hits a wall at this speed, after travelling for 2 seconds. How far did he travel? [645]

A. 8.0 meters

B. 9.0 meters

C. 10.0 meters

D. 11.0 meters

E. 12.0 meters

4. Mr. Smith starts at rest and accelerates to a speed of 2 m/s, in 2 seconds. He then travels at this speed for an additional 1 seconds. Then he decelerates uniformly, taking 2 seconds to come to rest. How far did he travel?[646]

A. 5.0 meters

B. 6.0 meters

C. 7.0 meters

D. 8.0 meters

E. 9.0 meters

5. Mr. Smith is driving at a speed of 4 m/s, when he slows down to a speed of 1 m/s, when he hits a wall at this speed, after travelling for 4 seconds. How far did he travel? [647]

A. 7.0 meters

B. 8.0 meters

C. 9.0 meters

D. 10.0 meters

E. 11.0 meters

6. Mr. Smith starts at rest and accelerates to a speed of 4 m/s, in 2 seconds. He then travels at this speed for an additional 3 seconds. Then he decelerates uniformly, taking 2 seconds to come to rest. How far did he travel?[648]

A. 19.0 meters

B. 20.0 meters

C. 21.0 meters

D. 22.0 meters

E. 23.0 meters

7. Mr. Smith starts from rest and accelerates to 2 m/s in 3 seconds. How far did he travel?[649]

A. 3.0 meters

B. 4.0 meters

C. 5.0 meters

D. 6.0 meters

E. 7.0 meters

8. Mr. Smith is driving at a speed of 5 m/s, when he slows down to a speed of 4 m/s, when he hits a wall at this speed, after travelling for 2 seconds. How far did he travel? [650]

A. 8.0 meters

B. 9.0 meters

C. 10.0 meters

D. 11.0 meters

E. 12.0 meters

9. Mr. Smith starts at rest and accelerates to a speed of 2 m/s, in 6 seconds. He then travels at this speed for an additional 3 seconds. Then he decelerates uniformly, taking 4 seconds to come to rest. How far did he travel?[651]

A. 16.0 meters

B. 17.0 meters

C. 18.0 meters

D. 19.0 meters

E. 20.0 meters

10. Mr. Smith starts from rest and accelerates to 3 m/s in 2 seconds. How far did he travel?[652]

A. 1.0 meters

B. 2.0 meters

C. 3.0 meters

D. 4.0 meters

E. 5.0 meters

11. Mr. Smith is driving at a speed of 7 m/s, when he slows down to a speed of 5 m/s, when he hits a wall at this speed, after travelling for 4 seconds. How far did he travel? [653]

A. 23.0 meters

B. 24.0 meters

C. 25.0 meters

D. 26.0 meters

E. 27.0 meters

12. Mr. Smith starts at rest and accelerates to a speed of 2 m/s, in 6 seconds. He then travels at this speed for an additional 3 seconds. Then he decelerates uniformly, taking 4 seconds to come to rest. How far did he travel?[654]

A. 13.0 meters

B. 14.0 meters

C. 15.0 meters

D. 16.0 meters

E. 17.0 meters

69 b_nuclearPower_1

1. What fraction of the world's electricity was produced by nuclear power in 2012?[655]

A. 63

B. 13

C. 3

D. 33

2. Chadwicks discovery of the neutron was significant because[656]

   A. neutrons permit induced radiation

   B. neutrons are stable

   C. neutrons are slow

3. Neutrons and protons both have "strong" short range interactions with the nucleus. Why can't slow protons be used to cause nuclei to undergo fission?[657]

   A. protons are positively charged

   B. slow protons can induce fission but they are too expensive to produce

   C. slow protons are attracted to the nucleus

   D. protons move at the speed of light

4. Fermi used _______ to create what he thought was _______[658]

   A. slow neutrons; "moonshine"

   B. "moonshine"; fast neutrons

   C. slow neutrons; a new element heavier than uranium (called a transuranic element)

   D. transuranic (heavy) elements; a new source of slow neutrons

5. Fermi thought he had discovered ________, when he actually discovered ________[659]

   A. fusion; hesparium

   B. hesperium; fission

   C. hesperium; fusion

   D. fission; hesparium

6. Which was developed first, nuclear power generation or nuclear weapons?[660]

   A. they were developed simultaneously

   B. nuclear weapons

   C. nuclear power generation

7. The Manhattan project made[661]

   A. plutonium and enriched hesparium

   B. plutonium and enriched uranium

   C. uranium and enriched plutonium

8. The Atomic Age, published in 1945, predicted ... [662]

   A. nuclear war

   B. a world government to prevent nuclear war

   C. that fossil fuels would go unused

   D. widespread radiation poisoning

9. In 1953, "Atoms for Peace" was[663]

   A. a presidential speech warning of the need for nuclear arms agreements

   B. a congressional committee

   C. a protest movement centered in US universities

D. a presidential speech promoting nuclear energy production

10. The first nuclear power plant to contribute to the grid was situated in[664]
    A. Russia
    B. Oak Ridge
    C. Virginia
    D. Great Britain

11. According to Wikipedia, the prediction made in 1954 that electricity would someday be "too cheap to meter" was[665]
    A. an argument that fossil fuels are so abundant that we don't need nuclear energy
    B. an effort to promote nuclear fission as an energy source
    C. an effort to promote nuclear fusion as an energy source

12. How does Wikipedia assess the prospects of commercial fusion power production before 2050?[666]
    A. likely
    B. unlikely
    C. impossible
    D. expected

13. The third worst nuclear disaster occurred in Russia (1957) and was kept secret for 30 years [667]
    A. true
    B. false

14. More US nuclear submarines sank due to nuclear accidents than did Russian submarines[668]
    A. true
    B. false

15. The worst nuclear disaster on record occurred in Russia[669]
    A. true
    B. false

16. The worldwide number of nuclear reactors and their net capacity grew steadily from 1960, and[670]
    A. fluctuated randomly but with a strong correlation with the world economy and price of oil
    B. leveled off between Three Mile Island (1979) and Chernobyl (1986).
    C. did not begin to level off until Chernobyl (1986)
    D. briefly fell sharply after Three Mile Island (1979), rose again, and again fell after Chernobyl (1986)

17. In terms of lives lost per unit of energy generated, evidence suggests that nuclear power has caused ______ fatalities per unit of energy generated than the other major sources of energy.[671]
    A. comparable
    B. less
    C. more

18. According to Wikipedia, the amount of green house gasses associated with the construction and maintenance of nuclear power plants is ________ than the emissions associated with other renewable sources (wind, solar, and hydro power.)[672]
    A. about the same

B. less

C. greater

19. Estimates of additional nuclear generating capacity to be built by 2035 fell by ______ percent after the Fukushima nuclear accident in 2011.[673]

A. 50

B. 10

C. 90

20. From the figure depicting percentage of power produced by nuclear power plants, we see that the proper ranking from greatest to least reliance on nuclear power for three nations is[674]

A. France, United States, with Turkey least reliant.

B. France ,Turkey , with the United States least reliant.

C. United States, France, with Turkey least reliant.

D. United States, Turkey, France least reliant.

21. It was discovered that radioactive elements released immense amounts of energy according to the principle of mass-energy equivalence in the ______ [675]

A. late 19th century

B. early 20th century

C. early 19th century

22. Chadwick's discovery of the neutron was significant because neutrons[676]

A. are an excellent fuel for nuclear power

B. are not radioactive

C. can be used to create radioactive material at a low price

23. Ernest Rutherford's "moonshine" was[677]

A. what called neutrons

B. what he called the idea of harnessing nuclear power

C. what he called the idea of relying on fossil fuels

D. what he called alpha particles

70 b_nuclearPower_2

1. In a PWR reactor, the water is kept under high pressure [678]

A. to prevent it from boiling

B. only in the reactor core

C. to slow down the neutrons

D. to reduce the heat required to boil it

2. A 2008 report from Oak Ridge National Laboratory concluded that the dose to the public from radiation from properly run nuclear plants is __________ the radiation created by burning coal[679]

A. 100 times less than

B. 100 times more than

C. 10 times less than

D. 10 times more than

E. about the same as

3. One concern is that long term nuclear waste management is now being performed by a number of private waste management companies[680]

A. true

B. false

4. The Waste Isolation Pilot Plant in New Mexico [681]

A. can no longer nuclear waste from production reactors because it is full

B. is currently taking nuclear waste from production reactors

C. was originally a research and development facility but is now under private ownership

5. In the United States, reprocessing of spent Uranium[682]

A. provides 5

B. is not allowed due to nuclear weapon proliferation concerns

C. is not allowed due to waste management concerns

D. provides 20

6. The reprocessing of spent Uranium worsens the problem of long term waste storage[683]

A. true

B. false

7. The reprocessing of spent Uranium helps alleviate the problem of long term waste storage[684]

A. true

B. false

8. Nuclear power plants typically have[685]

A. low capital costs and high fuel costs

B. high capital costs and low fuel costs

C. high capital costs and high fuel costs

D. low capital costs and low fuel costs

9. How many latent (cancer) deaths are estimated to result from the Three Mile Island accident?[686]

A. zero

B. from 4000 to 25,000

C. from 0 to 1000

10. It has been estimated that if Japan had never adopted nuclear power, the use of other fuels would have caused more lost years of life.[687]

A. true

B. false

11. It has been estimated that farmland lost due to Fukushima accident will be again useful for farming in 40-60 years[688]

A. true

B. false

12. Fuel rods spend typically ______ total now inside the reactor, generally until _____ of their uranium has been fissioned[689]

   A. 6 years; 3

   B. 6 months; 30

   C. 6 months; 3

   D. 6 years; 30

13. It has been estimated that farmland lost due to Fukushima accident will not be farmed for centuries[690]

   A. true

   B. false

14. The Megatons to Megawatts Program[691]

   A. purchases spent fuel that could otherwise be used to make weapons, and is considered a failure

   B. converts weapons grade uranium into fuel for commercial reactors, and is considered a failure

   C. converts weapons grade uranium into fuel for commercial reactors, and is considered a success

   D. purchases spent fuel that could otherwise be used to make weapons, and is considered a success

15. After about __________ in a spent fuel pool the spent fuel can be moved to dry storage casks or reprocessed.[692]

   A. 5 months

   B. 50 years

   C. 5 years

16. Uranium is approximately ______________ than silver in the Earth's crust.[693]

   A. 40 times less common

   B. 4 times more common

   C. 40 times more common

   D. 4 times less common

17. Reactors that use natural (unenriched) uranium are[694]

   A. considered impossible

   B. are already in use

   C. are likely to emerge in the next few decades

18. Fast breeder reactors use uranium-238, an isotope which constitutes _____ of naturally occurring uranium[695]

   A. 30

   B. 3

   C. 1

   D. 99

   E. 60

19. One concern about fast breeder reactors is that the uranium reserves will be exhausted more quickly[696]

   A. true

   B. false

20. High-level radioactive waste management is a daunting problem because[697]

A. they cannot be stored underground

B. the isotopes are long-lived

C. the isotopes are short-lived

21. A 2008 report from Oak Ridge National Laboratory concluded that the dose to the public from radiation from coal plants is ___________ the radiation nuclear plants (excluding the possibility of accidental discharges of radioactive material[698]

A. 10 times less than

B. about the same as

C. 100 times more than

D. 10 times more than

E. 100 times less than

71 b_photoelectricEffect

1. If the electron behaved as a classical (non-quantum) particle and "'NOT"' somehow connected to a spring inside the metal, then one would expect that photoelectrons would be emitted _______[699]

A. above a threshold intensity

B. above a threshold wavelength

C. above a threshold frequency

D. at a specific frequency

2. If the electron behaved as a classical (non-quantum) particle and the electron "'was"' somehow connected to a spring inside the metal, then one would expect that photoelectrons would be emitted _______[700]

A. above a threshold intensity

B. above a threshold wavelength

C. above a thresholdfrequency

D. at a specific frequency

3. In the photoelectric effect, how was the maximum kinetic energy measured?[701]

A. by measuring the voltage required to prevent the electrons from passing between the two electrodes.

B. by measuring the wavelength of the light

C. by measuring the distance between the electrodes

72 b_QuantumTimeline

1. Excepting cases where where quantum jumps in energy are induced in another object (i.e., using only the uncertainty principle), which would NOT put a classical particle into the quantum regime?[702]

A. high speed

B. confinement to a small space

C. low speed

D. low mass

2. How does the Bohr atom differ from Newton's theory of planetary orbits?[703]

- A. The force between proton and electron is not attractive for the atom, but it is for planets and the sun.
- B. The force between planets and the sun is not attractive for the atom, but it is for proton and electron.
- **C. planets make elliptical orbits while the electron makes circular orbits**
- D. electrons make elliptical orbits while planets make circular orbits

3. What are the units of Plank's constant?[704]
   - A. mass x velocity x distance
   - B. energy x time
   - C. momentum x distance
   - **D. all of the above**
   - E. none of the above

4. What are the units of Plank's constant?[705]
   - A. mass x energy
   - B. energy x distance
   - C. momentum x time x mass
   - D. all of the above
   - **E. none of the above**

5. How would you describe Old Quantum Theory[706]
   - A. complete and self-consistent
   - B. complete but not self-consistent
   - C. self-consistent but not complete
   - **D. neither complete nor self-consistent**

6. The first paper that introduced quantum mechanics was Plank's study of [707]
   - **A. light**
   - B. electrons
   - C. protons
   - D. energy

7. What are examples of energy?[708]
   - A. $\frac{1}{2}mv^2$
   - B. mgh where m is mass, g is gravity, and h is height
   - C. heat
   - **D. all of the above**
   - E. none of the above

8. What are examples of energy?[709]
   - A. $\frac{1}{2}mv$
   - B. momentum
   - C. heat
   - D. all of the above
   - **E. none of the above**

9. What was Plank's understanding of the significance of his work on blackbody radiation?[710]
   A. he was afraid to publish it for fear of losing his reputation
   B. he eventually convinced his dissertation committee that the theory was correct
   C. the thought it was some sort of mathematical trick
   D. he knew it would someday win him a Nobel prize

10. What was "spooky" about Taylor's 1909 experiment with wave interference?[711]
    A. The light was so dim that the photoelectric effect couldn't occur
    B. The light was dim, but it didn't matter because he was blind.
    C. The light was so dim that only one photon at a time was near the slits.
    D. The interference pattern mysteriously disappeared.

11. The pilot wave hypothesis was that the Schroedinger wave described the electron's charge density.[712]
    A. True
    B. False

12. The pilot wave hypothesis was that the Schroedinger wave described the electron's probability density.[713]
    A. True
    B. False

13. The pilot wave hypothesis was that the Schroedinger wave described a force on the electron.[714]
    A. True
    B. False

73 b_saros_quiz1

1. Saros (or Sar) was the Babylonian word for the Saros cycle.[715]
   A. true
   B. false

2. Your best friend's pet lizard is thirsty every 2 days, hungry every 3 days, and frisky every 5 days. If she is thirsty, hungry, and frisky today, whe will be thirsty, hungry, and frisky ______ days later[716]
   A. 10
   B. 30
   C. 15
   D. 40

3. Between any given eclipse and the one that occurs one Saros (roughly 18 years) later, there will be approximately ______ lunar and solar eclipses.[717]
   A. 40
   B. 1
   C. 2
   D. 10
   E. 20

4. While the Babylonians invented what we call the Saros cycle, they did not call it by that name.[718]

A. true

B. false

5. Suppose that you see a full moon, but no eclipse. You can be certain that a full moon will also occur exactly one Saros later.[719]

A. true

B. false

6. The name "saros" (Greek: σαρος) was first given to the eclipse cycle by[720]

A. an unknown Babylonian

B. Hipparchus (Greek astronomer: 190 BC-120 BC)

C. Edmond Halley (A friend and colleage of Newton: 1656 AD-1742 AD)

D. Ptolemy (Greek astronomer who lived in Egypt: 90 AD-168 AD)

7. The Saros cycle is 18 years plus either 10.321 or 11.321 days. The reason for the variable number of days has to do with[721]

A. leap years

B. precession of the equinoxes

C. precession of the Moon's orbit

D. a wobble in the Moon's orbit

8. If an eclipse occurs, a simlar eclipse will occur at the next Saros(roughly 18 years later). At this eclipse, the ______ will be the same. (Pick the best answer.)[722]

A. day of the month

B. time of day

C. season of the year

9. What is so special about 3 Saros cycles (triple Saros)?[723]

A. this eclipse will occur at the same time of day

B. this eclipse terminates the Saros (and a new Saros number is assigned.)

C. this eclipse will occur at the same day of the month (plus or minus one day)

D. this eclipse will occur with the Moon in the same position on the zodiac.

10. What remains nearly the same after a single saros cycle has occured?[724]

A. phase of moon and earth-moon distance

B. phase of moon and position of moon relative to the background stars (i.e. zodiacal location)

C. phase of moon and position of sun relative to background stars (i.e. zodiacal location)

11. Your pet lizard is thirsty every 3 days and hungry every 5 days. If she is both thirsty and hungry today, she will be both thirsty and hungry ______ days later[725]

A. 15

B. 5

C. 8

D. 30

74 b_velocityAcceleration

1. When a table cloth is quickly pulled out from under dishes, they hardly move. This is because[726]

   A. the cloth is more slippery when it is pulled quickly

   B. the cloth is accelerating for such a brief time that there is little motion

   C. objects don't begin to accelerate until after the force has been applied

2. If you toss a coin into the air, the acceleration while it as its highest point is[727]

   A. up

   B. down

   C. zero

3. If you toss a coin into the air, the velocity on the way up is[728]

   A. zero

   B. down

   C. up

4. If you toss a coin into the air, the velocity on the way down is[729]

   A. down

   B. zero

   C. up

5. If you toss a coin into the air, the velocity while it as its highest point is[730]

   A. up

   B. zero

   C. down

6. A car is headed due north and increasing its speed. It is also turning left because it is also traveling in a perfect circle. The acceleration vector points[731]

   A. northwest

   B. south

   C. southwest

   D. north

   E. northeast

7. A car is headed due north and increasing its speed. It is also turning right because it is also traveling in a perfect circle. The acceleration vector points[732]

   A. southwest

   B. south

   C. northwest

   D. north

   E. northeast

8. A car is headed due north and increasing its speed. It is also turning left because it is also traveling in a perfect circle. The velocity vector points[733]

   A. northeast

   B. southeast

C. northeast

D. northwest

E. north

9. A car is headed due north and increasing its speed. It is also turning right because it is also traveling in a perfect circle. The velocity vector points[734]

A. north

B. northwest

C. south

D. northeast

E. southwest

10. A car is headed due north and decreasing its speed. It is also turning left because it is also traveling in a perfect circle. The acceleration vector points[735]

A. west

B. northwest

C. southwest

D. southeast

E. south

11. A car is headed due north and decreasing its speed. It is also turning right because it is also traveling in a perfect circle. The acceleration vector points[736]

A. northwest

B. north

C. south

D. northeast

E. southeast

12. A car is traveling west and slowing down. The acceleration is[737]

A. zero

B. to the east

C. to the west

13. A car is traveling east and slowing down. The acceleration is[738]

A. zero

B. to the east

C. to the west

14. A car is traveling east and speeding up. The acceleration is[739]

A. to the east

B. to the west

C. zero

15. If you toss a coin into the air, the acceleration on the way up is[740]

A. down

B. zero

C. up

16. A car is traveling in a perfect circle at constant speed. If the car is headed north while turning west, the acceleration is[741]
    A. west
    B. zero
    C. south
    D. north
    E. east
17. A car is traveling in a perfect circle at constant speed. If the car is headed north while turning east, the acceleration is[742]
    A. east
    B. south
    C. north
    D. zero
    E. west
18. As the Moon circles Earth, the acceleration of the Moon is[743]
    A. away from Earth
    B. towards Earth
    C. opposite the direction of the Moon's velocity
    D. in the same direction as the Moon's velocity
    E. zero
19. If you toss a coin into the air, the acceleration on the way down is[744]
    A. up
    B. down
    C. zero

75 b_waves_PC

1. People don't usually perceive an echo when[745]
    A. it arrives less than a tenth of a second after the original sound
    B. it arrives at exactly the same pitch
    C. it arrives at a higher pitch
    D. it arrives at a lower pitch
    E. it takes more than a tenth of a second after the original sound to arrive
2. Why do rough walls give a concert hall a fuller sound, compared to smooth walls?[746]
    A. Rough walls make for a louder sound.
    B. The difference in path lengths creates more reverberation.
    C. The difference in path lengths creates more echo.
3. Comparing a typical church to a professional baseball stadium, the church is likely to have[747]
    A. reverberation instead of echo

B. echo instead of reverberation

C. both reverberation and echo

D. neither reverberation nor echo

4. A dense rope is connected to a rope with less density (i.e. fewer kilograms per meter). If the rope is stretched and a wave is sent along high density rope towards the low density rope,[748]

   A. the low density rope supports a wave with a higher frequency

   B. the low density rope supports a wave with a lower frequency

   C. the low density rope supports a wave with a higher speed

   D. the low density rope supports a wave with a lower speed

5. A low density rope is connected to a rope with higher density (i.e. more kilograms per meter). If the rope is stretched and a wave is sent along the low density rope towards the high density rope,[749]

   A. the high density rope supports a wave with a higher frequency

   B. the high density rope supports a wave with a lower frequency

   C. the high density rope supports a wave with a higher speed

   D. the high density rope supports a wave with a lower speed

6. What happens to the wavelength on a wave on a stretched string if the wave passes from lightweight (low density) region of the rope to a heavy (high density) rope?[750]

   A. the wavelength gets longer

   B. the wavelength stays the same

   C. the wavelength gets shorter

7. When a wave is reflected off a stationary barrier, the reflected wave[751]

   A. has lower amplitude than the incident wave

   B. has higher frequency than the incident wave

   C. both of these are true

8.  These two pulses will collide and produce[752]

   A. constructive interference

   B. destructive interference

   C. constructive diffraction

   D. destructive diffraction

9.  These two pulses will collide and produce[753]

   A. constructive interference

   B. destructive interference

   C. constructive diffraction

   D. destructive diffraction

10.  The two solid signals add to a (dashed)[754]

   A. octave

   B. fifth

   C. dissonance

11.  The two solid signals add to a (dashed)[755]

   A. octave
   B. fifth
   C. dissonance

12.  The two solid signals add to a (dashed)[756]

   A. octave
   B. fifth
   C. dissonance

13. Why don't we hear beats when two different notes on a piano are played at the same time?[757]

   A. The beats happen so many times per second you can't hear them.
   B. The note is over by the time the first beat is heard
   C. Reverberation usually stifles the beats
   D. Echo usually stifles the beats

14. A tuning fork with a frequency of 440 Hz is played simultaneously with a tuning fork of 442 Hz. How many beats are heard in 10 seconds?[758]

   A. 20
   B. 30
   C. 40
   D. 50
   E. 60

15. If you start moving towards a source of sound, the pitch[759]

   A. becomes higher
   B. becomes lower
   C. remains unchanged

16. If a source of sound is moving towards you, the pitch [760]

   A. becomes higher
   B. becomes lower
   C. remains unchanged

76 b_WhyIsSkyDarkAtNight

1. Approximately how often does a supernovae occur in a typical galaxy?[761]

   A. once a 5 months
   B. once every 5 years
   C. once every 50 years

2. If a star were rushing towards Earth at a high speed[762]

   A. there would be a blue shift in the spectral lines
   B. there would be a red shift in the spectral lines

C. there would be no shift in the spectral lines

3. An example of a standard candle is[763]

   A. any part of the nighttime sky that is giving off light

   B. any part of the nighttime sky that is dark

   C. a supernova in a distant galaxy

   D. all of these are standard candles

4. If a galaxy that is 10 Mpc away is receding at 700km/s, how far would a galaxy be receding if it were 20 Mpc away?[764]

   A. 350km/s

   B. 700km/s

   C. 1400km/s

5. The "apparent" magnitude of a star is[765]

   A. How bright it would be if you were exactly one light year away

   B. How bright it would be if it were not receding due to Hubble expansion

   C. How bright it is as viewed from Earth

6. In the essay "Why the sky is dark at night", a graph of velocity versus distance is shown. What is odd about those galaxies in the Virgo cluster (circled in the graph)?[766]

   A. they all have nearly the same speed

   B. they have a wide variety of speeds

   C. they are not receding away from us

   D. the cluster is close to us

7. Why was it important to observe supernovae in galaxies that are close to us?[767]

   A. we have other ways of knowing the distances to the nearby galaxies; this gives us the opportunity to study supernovae of known distance and ascertain their absolute magnitude.

   B. they have less of a red-shift, and interstellar gas absorbs red light

   C. it is easier to measure the doppler shift, and that is not always easy to measure.

   D. because supernovea are impossible to see in distant galaxies

8. What if clouds of dust blocked the light from distant stars? Could that allow for an infinite and static universe?[768]

   A. No, the clouds would get hot

   B. No, if there were clouds, we wouldn't see the distant galaxies

   C. No, there are clouds, but they remain too cold to resolve the paradox

   D. Yes, that is an actively pursued hypothesis

77 c07energy_lineIntegral

1. Integrate the line integral of, $\vec{F} = 9xy\hat{x} + 9.5y^3\hat{y}$, along the y axis from y = 5 to y = 14[769]

   A.) 7.33E+04

   B.) 7.84E+04

C.) 8.39E+04

D.) 8.98E+04

E.) 9.60E+04

2. Integrate the function, $\vec{F} = r^7\theta^9\hat{r} + r^7\theta^5\hat{\theta}$, along the first quadrant of a circle of radius 8[770]

A.) 3.43E+07

B.) 3.67E+07

C.) 3.93E+07

D.) 4.20E+07

E.) 4.49E+07

3. Integrate the line integral of $\vec{F} = 4xy\hat{x} + 7.7x\hat{y}$ from the origin to the point at x = 2.5 and y = 3.3[771]

A.) 5.93E+01

B.) 6.34E+01

C.) 6.78E+01

D.) 7.26E+01

E.) 7.77E+01

4. Integrate the function, $\vec{F} = -x^2y^2\hat{x}+x^2y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule[772]

A.) 4.45E-01

B.) 4.76E-01

C.) 5.10E-01

D.) 5.45E-01

E.) 5.83E-01

77.1 Renditions

c07energy_lineIntegral Q1

1. Integrate the function, $\vec{F} = -x^2y^3\hat{x}+x^2y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

A.) 4.66E-01

B.) 4.98E-01

C.) 5.33E-01

D.) 5.71E-01

E.) 6.11E-01

c07energy_lineIntegral Q2

1. Integrate the function, $\vec{F} = -x^3y^5\hat{x}+x^2y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

A.) 3.81E-01

B.) 4.08E-01

C.) 4.37E-01

D.) 4.67E-01

E.) 5.00E-01

c07energy_lineIntegral Q3

1. Integrate the function, $\vec{F} = -x^5y^2\hat{x}+x^5y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.64E-01

   B.) 3.89E-01

   C.) 4.17E-01

   D.) 4.46E-01

   E.) 4.77E-01

c07energy_lineIntegral Q4

1. Integrate the function, $\vec{F} = -x^4y^4\hat{x}+x^5y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.27E-01

   B.) 3.49E-01

   C.) 3.74E-01

   D.) 4.00E-01

   E.) 4.28E-01

c07energy_lineIntegral Q5

1. Integrate the function, $\vec{F} = -x^3y^5\hat{x}+x^5y^2\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 4.76E-01

   B.) 5.10E-01

   C.) 5.45E-01

   D.) 5.83E-01

   E.) 6.24E-01

c07energy_lineIntegral Q6

1. Integrate the function, $\vec{F} = -x^5y^4\hat{x}+x^5y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.67E-01

   B.) 3.92E-01

   C.) 4.20E-01

   D.) 4.49E-01

   E.) 4.81E-01

c07energy_lineIntegral Q7

1. Integrate the function, $\vec{F} = -x^4y^5\hat{x}+x^3y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 4.21E-01

   B.) 4.50E-01

   C.) 4.82E-01

   D.) 5.15E-01

   E.) 5.51E-01

c07energy_lineIntegral Q8

1. Integrate the function, $\vec{F} = -x^5y^3\hat{x}+x^5y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.43E-01

   B.) 3.67E-01

   C.) 3.92E-01

   D.) 4.20E-01

   E.) 4.49E-01

c07energy_lineIntegral Q9

1. Integrate the function, $\vec{F} = -x^2y^2\hat{x}+x^4y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 5.10E-01

   B.) 5.45E-01

   C.) 5.83E-01

   D.) 6.24E-01

   E.) 6.68E-01

c07energy_lineIntegral Q10

1. Integrate the function, $\vec{F} = -x^2y^5\hat{x}+x^2y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 5.33E-01

   B.) 5.71E-01

   C.) 6.11E-01

   D.) 6.53E-01

   E.) 6.99E-01

c07energy_lineIntegral Q11

1. Integrate the function, $\vec{F} = -x^3y^4\hat{x}+x^4y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.43E-01

   B.) 3.67E-01

   C.) 3.93E-01

   D.) 4.21E-01

   E.) 4.50E-01

c07energy_lineIntegral Q12

1. Integrate the function, $\vec{F} = -x^2y^4\hat{x}+x^4y^5\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 4.08E-01

   B.) 4.37E-01

   C.) 4.67E-01

   D.) 5.00E-01

   E.) 5.35E-01

c07energy_lineIntegral Q13

1. Integrate the function, $\vec{F} = -x^5y^2\hat{x}+x^2y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.43E-01

   B.) 3.67E-01

   C.) 3.92E-01

   D.) 4.20E-01

   E.) 4.49E-01

c07energy_lineIntegral Q14

1. Integrate the function, $\vec{F} = -x^4y^2\hat{x}+x^4y^5\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.67E-01

   B.) 3.92E-01

   C.) 4.20E-01

   D.) 4.49E-01

   E.) 4.81E-01

c07energy_lineIntegral Q15

1. Integrate the function, $\vec{F} = -x^3y^2\hat{x}+x^2y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.43E-01

   B.) 3.67E-01

   C.) 3.93E-01

   D.) 4.21E-01

   E.) 4.50E-01

c07energy_lineIntegral Q16

1. Integrate the function, $\vec{F} = -x^4y^2\hat{x}+x^3y^4\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 3.74E-01

   B.) 4.00E-01

   C.) 4.28E-01

   D.) 4.58E-01

   E.) 4.90E-01

c07energy_lineIntegral Q17

1. Integrate the function, $\vec{F} = -x^2y^4\hat{x}+x^4y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule

   A.) 5.10E-01

   B.) 5.45E-01

   C.) 5.83E-01

   D.) 6.24E-01

   E.) 6.68E-01

c07energy_lineIntegral Q18

1. Integrate the function, $\vec{F} = -x^4y^2\hat{x}+x^2y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule
   - **A.) 4.50E-01**
   - B.) 4.82E-01
   - C.) 5.15E-01
   - D.) 5.51E-01
   - E.) 5.90E-01

c07energy_lineIntegral Q19

1. Integrate the function, $\vec{F} = -x^5y^5\hat{x}+x^5y^5\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule
   - A.) 3.12E-01
   - **B.) 3.33E-01**
   - C.) 3.57E-01
   - D.) 3.82E-01
   - E.) 4.08E-01

c07energy_lineIntegral Q20

1. Integrate the function, $\vec{F} = -x^3y^2\hat{x}+x^5y^3\hat{y}$, as a line integral around a unit square with corners at (0,0),(1,0),(1,1),(0,1) Orient the path so its direction is out of the paper by the right hand rule
   - **A.) 5.00E-01**
   - B.) 5.35E-01
   - C.) 5.72E-01
   - D.) 6.13E-01
   - E.) 6.55E-01

78 c16OscillationsWaves_calculus

1. If a particle's position is given by "x(t) = 7sin(3t-π/6)", what is the velocity?[773]
   - A. "v(t) = 21sin(3t-π/6)"
   - B. "v(t) = 7cos(3t-π/6)"
   - **C. "v(t) = 21cos(3t-π/6)"**
   - D. "v(t) = -21sin(3t-π/6)"
   - E. "v(t) = -21cos(3t-π/6)"
2. If a particle's position is given by "x(t) = 7sin(3t-π/6)", what is the acceleration?[774]
   - **A. "a(t) = -63sin(3t-π/6)"**
   - B. "a(t) = +63sin(3t-π/6)"
   - C. "a(t) = -21cos(3t-π/6)"
   - D. "a(t) = -21sin(3t-π/6)"
   - E. "a(t) = +21sin(3t-π/6)"

3. If a particle's position is given by ”x(t) = 5cos(4t-π/6)”, what is the velocity?[775]
   - A. ”v(t) = 5sin(4t-π/6)”
   - **B. ”v(t) = -20sin(4t-π/6)”**
   - C. ”v(t) = 20sin(4t-π/6)”
   - D. ”v(t) = -20cos(4t-π/6)”
   - E. ”v(t) = 20cos(4t-π/6)”

4. If a particle's position is given by ”x(t) = 5sin(4t-π/6)”, what is the velocity?[776]
   - A. ”v(t) = 20sin(4t-π/6)”
   - **B. ”v(t) = 20cos(4t-π/6)”**
   - C. ”v(t) = -20cos(4t-π/6)”
   - D. ”v(t) = 5cos(4t-π/6)”
   - E. ”v(t) = -20sin(4t-π/6)”

5. If a particle's position is given by ”x(t) = 7cos(3t-π/6)”, what is the velocity?[777]
   - A. ”v(t) = 7sin(3t-π/6)”
   - B. ”v(t) = -21cos(3t-π/6)”
   - **C. ”v(t) = -21sin(3t-π/6)”**
   - D. ”v(t) = 21sin(3t-π/6)”
   - E. ”v(t) = 21cos(3t-π/6)”

6. If a particle's position is given by ”x(t) = 5sin(4t-π/6)”, what is the acceleration?[778]
   - **A. ”a(t) = -80sin(4t-π/6)”**
   - B. ”a(t) = +80sin(4t-π/6)”
   - C. ”a(t) = -100cos(4t-π/6)”
   - D. ”a(t) = -100sin(4t-π/6)”
   - E. ”a(t) = +20sin(4t-π/6)”

79 c18ElectricChargeField_lineCharges

1. A line of charge density λ situated on the y axis extends from y = -3 to y = 2. What is the y component of the electric field at the point (3, 7)?*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{B} =$[779]
   - A. −7
   - B. −3
   - C. −3
   - D. 3
   - **E. 2**

2. A line of charge density λ situated on the y axis extends from y = 4 to y = 6. What is the y component of the electric field at the point (5, 1)?¡br /¿*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C} =$:[780]
   - A. a) 5
   - B. b) s−4
   - C. c) 5−s
   - **D. d) 1−s**

E. e) s−1

3. A line of charge density λ situated on the y axis extends from y = 4 to y = 6. What is the y component of the electric field at the point (5, 1)?¡br /¿$Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{F}$ =:[781]

   A. 1/2
   B. 2/3
   C. 2
   D. 3/2
   E. 3

4. A line of charge density λ situated on the x axis extends from x = 3 to x = 7. What is the x component of the electric field at the point (7, 8)?¡br /¿$Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C}$ =:[782]

   A. s−3
   B. 3−s
   C. 8
   D. s−7
   E. 7−s

5. A line of charge density λ situated on the x axis extends from x = 3 to x = 7. What is the x component of the electric field at the point (7, 8)?¡br /¿$Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{D}^2 + \mathcal{E}^2$ =:[783]

   A. $7^2 + (8–s)^2$
   B. $7^2 + 8^2$
   C. $(7\text{-s})^2 + 8^2$
   D. $7^2 + (3–s)^2$
   E. $3^2 + 8^2$

6. A line of charge density λ situated on the y axis extends from y = -3 to y = 2. What is the y component of the electric field at the point (3, 7)?$Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C}$ =[784]

   A. 3−s
   B. 3
   C. s−7
   D. 7−s
   E. s−3

7. A line of charge density λ situated on the y axis extends from y = -3 to y = 2. What is the y component of the electric field at the point (3, 7)?$Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where$\mathcal{F}$ =[785]

   A. 2
   B. 3
   C. 3/2
   D. 1/2

8. A line of charge density λ situated on the y axis extends from y = 2 to y = 7. What is the y component of the electric field at the point (2, 9)?¡br /¿ $Answer$ (assuming $\mathcal{B} > \mathcal{A}$) is : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}} \frac{\mathcal{C}\ \lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C}$ =:[786]

   A. 2
   B. s − 2

C. 2 − s

D. s − 9

E. 9 − s

9. A line of charge density λ situated on the y axis extends from y = 2 to y = 7. What is the y component of the electric field at the point (2, 9)?¡br /¿ *Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}}\frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{D}^2 + \mathcal{E}^2 =$:[787]

A. $9^2 + (7\text{-s})^2$

B. $9^2 + (2\text{-s})^2$

C. $7^2 + (2\text{-s})^2$

D. $2^2 + (7\text{-s})^2$

E. $2^2 + (9\text{-s})^2$

10. A line of charge density λ situated on the x axis extends from x = 4 to x = 8. What is the y component of the electric field at the point (8, 4)?¡br /¿*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}}\frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{A} =$:[788]

A. 1/2

B. 4

C. 2

D. 8

11. A line of charge density λ situated on the x axis extends from x = 4 to x = 8. What is the y component of the electric field at the point (8, 4)?¡br /¿*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}}\frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C} =$:[789]

A. s−8

B. 8−s

C. s−4

D. 4−s

E. 4

12. A line of charge density λ situated on the x axis extends from x = 4 to x = 8. What is the x component of the electric field at the point (8, 4)?¡br /¿*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}}\frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C} =$:[790]

A. s−8

B. 8−s

C. s−4

D. 4−s

E. 4

13. A line of charge density λ situated on the y axis extends from y = 4 to y = 6. What is the x component of the electric field at the point (5, 1)?¡br /¿*Answer* (assuming $\mathcal{B} > \mathcal{A}$) *is* : $\frac{1}{4\pi\epsilon_0}\int_{\mathcal{A}}^{\mathcal{B}}\frac{\mathcal{C}\,\lambda ds}{[\mathcal{D}^2+\mathcal{E}^2]^{\mathcal{F}}}$, where $\mathcal{C} =$:[791]

A. 5

B. s−4

C. 5−s

D. 1−s

E. s−1

80 c19ElectricPotentialField_GaussLaw

1. A cylinder of radius, R, and height H has a uniform charge density of ρ. The height is much less than the radius: $H << R$. The electric field at the center vanishes. What formula describes the electric field at a distance, z, on axis from the center if $z > H/2$?[792]

    A. answer: $\varepsilon_0 E = \rho z$

    B. answer: $\varepsilon_0 E = H\rho$

    C. answer: $\varepsilon_0 E = H\rho z$

    D. answer: $\varepsilon_0 E = H\rho/2$

    E. answer: $\varepsilon_0 E = r\rho$

2. A cylinder of radius, R, and height H has a uniform charge density of ρ. The height is much less than the radius: $H << R$. The electric field at the center vanishes. What formula describes the electric field at a distance, z, on axis from the center if $z < H/2$?[793]

    A. answer: $\varepsilon_0 E = H\rho/2$

    B. answer: $\varepsilon_0 E = \rho z/2$

    C. answer: $\varepsilon_0 E = \rho z$

    D. answer: $\varepsilon_0 E = H\rho$

    E. answer: $\varepsilon_0 E = H\rho z$

3. A sphere has a uniform charge density of ρ, and a radius or R. What formula describes the electric field at a distance $r > R$?[794]

    A. answer: $r^2\varepsilon_0 E = rR^2\rho/2$

    B. answer: $r^2\varepsilon_0 E = R^3\rho/2$

    C. answer: $r^2\varepsilon_0 E = r^3\rho/3$

    D. answer: $r^2\varepsilon_0 E = r^3\rho/2$

    E. answer: $r^2\varepsilon_0 E = R^3\rho/3$

4. A sphere has a uniform charge density of ρ, and a radius equal to R. What formula describes the electric field at a distance $r < R$?[795]

    A. answer: $r^2\varepsilon_0 E = r^3\rho/2$

    B. answer: $r^2\varepsilon_0 E = R^3\rho/3$

    C. answer: $r^2\varepsilon_0 E = Rr^2\rho/3$

    D. answer: $r^2\varepsilon_0 E = r^3\rho/3$

    E. answer: $r^2\varepsilon_0 E = R^3\rho/2$

5. A cylinder of radius, R, and height H has a uniform charge density of ρ. The height is much greater than the radius: $H >> R$?. The electric field at the center vanishes. What formula describes the electric field at a distance, r, radially from the center if $r < R$? [796]

    A. answer: $2R\varepsilon_0 E = r^2\rho$

    B. answer: $2r\varepsilon_0 E = R^2\rho$

    C. answer: $2\varepsilon_0 E = r\rho$

    D. answer: $2\varepsilon_0 E = R\rho$

    E. answer: $2r^2\varepsilon_0 E = R^3\rho$

6. A cylinder of radius, R, and height H has a uniform charge density of ρ. The height is much greater than the radius: $H >>$. The electric field at the center vanishes. What formula describes the electric field at a distance, r, radially from the center if $r > R$?[797]

   A. answer: $2R\varepsilon_0 E = r^2\rho$

   B. answer: $2\varepsilon_0 E = r\rho$

   C. answer: $2r\varepsilon_0 E = R^2\rho$

   D. answer: $2r\varepsilon_0 E = 2R^2\rho$

   E. answer: $2r^2\varepsilon_0 E = R^3\rho$

81 c19ElectricPotentialField_SurfaceIntegral

1. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.35 + 2.57z)\rho^3\hat{\rho} + 7.45z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\int_{top} \vec{F}\cdot\hat{n}dA\right|$ over the top surface of the cylinder.[798]

   A. 1.148E+03

   B. 1.391E+03

   C. 1.685E+03

   D. 2.042E+03

   E. 2.473E+03

2. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.35 + 2.57z)\rho^3\hat{\rho} + 7.45z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\int_{side} \vec{F}\cdot\hat{n}dA\right|$ over the curved side surface of the cylinder.[799]

   A. 2.221E+03

   B. 2.690E+03

   C. 3.259E+03

   D. 3.949E+03

   E. 4.784E+03

3. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.35 + 2.57z)\rho^3\hat{\rho} + 7.45z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F}\cdot\hat{n}dA\right|$ over the entire surface of the cylinder.[800]

   A. 4.59E+03

   B. 5.56E+03

   C. 6.73E+03

   D. 8.15E+03

   E. 9.88E+03

81.1 Renditions

c19ElectricPotentialField_SurfaceIntegral Q1

1. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.05 + 2.59z)\rho^2\hat{\rho} + 7.4z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F}\cdot\hat{n}dA\right|$ over the entire surface of the cylinder.

A. 6.46E+02

B. 7.82E+02

C. 9.48E+02

D. 1.15E+03

E. 1.39E+03

c19ElectricPotentialField_SurfaceIntegral Q2

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.12 + 1.85z)\rho^3\hat{\rho} + 8.88z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

A. 3.96E+02

B. 4.79E+02

C. 5.81E+02

D. 7.04E+02

E. 8.53E+02

c19ElectricPotentialField_SurfaceIntegral Q3

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2 + 1.45z)\rho^2\hat{\rho} + 8.02z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

A. 1.13E+03

B. 1.37E+03

C. 1.66E+03

D. 2.01E+03

E. 2.44E+03

c19ElectricPotentialField_SurfaceIntegral Q4

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.14 + 2.8z)\rho^2\hat{\rho} + 9.94z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

A. 2.93E+02

B. 3.55E+02

C. 4.30E+02

D. 5.21E+02

E. 6.32E+02

c19ElectricPotentialField_SurfaceIntegral Q5

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.85 + 1.33z)\rho^3\hat{\rho} + 7.52z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

A. 3.18E+03

B. 3.85E+03

C. 4.66E+03

D. 5.65E+03

E. 6.84E+03

c19ElectricPotentialField_SurfaceIntegral Q6

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.07 + 2.87z)\rho^2\hat{\rho} + 9.56z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

   A. 1.59E+03

   B. 1.93E+03

   C. 2.34E+03

   D. 2.83E+03

   E. 3.43E+03

c19ElectricPotentialField_SurfaceIntegral Q7

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.17 + 1.5z)\rho^2\hat{\rho} + 8.75z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

   A. 3.60E+02

   B. 4.36E+02

   C. 5.29E+02

   D. 6.40E+02

   E. 7.76E+02

c19ElectricPotentialField_SurfaceIntegral Q8

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.28 + 1.72z)\rho^3\hat{\rho} + 7.33z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

   A. 1.50E+04

   B. 1.82E+04

   C. 2.20E+04

   D. 2.66E+04

   E. 3.23E+04

c19ElectricPotentialField_SurfaceIntegral Q9

1. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.04 + 1.66z)\rho^2\hat{\rho} + 7.54z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

   A. 9.43E+02

   B. 1.14E+03

   C. 1.38E+03

   D. 1.68E+03

   E. 2.03E+03

c19ElectricPotentialField_SurfaceIntegral Q10

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.21 + 1.16z)\rho^2\hat{\rho} + 7.96z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 6.69E+03
   - B. 8.10E+03
   - C. 9.81E+03
   - D. 1.19E+04
   - **E. 1.44E+04**

c19ElectricPotentialField_SurfaceIntegral Q11

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.12 + 1.68z)\rho^2\hat{\rho} + 8.83z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 1.29E+04
   - **B. 1.56E+04**
   - C. 1.89E+04
   - D. 2.30E+04
   - E. 2.78E+04

c19ElectricPotentialField_SurfaceIntegral Q12

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.05 + 2.05z)\rho^2\hat{\rho} + 9.62z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 1.09E+03
   - B. 1.32E+03
   - C. 1.60E+03
   - D. 1.94E+03
   - **E. 2.35E+03**

c19ElectricPotentialField_SurfaceIntegral Q13

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.93 + 2.31z)\rho^3\hat{\rho} + 7.21z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 5.40E+02
   - B. 6.55E+02
   - C. 7.93E+02
   - D. 9.61E+02
   - **E. 1.16E+03**

c19ElectricPotentialField_SurfaceIntegral Q14

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.24 + 1.11z)\rho^3\hat{\rho} + 8.16z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 4.69E+03
   - B. 5.69E+03
   - **C. 6.89E+03**
   - D. 8.35E+03
   - E. 1.01E+04

c19ElectricPotentialField_SurfaceIntegral Q15

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.96 + 2.52z)\rho^2\hat{\rho} + 7.11z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - **A. 5.91E+02**
   - B. 7.16E+02
   - C. 8.68E+02
   - D. 1.05E+03
   - E. 1.27E+03

c19ElectricPotentialField_SurfaceIntegral Q16

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.86 + 2.43z)\rho^2\hat{\rho} + 9.75z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 4.63E+02
   - **B. 5.61E+02**
   - C. 6.80E+02
   - D. 8.23E+02
   - E. 9.98E+02

c19ElectricPotentialField_SurfaceIntegral Q17

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.24 + 2.08z)\rho^2\hat{\rho} + 8.93z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 3.13E+03
   - B. 3.79E+03
   - C. 4.59E+03
   - D. 5.56E+03
   - **E. 6.74E+03**

c19ElectricPotentialField_SurfaceIntegral Q18

1. A cylinder of radius, r=2, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.89 + 1.31z)\rho^3\hat{\rho} + 8.35z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 9.41E+02
   - **B. 1.14E+03**
   - C. 1.38E+03
   - D. 1.67E+03
   - E. 2.03E+03

c19ElectricPotentialField_SurfaceIntegral Q19

1. A cylinder of radius, r=3, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.37 + 2.6z)\rho^2\hat{\rho} + 8.84z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 4.63E+03
   - **B. 5.61E+03**
   - C. 6.79E+03
   - D. 8.23E+03
   - E. 9.97E+03

c19ElectricPotentialField_SurfaceIntegral Q20

1. A cylinder of radius, r=2, and height, h=4, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.45 + 2.26z)\rho^2\hat{\rho} + 8.92z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 1.29E+03
   - B. 1.56E+03
   - C. 1.89E+03
   - **D. 2.29E+03**
   - E. 2.77E+03

c19ElectricPotentialField_SurfaceIntegral Q21

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (1.88 + 1.29z)\rho^2\hat{\rho} + 7.2z^2\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.
   - A. 1.08E+03
   - B. 1.30E+03
   - C. 1.58E+03
   - **D. 1.91E+03**
   - E. 2.32E+03

c19ElectricPotentialField_SurfaceIntegral Q22

1. A cylinder of radius, r=3, and height, h=6, is centered at the origin and oriented along the z axis. A vector field can be expressed in cylindrical coordinates as, $\vec{F} = (2.44 + 2.86z)\rho^2\hat{\rho} + 7.42z^3\hat{z}$. Let $\hat{n}$ be the outward unit normal to this cylinder and evaluate $\left|\oint \vec{F} \cdot \hat{n} dA\right|$ over the entire surface of the cylinder.

    A. 9.41E+03

    B. 1.14E+04

    C. 1.38E+04

    D. 1.67E+04

    E. 2.03E+04

82 c22Magnetism_ampereLaw

1. Amphere's law for a magnetostatic current is, $\oint \vec{H} \cdot \vec{d\ell} = \int \vec{J} \cdot d\vec{A}$, which equals the current enclosed by the closed loop, and $B = \mu_0 H$ is the magnetic field. A current of 8.5A flows upward along the z axis. Noting that for this geometry, $\oint \vec{B} \cdot \vec{d\ell} = B \oint d\ell$, calculate the line integral $\oint d\ell$ for a circle of radius 4.7m.[801]

    A. 2.69E+01 m

    B. 2.95E+01 m

    C. 3.24E+01 m

    D. 3.55E+01 m

    E. 3.89E+01 m

2. If $H = B/\mu_0$, where B is magnetic field, what is H at a distance of 4.7m from a wire carrying a current of 8.5A?[802]

    A. 2.63E-01 A/m

    B. 2.88E-01 A/m

    C. 3.16E-01 A/m

    D. 3.46E-01 A/m

    E. 3.79E-01 A/m

3. If $H = B/\mu_0$, where B is magnetic field, what is H_y at the point (3.4389,3.2037) if a current of 8.5A flows through a wire that runs along the z axis?[803]

    A. 1.46E-01 A/m

    B. 1.60E-01 A/m

    C. 1.75E-01 A/m

    D. 1.92E-01 A/m

    E. 2.11E-01 A/m

4. A very long and thin solenoid has 1331 turns and is 140 meters long. The wire carrys a current of 9.6A. What is the magnetic field in the center?[804]

    A. 8.70E-05 Tesla

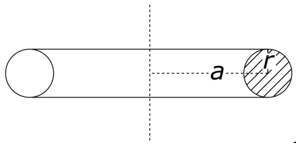
    B. 9.54E-05 Tesla

    C. 1.05E-04 Tesla

    D. 1.15E-04 Tesla

    E. 1.26E-04 Tesla

5. A very long and thin solenoid has 1770 turns and is 140 meters long. The wire carrys a current of 9.6A. If this solenoid is sufficiently thin, what is the line integral of $\int \vec{H} \cdot d\vec{\ell}$ along an on-axis path that starts 25 meters from the center and stops 98 meters from the center?[805]
   - A. 4.54E+03 A
   - B. 4.98E+03 A
   - **C. 5.46E+03 A**
   - D. 5.99E+03 A
   - E. 6.57E+03 A



6. A torus is centered around the x-y plane, with major radius, a = 1.56 m, and minor radius, r = 0.65m. A wire carrying 4.4A is uniformly wrapped with 890 turns. If $B=\mu_0 H$ is the magnetic field, what is H inside the torus, at a point on the xy plane that is 0.26m from the outermost edge of the torus?[806]
   - A. 2.22E+02 amps per meter
   - **B. 2.40E+02 amps per meter**
   - C. 2.59E+02 amps per meter
   - D. 2.79E+02 amps per meter
   - E. 3.02E+02 amps per meter

82.1 Renditions

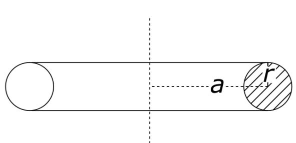
c22Magnetism_ampereLaw Q1

1. What is the sum of 5.2 apples plus 76 apples?
   - A. 7.41E+01 apples
   - **B. 8.12E+01 apples**
   - C. 8.90E+01 apples
   - D. 9.76E+01 apples
   - E. 1.07E+02 apples

c22Magnetism_ampereLaw Q2

1. What is the sum of 3.4 apples plus 62 apples?
   - A. 4.96E+01 apples
   - B. 5.44E+01 apples
   - C. 5.96E+01 apples
   - **D. 6.54E+01 apples**
   - E. 7.17E+01 apples

c22Magnetism_ampereLaw Q3



1. A torus is centered around the x-y plane, with major radius, a = 3.24 m, and minor radius, r = 1.35m. A wire carrying 4.9A is uniformly wrapped with 731 turns. If $B=\mu_0 H$ is the magnetic field, what is H inside the torus, at a point on the xy plane that is 0.81m from the outermost edge of the torus?

A. 1.11E+02 amps per meter
B. 1.20E+02 amps per meter
C. 1.30E+02 amps per meter
D. 1.40E+02 amps per meter
E. 1.51E+02 amps per meter

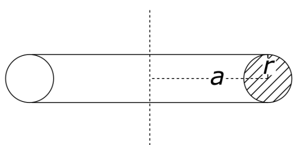
c22Magnetism_ampereLaw Q4

1. What is the sum of 6.6 apples plus 33 apples?
   A. 3.61E+01 apples
   B. 3.96E+01 apples
   C. 4.34E+01 apples
   D. 4.76E+01 apples
   E. 5.22E+01 apples

c22Magnetism_ampereLaw Q5

1. What is the sum of 0.2 apples plus 57 apples?
   A. 5.72E+01 apples
   B. 6.27E+01 apples
   C. 6.88E+01 apples
   D. 7.54E+01 apples
   E. 8.27E+01 apples

c22Magnetism_ampereLaw Q6



1. A torus is centered around the x-y plane, with major radius, a = 6.48 m, and minor radius, r = 2.16m. A wire carrying 5A is uniformly wrapped with 930 turns. If $B=\mu_0 H$ is the magnetic field, what is H inside the torus, at a point on the xy plane that is 0.54m from the outermost edge of the torus?
   A. 5.31E+01 amps per meter
   B. 5.73E+01 amps per meter
   C. 6.19E+01 amps per meter
   D. 6.68E+01 amps per meter
   E. 7.21E+01 amps per meter

c22Magnetism_ampereLaw Q7

1. What is the sum of 0.8 apples plus 18 apples?
   A. 1.56E+01 apples
   B. 1.71E+01 apples
   C. 1.88E+01 apples
   D. 2.06E+01 apples
   E. 2.26E+01 apples

c22Magnetism_ampereLaw Q8

1. What is the sum of 7.2 apples plus 9 apples?
   - **A. 1.62E+01 apples**
   - B. 1.78E+01 apples
   - C. 1.95E+01 apples
   - D. 2.14E+01 apples
   - E. 2.34E+01 apples

83 c22Magnetism_ampereLawSymmetry

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 48A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot \vec{d\ell}$, from the point $(0, 6.7)$ to the point $(6.7, 0)$.[807]
   - A. 9.10E+00 amps
   - B. 9.98E+00 amps
   - C. 1.09E+01 amps
   - **D. 1.20E+01 amps**
   - E. 1.32E+01 amps

2. H is defined by, B=μ_0H, where B is magnetic field. A current of 67A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot \vec{d\ell}$, from the point $(-6.1, 6.1)$ to the point $(6.1, 6.1)$.[808]
   - A. 1.27E+01 amps
   - B. 1.39E+01 amps
   - C. 1.53E+01 amps
   - **D. 1.68E+01 amps**
   - E. 1.84E+01 amps

3. H is defined by, B=μ_0H, where B is magnetic field. A current of 84A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot \vec{d\ell}$, from the point $(0, 9.3)$ to the point $(9.3, 9.3)$.[809]
   - **A. 1.05E+01 amps**
   - B. 1.15E+01 amps
   - C. 1.26E+01 amps
   - D. 1.38E+01 amps
   - E. 1.52E+01 amps

4. H is defined by, B=μ_0H, where B is magnetic field. A current of 81A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot \vec{d\ell}$, from $(-\infty, 6.4)$ to $(+\infty, 6.4)$.[810]
   - A. 3.37E+01 amps
   - B. 3.69E+01 amps
   - **C. 4.05E+01 amps**
   - D. 4.44E+01 amps
   - E. 4.87E+01 amps

83.1 Renditions

c22Magnetism_ampereLawSymmetry Q1

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 94A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 6.2)$ to $(+\infty, 6.2)$.
   - A. 3.91E+01 amps
   - B. 4.29E+01 amps
   - **C. 4.70E+01 amps**
   - D. 5.15E+01 amps
   - E. 5.65E+01 amps

c22Magnetism_ampereLawSymmetry Q2

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 93A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 4.1)$ to $(+\infty, 4.1)$.
   - A. 3.53E+01 amps
   - B. 3.87E+01 amps
   - C. 4.24E+01 amps
   - **D. 4.65E+01 amps**
   - E. 5.10E+01 amps

c22Magnetism_ampereLawSymmetry Q3

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 74A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9)$ to $(+\infty, 9)$.
   - A. 3.08E+01 amps
   - B. 3.37E+01 amps
   - **C. 3.70E+01 amps**
   - D. 4.06E+01 amps
   - E. 4.45E+01 amps

c22Magnetism_ampereLawSymmetry Q4

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 67A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9.4)$ to $(+\infty, 9.4)$.
   - A. 2.32E+01 amps
   - B. 2.54E+01 amps
   - C. 2.79E+01 amps
   - D. 3.06E+01 amps
   - **E. 3.35E+01 amps**

c22Magnetism_ampereLawSymmetry Q5

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 31A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9.2)$ to $(+\infty, 9.2)$.
   - A. 1.41E+01 amps
   - **B. 1.55E+01 amps**

C. 1.70E+01 amps

D. 1.86E+01 amps

E. 2.04E+01 amps

c22Magnetism_ampereLawSymmetry Q6

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 74A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8.2)$ to $(+\infty, 8.2)$.

A. 3.37E+01 amps

B. 3.70E+01 amps

C. 4.06E+01 amps

D. 4.45E+01 amps

E. 4.88E+01 amps

c22Magnetism_ampereLawSymmetry Q7

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 69A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 5.8)$ to $(+\infty, 5.8)$.

A. 2.87E+01 amps

B. 3.15E+01 amps

C. 3.45E+01 amps

D. 3.78E+01 amps

E. 4.15E+01 amps

c22Magnetism_ampereLawSymmetry Q8

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 85A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8)$ to $(+\infty, 8)$.

A. 2.94E+01 amps

B. 3.22E+01 amps

C. 3.53E+01 amps

D. 3.88E+01 amps

E. 4.25E+01 amps

c22Magnetism_ampereLawSymmetry Q9

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 88A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8.7)$ to $(+\infty, 8.7)$.

A. 4.01E+01 amps

B. 4.40E+01 amps

C. 4.82E+01 amps

D. 5.29E+01 amps

E. 5.80E+01 amps

c22Magnetism_ampereLawSymmetry Q10

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 94A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9.4)$ to $(+\infty, 9.4)$.
   - A. 3.25E+01 amps
   - B. 3.57E+01 amps
   - C. 3.91E+01 amps
   - D. 4.29E+01 amps
   - **E. 4.70E+01 amps**

c22Magnetism_ampereLawSymmetry Q11

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 96A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8.1)$ to $(+\infty, 8.1)$.
   - A. 3.32E+01 amps
   - B. 3.64E+01 amps
   - C. 3.99E+01 amps
   - D. 4.38E+01 amps
   - **E. 4.80E+01 amps**

c22Magnetism_ampereLawSymmetry Q12

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 36A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8.3)$ to $(+\infty, 8.3)$.
   - A. 1.50E+01 amps
   - B. 1.64E+01 amps
   - **C. 1.80E+01 amps**
   - D. 1.97E+01 amps
   - E. 2.16E+01 amps

c22Magnetism_ampereLawSymmetry Q13

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 76A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 5.8)$ to $(+\infty, 5.8)$.
   - A. 3.16E+01 amps
   - B. 3.47E+01 amps
   - **C. 3.80E+01 amps**
   - D. 4.17E+01 amps
   - E. 4.57E+01 amps

c22Magnetism_ampereLawSymmetry Q14

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 44A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 5)$ to $(+\infty, 5)$.
   - A. 1.67E+01 amps
   - B. 1.83E+01 amps
   - C. 2.01E+01 amps
   - **D. 2.20E+01 amps**
   - E. 2.41E+01 amps

c22Magnetism_ampereLawSymmetry Q15

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 39A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 8.5)$ to $(+\infty, 8.5)$.
   - A. 1.62E+01 amps
   - B. 1.78E+01 amps
   - **C. 1.95E+01 amps**
   - D. 2.14E+01 amps
   - E. 2.34E+01 amps

c22Magnetism_ampereLawSymmetry Q16

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 43A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 5.8)$ to $(+\infty, 5.8)$.
   - A. 1.63E+01 amps
   - B. 1.79E+01 amps
   - C. 1.96E+01 amps
   - **D. 2.15E+01 amps**
   - E. 2.36E+01 amps

c22Magnetism_ampereLawSymmetry Q17

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 31A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9.4)$ to $(+\infty, 9.4)$.
   - **A. 1.55E+01 amps**
   - B. 1.70E+01 amps
   - C. 1.86E+01 amps
   - D. 2.04E+01 amps
   - E. 2.24E+01 amps

c22Magnetism_ampereLawSymmetry Q18

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 66A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 5.5)$ to $(+\infty, 5.5)$.
   - A. 3.01E+01 amps
   - **B. 3.30E+01 amps**
   - C. 3.62E+01 amps
   - D. 3.97E+01 amps
   - E. 4.35E+01 amps

c22Magnetism_ampereLawSymmetry Q19

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 76A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 9.6)$ to $(+\infty, 9.6)$.
   - A. 3.16E+01 amps
   - B. 3.47E+01 amps
   - **C. 3.80E+01 amps**
   - D. 4.17E+01 amps
   - E. 4.57E+01 amps

c22Magnetism_ampereLawSymmetry Q20

1. H is defined by, B=μ_0H, where B is magnetic field. A current of 67A passes along the z-axis. Use symmetry to find the integral, $\int \vec{H} \cdot d\vec{\ell}$, from $(-\infty, 6.9)$ to $(+\infty, 6.9)$.

   A. 2.54E+01 amps

   B. 2.79E+01 amps

   C. 3.06E+01 amps

   D. 3.35E+01 amps

   E. 3.67E+01 amps

84 c24ElectromagneticWaves_displacementCurrent

1. A circlular capactitor of radius 4.2 m has a gap of 8 mm, and a charge of 45 μ C. What is the electric field between the plates?[811]

   A. 5.16E+04 N/C (or V/m)

   B. 6.25E+04 N/C (or V/m)

   C. 7.57E+04 N/C (or V/m)

   D. 9.17E+04 N/C (or V/m)

   E. 1.11E+05 N/C (or V/m)

2. A circlular capactitor of radius 3.2 m has a gap of 13 mm, and a charge of 49 μ C. Compute the surface integral $c^{-2} \oint \vec{E} \cdot d\vec{A}$ over an inner face of the capacitor.[812]

   A. 3.46E-11 Vs^2m^{-1}

   B. 4.20E-11 Vs^2m^{-1}

   C. 5.08E-11 Vs^2m^{-1}

   D. 6.16E-11 Vs^2m^{-1}

   E. 7.46E-11 Vs^2m^{-1}

3. A circlular capactitor of radius 4.9 m has a gap of 17 mm, and a charge of 54 μ C. The capacitor is discharged through a 9 kΩ resistor. What is the decay time? [813]

   A. 2.92E-04 s

   B. 3.54E-04 s

   C. 4.28E-04 s

   D. 5.19E-04 s

   E. 6.29E-04 s

4. A circlular capactitor of radius 3.3 m has a gap of 12 mm, and a charge of 93 μ C. The capacitor is discharged through a 9 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)[814]

   A. 9.88E-09 Tesla

   B. 1.24E-08 Tesla

   C. 1.57E-08 Tesla

   D. 1.97E-08 Tesla

   E. 2.48E-08 Tesla

84.1 Renditions

c24ElectromagneticWaves_displacementCurrent Q1

1. A circlular capactitor of radius 4.1 m has a gap of 11 mm, and a charge of 66 µ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 6.33E-09 Tesla

    B. 7.96E-09 Tesla

    C. 1.00E-08 Tesla

    D. 1.26E-08 Tesla

    E. 1.59E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q2

1. A circlular capactitor of radius 4.4 m has a gap of 15 mm, and a charge of 63 µ C. The capacitor is discharged through a 8 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 7.92E-09 Tesla

    B. 9.97E-09 Tesla

    C. 1.26E-08 Tesla

    D. 1.58E-08 Tesla

    E. 1.99E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q3

1. A circlular capactitor of radius 4 m has a gap of 13 mm, and a charge of 89 µ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 8.62E-09 Tesla

    B. 1.09E-08 Tesla

    C. 1.37E-08 Tesla

    D. 1.72E-08 Tesla

    E. 2.17E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q4

1. A circlular capactitor of radius 4.3 m has a gap of 10 mm, and a charge of 46 µ C. The capacitor is discharged through a 5 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 8.32E-09 Tesla

    B. 1.05E-08 Tesla

    C. 1.32E-08 Tesla

    D. 1.66E-08 Tesla

    E. 2.09E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q5

1. A circlular capactitor of radius 4.1 m has a gap of 15 mm, and a charge of 90 µ C. The capacitor is discharged through a 5 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 1.41E-08 Tesla

   B. 1.78E-08 Tesla

   C. 2.24E-08 Tesla

   D. 2.82E-08 Tesla

   E. 3.55E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q6

1. A circlular capactitor of radius 4.6 m has a gap of 12 mm, and a charge of 52 µ C. The capacitor is discharged through a 7 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 3.30E-09 Tesla

   B. 4.15E-09 Tesla

   C. 5.23E-09 Tesla

   D. 6.58E-09 Tesla

   E. 8.29E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q7

1. A circlular capactitor of radius 3.6 m has a gap of 19 mm, and a charge of 98 µ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 1.90E-08 Tesla

   B. 2.40E-08 Tesla

   C. 3.02E-08 Tesla

   D. 3.80E-08 Tesla

   E. 4.78E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q8

1. A circlular capactitor of radius 4.6 m has a gap of 18 mm, and a charge of 44 µ C. The capacitor is discharged through a 7 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 6.64E-09 Tesla

   B. 8.36E-09 Tesla

   C. 1.05E-08 Tesla

   D. 1.32E-08 Tesla

   E. 1.67E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q9

1. A circlular capactitor of radius 4.9 m has a gap of 18 mm, and a charge of 45 μ C. The capacitor is discharged through a 7 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 2.82E-09 Tesla

   B. 3.54E-09 Tesla

   C. 4.46E-09 Tesla

   D. 5.62E-09 Tesla

   E. 7.07E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q10

1. A circlular capactitor of radius 4.3 m has a gap of 15 mm, and a charge of 21 μ C. The capacitor is discharged through a 7 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 1.62E-09 Tesla

   B. 2.04E-09 Tesla

   C. 2.57E-09 Tesla

   D. 3.23E-09 Tesla

   E. 4.07E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q11

1. A circlular capactitor of radius 4.7 m has a gap of 16 mm, and a charge of 12 μ C. The capacitor is discharged through a 8 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 6.62E-10 Tesla

   B. 8.33E-10 Tesla

   C. 1.05E-09 Tesla

   D. 1.32E-09 Tesla

   E. 1.66E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q12

1. A circlular capactitor of radius 4.9 m has a gap of 16 mm, and a charge of 46 μ C. The capacitor is discharged through a 9 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 5.00E-09 Tesla

   B. 6.29E-09 Tesla

   C. 7.92E-09 Tesla

   D. 9.97E-09 Tesla

   E. 1.26E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q13

1. A circlular capactitor of radius 4.9 m has a gap of 14 mm, and a charge of 56 μ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 3.18E-09 Tesla

   B. 4.00E-09 Tesla

   C. 5.04E-09 Tesla

   D. 6.34E-09 Tesla

   E. 7.99E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q14

1. A circlular capactitor of radius 4.8 m has a gap of 14 mm, and a charge of 55 μ C. The capacitor is discharged through a 8 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 3.95E-09 Tesla

   B. 4.97E-09 Tesla

   C. 6.26E-09 Tesla

   D. 7.88E-09 Tesla

   E. 9.92E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q15

1. A circlular capactitor of radius 4.4 m has a gap of 12 mm, and a charge of 85 μ C. The capacitor is discharged through a 8 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 5.39E-09 Tesla

   B. 6.79E-09 Tesla

   C. 8.55E-09 Tesla

   D. 1.08E-08 Tesla

   E. 1.35E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q16

1. A circlular capactitor of radius 3.1 m has a gap of 9 mm, and a charge of 85 μ C. The capacitor is discharged through a 5 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

   A. 2.33E-08 Tesla

   B. 2.93E-08 Tesla

   C. 3.69E-08 Tesla

   D. 4.65E-08 Tesla

   E. 5.85E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q17

1. A circlular capactitor of radius 4.6 m has a gap of 15 mm, and a charge of 57 µ C. The capacitor is discharged through a 9 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 4.43E-09 Tesla

    B. 5.57E-09 Tesla

    C. 7.02E-09 Tesla

    D. 8.83E-09 Tesla

    E. 1.11E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q18

1. A circlular capactitor of radius 4 m has a gap of 14 mm, and a charge of 78 µ C. The capacitor is discharged through a 5 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 9.77E-09 Tesla

    B. 1.23E-08 Tesla

    C. 1.55E-08 Tesla

    D. 1.95E-08 Tesla

    E. 2.45E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q19

1. A circlular capactitor of radius 3.5 m has a gap of 14 mm, and a charge of 88 µ C. The capacitor is discharged through a 7 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 1.86E-08 Tesla

    B. 2.34E-08 Tesla

    C. 2.95E-08 Tesla

    D. 3.72E-08 Tesla

    E. 4.68E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q20

1. A circlular capactitor of radius 3.9 m has a gap of 8 mm, and a charge of 55 µ C. The capacitor is discharged through a 8 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)

    A. 5.30E-09 Tesla

    B. 6.67E-09 Tesla

    C. 8.39E-09 Tesla

    D. 1.06E-08 Tesla

    E. 1.33E-08 Tesla

c24ElectromagneticWaves_displacementCurrent Q21

1. A circlular capactitor of radius 4.8 m has a gap of 9 mm, and a charge of 53 μ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)
   - A. 3.26E-09 Tesla
   - B. 4.11E-09 Tesla
   - **C. 5.17E-09 Tesla**
   - D. 6.51E-09 Tesla
   - E. 8.19E-09 Tesla

c24ElectromagneticWaves_displacementCurrent Q22

1. A circlular capactitor of radius 4.1 m has a gap of 9 mm, and a charge of 79 μ C. The capacitor is discharged through a 6 kΩ resistor. What is what is the maximum magnetic field at the edge of the capacitor? (There are two ways to do this; you should know both.)
   - A. 7.80E-09 Tesla
   - B. 9.82E-09 Tesla
   - **C. 1.24E-08 Tesla**
   - D. 1.56E-08 Tesla
   - E. 1.96E-08 Tesla

85 d_Bell.binomial

1. The normal distribution (often called a "bell curve") is never skewed[815]
   - **A. True**
   - B. False
2. The normal distribution (often called a "bell curve") is usually skewed[816]
   - A. True
   - **B. False**
3. By definition, a skewed distribution[817]
   - A. is broader than an unskewed distribution
   - B. includes negative values of the observed variable
   - C. is a "normal" distribution
   - **D. is asymmetric about its peak value**
   - E. contains no outliers
4. The binomial distribution results from observing n outcomes, each having a probability p of "success"[818]
   - **A. True**
   - B. False
5. What is the probability of success, p, for a binary distribution using a six-sided die, with success defined as "two"?[819]
   - A. 3/6
   - B. 2/6

C. 1/6

D. 5/6

E. 4/6

6. What is the probability of success, p, for a binary distribution using a six-sided die, with success defined as anything but "two"?[820]

    A. 3/6

    B. 2/6

    C. 1/6

    D. 5/6

    E. 4/6

7. What is the probability of success, p, for a binary distribution using a six-sided die, with success defined as either a "two" or a "three"?[821]

    A. 3/6

    B. 2/6

    C. 1/6

    D. 5/6

    E. 4/6

8. How would you describe the "skew" of a binary distribution?[822]

    A. The binary distribution is always skewed, but has little skew for a large number of trials n.

    B. The binary distribution is always skewed, but has little skew for a small number of trials n.

    C. The binary distribution is never skewed if it is a true binary distribution.

    D. Distributions are never skewed. Only experimental measurements of them are skewed.

    E. None of these are true.

9. For a binomial distribution with n trials, the variance is σ^2=np(1-p). If 90 trials are observed, then 68% of the time the observed number of positive outcomes will fall within ±___ of the expected value if p=.11 is the probability of a positive outcome. Make the approximation that this binomial distribution is approximately a Gaussian (normal) distribution).[823]

    A. 6

    B. 18

    C. 3

    D. 9

    E. 1

10. For a binomial distribution with n trials, the variance is σ^2=np(1-p). If 40 trials are observed, then 68% of the time the observed number of positive outcomes will fall within ±___ of the expected value if p=.11 is the probability of a positive outcome. Make the approximation that this binomial distribution is approximately a Gaussian (normal) distribution).[824]

    A. 6

    B. 18

    C. 3

    D. 9

E. 2

11. For a binomial distribution with n trials, the variance is σ^2=np(1-p). If 40 trials are made and p=.11, the expected number of positive outcomes is__. Make the approximation that this binomial distribution is approximately a Gaussian (normal) distribution.[825]

    A. 4.4

    B. 2.2

    C. 9.9

    D. 3.3

    E. 1.1

12. For a binomial distribution with n trials, the variance is σ^2=np(1-p). If 90 trials are made and p=.11, the expected number of positive outcomes is__. Make the approximation that this binomial distribution is approximately a Gaussian (normal) distribution.[826]

    A. 2.2

    B. 9.9

    C. 3.3

    D. 1.1

13. Recall that only 4.6% of the outcomes for a normal distribution lie outside of two standard deviations from the mean, and approximate the binomial distribution as normal for large numbers. If the variance is σ^2=np(1-p) where n is the number of trials and p=.11 is the probability of a positive outcome for 40 trials, roughly 98% of the outcomes will be smaller than approximately __[827]

    A. 6

    B. 8

    C. 12

    D. 16

    E. 22

14. Recall that only 4.6% of the outcomes for a normal distribution lie outside of two standard deviations from the mean, and approximate the binomial distribution as normal for large numbers. If the variance is σ^2=np(1-p) where n is the number of trials and p=.11 is the probability of a positive outcome for 90 trials, roughly 98% of the outcomes will be smaller than approximately __[828]

    A. 6

    B. 8

    C. 12

    D. 16

    E. 22

15. A local college averages 2500 new incoming students each year. Suppose the pool of potential high school graduates in the local area is so large that the probability of a given student selecting this college is small, and assume a variance of σ^2 equal to p(1-p). What standard deviation would you expect in the yearly total of new enrollees, assuming nothing changes in this population from year to year? [829]

    A. 50

    B. 150

    C. 500

    D. 200

E. 250

16. A local college averages 1600 new incoming students each year. Suppose the pool of potential high school graduates in the local area is so large that the probability of a given student selecting this college is small, and assume a variance of σ^2 equal to p(1-p). What standard deviation would you expect in the yearly total of new enrollees, assuming nothing changes in this population from year to year? [830]

    A. 16

    B. 160

    C. 40

    D. 10

    E. 32

86 d_Bell.partners

1. When is the referee allowed to observe Alice and Bob?[831]

    A. never

    B. While they are discussing strategy (phase 1), but not while their backs are turned to each other.

    C. While their backs are turned, but not while they are discussing strategy (phase 1)

    D. The referee should carefully observe Alice and Bob all the time

2. Is it cheating for one of the partners to change their mind in after communication ceases?[832]

    A. It is cheating and the game should be terminated if the partners are caught doing this

    B. It is cheating, but fortunately the penalty allows partners to do it

    C. It is not cheating, but allowing to partners to do so violates the spirit of the game as a Bell's test experiment simulation.

    D. It is not cheating, and allowing to partners to do this is in the spirit of the game as a Bell's test experiment simulation.

3. The β -strategy is a new strategy introduced in the couples version of the card game that calls for[833]

    A. Alice and Bob to sometimes give different answers (one "even" while the other "odd")

    B. Alice and Bob to always give different answers (one "even" while the other "odd")

    C. Alice and Bob to always answer "even"

    D. Alice and Bob to always answer "odd"

    E. None of these describes the β -strategy

4. The α -strategy in the couples version of the card game is similar to the strategy introduced in the solitaire version, and calls for[834]

    A. Alice and Bob to sometimes give different answers (one "even" while the other "odd")

    B. Alice and Bob to always give different answers (one "even" while the other "odd")

    C. Alice and Bob to always answer "even"

    D. Alice and Bob to always answer "odd"

    E. None of these describes the α -strategy

5. Suppose the referee gives Alice and Bob receive question cards of the different suit (different questions). What are the best and worst possible outcomes for the partners? (Assume for this question that $Q > 3$)[835]

    A. Best for partners: +1 ... Worst: $-Q$

B. Best for partners: +1 ... Worst: −3

C. Best for partners: 0 ... Worst: $-Q$

D. Best for partners: 0 ... Worst: −3

E. None of these is correct

6. Suppose the referee gives Alice and Bob receive question cards of the same suit (same questions). What are the best and worst possible outcomes for the partners? (Assume for this question that $Q > 3$)[836]

A. Best for partners: +1 ... Worst: $-Q$

B. Best for partners: +1 ... Worst: −3

C. Best for partners: 0 ... Worst: $-Q$

D. Best for partners: 0 ... Worst: −3

E. None of these is correct

7. Suppose the partners choose the β strategy (which was not available in the solitaire version). What are the best and worst possible outcomes for the partners? (Assume for this question that $Q > 3$)[837]

A. Best for partners: +1 ... Worst: $-Q$

B. Best for partners: +1 ... Worst: −3

C. Best for partners: 0 ... Worst: $-Q$

D. Best for partners: 0 ... Worst: −3

E. None of these is correct

8. Suppose both partners choose to answer "even" to any question that is asked. What are the best and worst possible outcomes for the partners? (Assume for this question that $Q > 3$)[838]

A. Best for partners: +1 ... Worst: $-Q$

B. Best for partners: +1 ... Worst: −3

C. Best for partners: 0 ... Worst: $-Q$

D. Best for partners: 0 ... Worst: −3

E. None of these is correct

9. Suppose both partners choose to answer "even" to any question that is asked. Why would such a strategy ever be adopted? (Assume for this question that $Q > 3$)[839]

A. The partners might have cheated so much in the past that they need to lose a round.

B. One partner might announce that all answers will be "even", while the other is certain that the both question cards will have the same suit.

C. Both partners agree that there is a 90

D. Two of these reasons for this strategy might be valid

E. There is no reason for the partners to ever adopt this strategy

10. How much do the partners win or lose if Alice answers 4♠ to K♠ while Bob answers 4♡ to A♡?[840]

A. win 1 point

B. lose Q points

C. no points awarded or lost

D. lose 3 points

11. How much do the partners win or lose if Alice answers 4♠ to K♠ while Bob answers 5♡ to A♡?[841]

A. win 1 point

B. lose Q points

C. no points awarded or lost

D. lose 3 points

12. How much do the partners win or lose if Alice answers 4♠ to K♠ while Bob answers 4♠ to A♠? [842]

A. win 1 point

B. lose Q points

C. no points awarded or lost

D. lose 3 points

13. How much do the partners win or lose if Alice answers 4♠ to K♠ while Bob answers 5♠ to A♠? [843]

A. win 1 point

B. lose Q points

C. no points awarded or lost

D. lose 3 points

14. Suppose referee adopts neutral scoring with Q=4 and asks the same question with a probability P_S=0.25. This reduces the average loss rate for their partners for the following reason: Consider a probability space with[844]

A. 3 equally probable events: On two they are given different questions, winning twice. On the third event they are given the same answer and lose a point.

B. 3 equally probable events: On two they are given different questions, winning once and losing once. On the third event they are given the same answer and lose a point.

C. 3 equally probable events: On two they are given different questions, winning once and losing once. On the third event they are given the same answer and neither gain nor lose a point.

D. 4 equally probable events: On three they are given different questions, winning once but losing twice. On the fourth event they are given the same answer and lose a point.

E. 4 equally probable events: On three they are given different questions, winning twice but losing once. On the fourth event they are given the same answer and neither gain nor lose a point.

15. Although it decreases the rate at which the partners lose point, increasing the probability of asking the same question is more effective at persuading students to act as particles by relying on the α -strategy because relying on a larger penalty for giving different answers to the same question will tempt students to use the β -strategy only briefly (hoping never to be caught) and then requesting a break to "re-establish" quantum entanglement.[845]

A. True

B. False

16. Suppose the referee selects neutral scoring with $Q = \frac{4}{3}\left(\frac{1-P_S}{P_S}\right)$. What number does the penalty approach as the probability of asking the same question goes to 1?[846]

A. 0

B. ∞

C. 3

D. 4

E. 4/3

17. Suppose the referee selects neutral scoring with $Q = \frac{4}{3}\left(\frac{1-P_S}{P_S}\right)$. What number does the penalty approach as the probability of asking the same question goes to 0?[847]

   A. 0

   B. ∞

   C. 3

   D. 4

   E. 4/3

18. Suppose the referee selects neutral scoring with $Q = \frac{4}{3}\left(\frac{1-P_S}{P_S}\right)$. What is the penalty if the probability of asking the same question is 0.25?[848]

   A. 0

   B. ∞

   C. 3

   D. 4

   E. 4/3

19. Suppose the referee selects neutral scoring with $Q = \frac{4}{3}\left(\frac{1-P_S}{P_S}\right)$. What is the penalty if the probability of asking the same question is 0.5?[849]

   A. 0

   B. ∞

   C. 3

   D. 4

   E. 4/3

87 d_Bell.photon

1. If the wavelength "λ " associated with a photon is cut in half, the photon's energy "E"[850]

   A. is cut in half

   B. is reduced by a factor of 4

   C. stays the same

   D. becomes twice as big

   E. becomes 4 times as big

2. If the wavelength "λ " associated with a photon doubles, the photon's frequency "f"[851]

   A. is cut in half

   B. is reduced by a factor of 4

   C. stays the same

   D. becomes twice as big

   E. becomes 4 times as big

3. If the frequency "f" associated with a photon increases by a factor of 4, the photon's wavelength "λ "[852]

   A. is cut in half

   B. is reduced by a factor of 4

C. stays the same
D. becomes twice as big
E. becomes 4 times as big

4. If the frequency "f" associated with a photon increases by a factor of 4, the photon's energy "E"[853]
   A. is cut in half
   B. is reduced by a factor of 4
   C. stays the same
   D. becomes twice as big
   E. becomes 4 times as big

5. If an atom emits two photons in a cascade emission and both photons have 2 eV of energy, the atom's energy[854]
   A. stays the same
   B. increases by 2 eV
   C. increases by 4 eV
   D. decreases by 2 eV
   E. decreases by 4 eV

6. If an atom absorbs a photon with 2 eV energy, the atom's energy[855]
   A. stays the same
   B. increases by 2 eV
   C. increases by 4 eV
   D. decreases by 2 eV
   E. decreases by 4 eV

7. If a 3 eV photon strikes a metal plate and causes an electron to escape, that electron will have a kinetic energy that is[856]
   A. zero
   B. less than 3 eV
   C. equal to 3 eV
   D. greater than 3 eV
   E. equal to 6 eV

8. In the PhET Interactive Simulation for photoelectric effect, how was the electron's kinetic energy measured?[857]
   A. measuring spin
   B. measuring polarization
   C. measuring both spin and polarization
   D. deflecting the electron with a magnetic field
   E. stopping the electron with an applied voltage

9. If an atom absorbs a photon with 4 eV energy, the atom's energy[858]
   A. stays the same
   B. increases by 2 eV
   C. increases by 4 eV
   D. decreases by 2 eV

E. decreases by 4 eV

10. If 10^{18} photons pass through a small hole in your roof every second, how many photons would pass through it if you doubled the diameter?[859]

    A. 10^{18}

    B. $2x10^{18}$

    C. $4x10^{18}$

    D. $6x10^{18}$

    E. $8x10^{18}$

11. Two black bodies of are created by cutting identical small holes in two large containers. The holes are oriented so that all the photons leaving one will enter the other. The objects have different temperature and different volume. Which object has the greater electromagnetic ("photon") energy density (energy per unit volume)?[860]

    A. The hotter object has a greater energy density.

    B. The larger object has a greater energy density.

    C. They have the same energy density (since the holes are identical).

    D. No unique answer exists because two variables are involved (temperature and volume).

12. Two black bodies of are created by cutting identical small holes two large containers. The holes are oriented so that all the photons leaving one will enter the other. The objects have different temperature and different volume. Which object emits more photons per second (above a given threshold energy)?[861]

    A. The object with the greater temperature emits more.

    B. The object with the greater volume.

    C. They both emit the same number of photons (since the holes are identical).

    D. No unique answer exists because two variables are involved (temperature and volume).

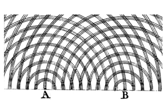
13. Two black bodies of are created by cutting identical small holes in two large containers. The holes are oriented so that all the photons leaving one will enter the other. The objects have different temperature and different volume. Which object has the greater electromagnetic ("photon") energy?[862]

    A. The hotter object has a greater energy.

    B. The larger object has a greater energy.

    C. They have the same energy (since the holes are identical).

    D. No unique answer exists because two variables are involved (temperature and volume).

14. 

This figure is associated with [863]

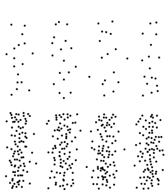
    A. Photons striking metal and ejecting electrons (photo-electric effect explained in 1905)

    B. Diffraction observed in light so faint that photons seemed to have no mechanism to interact with each other

    C. A system similar to the one that led to the 1901 proposal that light energy is quantized as integral multiples of hf (except that Plank assumed that the walls were conductive.)

    D. Evidence presented in 1800 that light is a wave.

    E. The transfer of energy and momentum of a high energy photon of a nearly free electron.

15.  This figure is associated with [864]

A. Photons striking metal and ejecting electrons (photo-electric effect explained in 1905)

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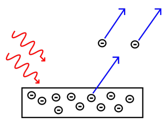
16.  This figure is associated with [865]

A. Photons striking metal and ejecting electrons (photo-electric effect explained in 1905)

B. Diffraction observed in light so faint that photons seemed to have no mechanism to interact with each other

C. A system similar to the one that led to the 1901 proposal that light energy is quantized as integral multiples of hf (except that Plank assumed that the walls were conductive.)

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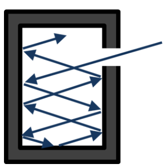
E. The transfer of energy and momentum of a high energy photon of a nearly free electron.

17.  This figure is associated with [866]

A. Photons striking metal and ejecting electrons (photo-electric effect explained in 1905)

B. Diffraction observed in light so faint that photons seemed to have no mechanism to interact with each other

C. A system similar to the one that led to the 1901 proposal that light energy is quantized as integral multiples of hf

D. Evidence presented in 1800 that light is a wave.

E. The transfer of energy and momentum of a high energy photon of a nearly free electron.

18. A photon is polarized at 5° when it encounters a filter oriented at 35°. What is the probability that it passes?[867]

A. 0

B. 1/4

C. 1/2

D. 3/4

E. 1

19. A photon is polarized at 10° when it encounters a filter oriented at 55°. What is the probability that it passes?[868]

A. 0

B. 1/4

C. 1/2

D. 3/4

E. 1

20. A photon is polarized at 10° when it encounters a filter oriented at 70°. What is the probability that it passes?[869]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

21. A photon is polarized at 10° when it encounters a filter oriented at 40°. What is the probability that it is blocked?[870]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

22. A photon is polarized at 5° when it encounters a filter oriented at 50°. What is the probability that it is blocked?[871]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

23. A photon is polarized at 5° when it encounters a filter oriented at 65°. What is the probability that it is blocked?[872]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

24. A photon is polarized at 10° when it encounters a filter oriented at 100°. What is the probability that it passes?[873]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

25. A photon is polarized at 10° when it encounters a filter oriented at 100°. What is the probability that it is blocked?[874]

    A. 0
    B. 1/4
    C. 1/2
    D. 3/4
    E. 1

88 d_Bell.polarization

1. The light is linearly polarized, the electric field is oriented ______ to the direction of motion[875]

    A. parallel

    B. perpendicular

    C. at 45 degrees

    D. all of these are possible

2. Hold a pendulum a moderate distance from equilibrium and release it by tossing it in a direction perpendicular to the displacement of the mass from equilibrium. The resulting polarization will be _____ (pick the best answer)[876]

    A. linear

    B. circular

    C. circular or linear

    D. circular or elliptical

    E. linear or elliptical

3. A mathematically pure (monochromatic) __________ wave or oscillation that is unpolarized cannot be created if it is[877]

    A. electromagnetic

    B. a pendulum

    C. either electromagnetic or a pendulum

    D. both oscillations can be created as pure (monochromatic) oscillations

4. To create an unpolarized pendulum oscillation[878]

    A. create an elliptically polarized wave with an ε¿0.2

    B. create an elliptically polarized wave with an ε¡0.8

    C. create an elliptically polarized wave with an 0.2¡ε¡0.8

    D. start with a linear, circular, or elliptical wave and evolve it randomly to different polarizations

5. If the hypotenuse of a 45°-45° right triangle has a length of $\sqrt{2}$ what is the length of each side?[879]

    A. $\frac{1}{2}$

    B. $\frac{1}{\sqrt{2}}$

    C. 1

    D. $\sqrt{2}$

    E. $2\sqrt{2}$

6. If the hypotenuse of a 45°-45° right triangle has a length of 1 what is the length of each side?[880]

    A. $\frac{1}{2}$

    B. $\frac{1}{\sqrt{2}}$

    C. 1

    D. $\sqrt{2}$

    E. $2\sqrt{2}$

7. If the hypotenuse of a 60°-30° right triangle has a length of 1 what is the length of the shorter side?[881]

A. $\frac{1}{4}$
B. $\frac{1}{\sqrt{2}}$
C. $\frac{1}{2}$
D. $\frac{\sqrt{3}}{2}$
E. $\frac{3}{4}$

8. If the hypotenuse of a 60°-30° right triangle has a length of 1 what is the length of the longer side?[882]
   A. $\frac{1}{4}$
   B. $\frac{1}{\sqrt{2}}$
   C. $\frac{1}{2}$
   D. $\frac{\sqrt{3}}{2}$
   E. $\frac{3}{4}$

9. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. By what factor does a filter reduce the electric field if it is oriented 30° to that field?[883]
   A. $\frac{1}{4}$
   B. $\frac{1}{\sqrt{2}}$
   C. $\frac{1}{2}$
   D. $\frac{\sqrt{3}}{2}$
   E. $\frac{3}{4}$

10. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. By what factor does a filter reduce the electric field if it is oriented 60° to that field?[884]
   A. $\frac{1}{4}$
   B. $\frac{1}{\sqrt{2}}$
   C. $\frac{1}{2}$
   D. $\frac{\sqrt{3}}{2}$
   E. $\frac{3}{4}$

11. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. A 12 mW laser strikes a polarizing filter oriented 30° to the incoming axis of polarization. How much power passes the filter?[885]
   A. 3mW
   B. 4mW
   C. 6mW
   D. 8mW
   E. 9mW

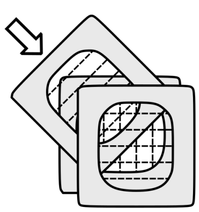
12. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. A 12 mW laser strikes a polarizing filter oriented 30° to the incoming axis of polarization. How much power is blocked by the filter?[886]
   A. 3mW

B. 4mW
C. 6mW
D. 8mW
E. 9mW

13. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. A 12 mW laser strikes a polarizing filter oriented 60° to the incoming axis of polarization. How much power is blocked by the filter?[887]
A. 3mW
B. 4mW
C. 6mW
D. 8mW
E. 9mW

14. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. A 12 mW laser strikes a polarizing filter oriented 60° to the incoming axis of polarization. How much power is passed by the filter?[888]
A. 3mW
B. 4mW
C. 6mW
D. 8mW
E. 9mW

15. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. A 12 mW laser strikes a polarizing filter oriented 45° to the incoming axis of polarization. How much power is passed by the filter?[889]
A. 3mW
B. 4mW
C. 6mW
D. 8mW
E. 9mW

16.  A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. Unpolarized light impinges on three linear filters, each oriented 45° to the previous, as shown. What fraction of the power incident on the first filter emerges from the last?[890]
A. 1/32
B. 1/16
C. 3/32
D. 1/8
E. 3/16

17. Hold a pendulum a moderate distance from equilibrium and release it by tossing it in a direction parallel to the displacement of the mass from equilibrium. The resulting polarization will be _____ (pick the best answer)[891]

A. linearly
B. circular
C. circular or linear
D. circular or elliptical
E. linear or elliptical

18. A linear polarizer selects a component of the electric field. Also, the energy density of light is proportional to the square of the electric field. Unpolarized light impinges on three linear filters. The second is oriented 30° from the first, and the third is rotated by an additional 60°, making it at right angles from the first filter. What fraction of the power incident on the first filter emerges from the last?[892]

A. 1/32
B. 1/16
C. 3/32
D. 1/8
E. 3/16

89 d_Bell.solitaire

1. Your solitaire deck uses ♡ ♠ ♣ and your answer cards are 4 and 5. You select 4♠, 4♣, and 5♡. If the questions were Q♠ and Q♣, you would___[893]

A. lose 3 points
B. lose 1 point
C. win 1 point
D. win 3 points
E. be disqualified for cheating

2. Your solitaire deck uses ♡ ♠ ♣ and your answer cards are 4 and 5. You select 4♠, 5♣, and 5♡. If the questions were Q♠ and Q♣, you would___[894]

A. lose 3 points
B. lose 1 point
C. win 1 point
D. win 3 points
E. be disqualified for cheating

3. You solitaire deck uses ♡ ♠ ♣ and your answer cards are 4 and 5. You select 4♠, 5♣, and 5♡. If the questions were Q♠ and Q♣. Which of the following wins?[895]

A. K♡ and K♠
B. K♠ and K♣
C. K♡ and K♣
D. two of these are true
E. none of these are true

4. You solitaire deck uses ♡ ♠ ♣ and your answer cards are 4 and 5. You select 4♠, 5♣, and 5♡. If the questions were Q♠ and Q♣. Which of the following loses?[896]

A. K♡ and K♠

B. K♠ and K♣

C. K♡ and K♣

D. two of these are true

E. none of these are true

5. If you play the solitaire game 6 times, you will on average win ____ times.[897]

A. 4

B. 2

C. 3

D. 6

E. 5

6. If you play the solitaire game 3 times, you will on average lose ____ times.[898]

A. 1

B. 2

C. 3

D. 4

E. 5

7. If you play the solitaire game 6 times, you will on average lose ____ times.[899]

A. 4

B. 2

C. 3

D. 6

E. 5

8. If you play the solitaire game 3 times, you will on average win ____ times.[900]

A. 1

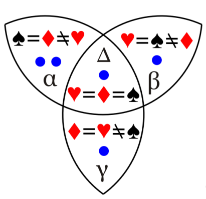
B. 2

C. 3

D. 4

E. 5

90 d_Bell.Venn

1. 

Calculate the measured probability: P(♠,♢) = ? Assume the dots represent five observations.[901]

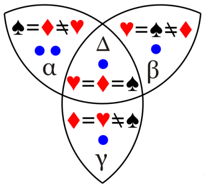
A. 2/4=1/2

B. 2/5

C. 3/5

D. 3/4

E. 5/6

2. 

Calculate the measured probability: P(♠,♡) = ? Assume the dots represent five observations.[902]

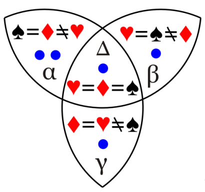
A. 2/4=1/2

B. 2/5

C. 3/5

D. 3/4

E. 5/6

3. 

Calculate the probability P(♠,♢)+P(♠,♡)+P(♡,♢) = ? Assume the dots represent five observations.[903]

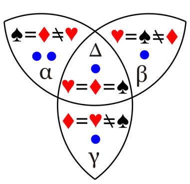
A. 4/5

B. 5/6

C. 5/4

D. 6/5

E. 7/5

4. 

Calculate the quantum correlation: C(♠,♢) = ? Assume the dots represent five observations.[904]

A. −2/5

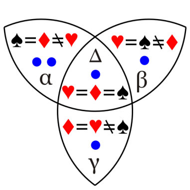
B. −1/5

C. 0

D. +1/5

E. +2/5

F. +1

5. 

Calculate the measured quantum correlation: C(♠,♡) = ? Assume the dots represent five observations.[905]

A. −2/5

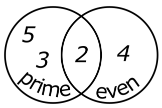
B. −1/5

C. 0

D. +1/5

E. +2/5

F. +1

6. 

If a number is randomly selected from the set 2,3,4,5, what is P(even), or the probability that the number is even?[906]

A. 0

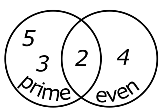
B. 1/4

C. 1/2

D. 3/4

E. 1

F. 5/4

7. 

If a number is randomly selected from the set 2,3,4,5, what is P(prime), or the probability that the number is prime?[907]

A. 0

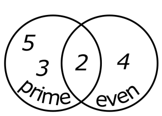
B. 1/4

C. 1/2

D. 3/4

E. 1

F. 5/4

8. 

If a number is randomly selected from the set 2,3,4,5, what is P(prime)+P(even), or the sum of the probability that it is even, plus the probability that it is prime?[908]

A. 0

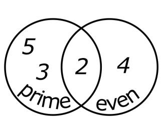
B. 1/4

C. 1/2

D. 3/4

E. 1

F. 5/4

9. 

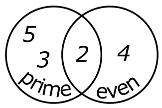
If a number is randomly selected from the set 2,3,4,5, what is the probability that it is both even and prime?[909]

A. 0

B. 1/4

C. 1/2

D. 3/4
E. 1
F. 5/4

10. 

If a number is randomly selected from the set 2,3,4,5, what is the probability that it is either even or prime?[910]

A. 0
B. 1/4
C. 1/2
D. 3/4
E. 1
F. 5/4

91 d_cp2.10

1. A given battery has a 12 V emf and an internal resistance of 0.1 Ω . If it is connected to a 0.5 Ω resistor what is the power dissipated by that load?[911]

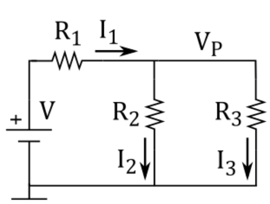
A. 1.503E+02 W
B. 1.653E+02 W
C. 1.818E+02 W
D. 2.000E+02 W
E. 2.200E+02 W

2. A battery with a terminal voltage of 9 V is connected to a circuit consisting of 4 20 Ω resistors and one 10 Ω resistor. What is the voltage drop across the 10 Ω resistor?[912]

A. 7.513E-01 V
B. 8.264E-01 V
C. 9.091E-01 V
D. 1.000E+00 V
E. 1.100E+00 V

3. Three resistors, $R_1 = 1\,\Omega$, and $R_2 = R_2 = 2\,\Omega$, are connected in parallel to a 3 V voltage source. Calculate the power dissipated by the smaller resistor (R_1.) [913]

A. 6.762E+00 W
B. 7.438E+00 W
C. 8.182E+00 W
D. 9.000E+00 W
E. 9.900E+00 W

4. 

In the circuit shown V=12 V, R_1=1 Ω , R_2=6 Ω , and R_3=13 Ω . What is the power dissipated by R_2?[914]

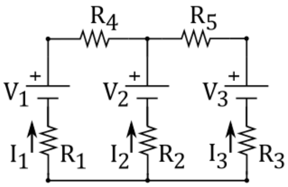
A. 1.552E+01 W

B. 1.707E+01 W

C. 1.878E+01 W

D. 2.066E+01 W

E. 2.272E+01 W

5. 

The resistances in the figure shown are R_1= 2 Ω , R_2= 1 Ω , and R_2= 3 Ω . V_1 and V_3 are text 0.5 V and 2.3 V, respectively. But V_2 is opposite to that shown in the figure, or, equivalently, V_2=−0.6 V. What is the absolute value of the current through R_1?[915]

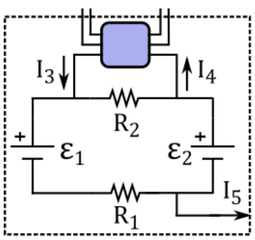
A. 1.653E-01 A

B. 1.818E-01 A

C. 2.000E-01 A

D. 2.200E-01 A

E. 2.420E-01 A

6. 

Two sources of emf ε_1=22.5 V, and ε_2=10 V are oriented as shown in the circuit. The resistances are R_1=2 kΩ and R_2=1 kΩ . Three other currents enter and exit or exit from portions of the circuit that lie outside the dotted rectangle and are not shown. I_3=5.0 mA and I_4=1.25 mA enter and leave near R_2, while the current I_5 exits near R_1.What is the magnitude (absolute value) of I_5?[916]

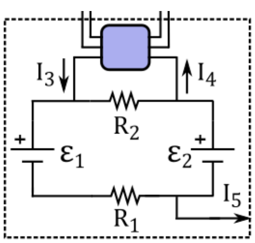
A. 3.099E+00 mA

B. 3.409E+00 mA

C. 3.750E+00 mA

D. 4.125E+00 mA

E. 4.538E+00 mA

7. 

Two sources of emf ε_1=22.5 V, and ε_2=10 V are oriented as shown in the circuit. The resistances are R_1=2 kΩ and R_2=1 kΩ . Three other currents enter and exit or exit from portions of the circuit that lie outside the dotted rectangle and are not shown. I_3=5.0 mA and I_4=1.25 mA enter and leave near R_2, while the current I_5 exits near R_1.What is the magnitude (absolute value) of voltage drop across R_1?[917]

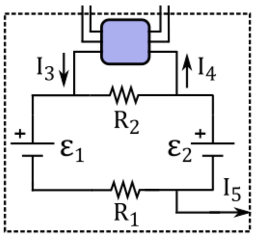
A. 5.000E+00 V

B. 5.500E+00 V

C. 6.050E+00 V

D. 6.655E+00 V

E. 7.321E+00 V

8. 

Two sources of emf ε_1=22.5 V, and ε_2=10 V are oriented as shown in the circuit. The resistances are R_1=2 kΩ and R_2=1 kΩ . Three other currents enter and exit or exit from portions of the circuit that lie outside the dotted rectangle and are not shown. I_3=5.0 mA and I_4=1.25 mA enter and leave near R_2, while the current I_5 exits near R_1.What is the magnitude (absolute value) of voltage drop across R_2?[918]

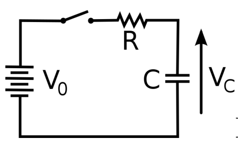
A. 6.198E+00 V

B. 6.818E+00 V

C. 7.500E+00 V

D. 8.250E+00 V

E. 9.075E+00 V

9. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 100 V. If the combined external and internal resistance is 101 Ω and the capacitance is 50 mF, how long will it take for the capacitor's voltage to reach 80 V?[919]

A. 8.128E+00 s

B. 8.940E+00 s

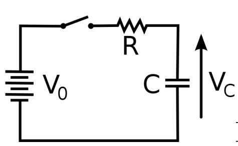
C. 9.834E+00 s

D. 1.082E+01 s

E. 1.190E+01 s

91.1 Renditions

d_cp2.10 Q1

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 379 V. If the combined external and internal resistance is 158 Ω and the capacitance is 95 mF, how long will it take for the capacitor's voltage to reach 234.0 V?

A. 1.084E+01 s

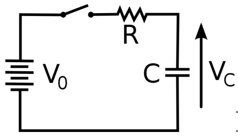
B. 1.192E+01 s

C. 1.311E+01 s

D. 1.442E+01 s

E. 1.586E+01 s

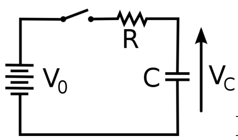
d_cp2.10 Q2

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 319 V. If the combined external and internal resistance is 231 Ω and the capacitance is 64 mF, how long will it take for the capacitor's voltage to reach 175.0 V?

   A. 9.718E+00 s
   B. 1.069E+01 s
   C. 1.176E+01 s
   D. 1.293E+01 s
   E. 1.423E+01 s

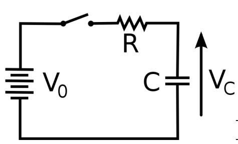
d_cp2.10 Q3

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 558 V. If the combined external and internal resistance is 198 Ω and the capacitance is 80 mF, how long will it take for the capacitor's voltage to reach 345.0 V?

   A. 1.146E+01 s
   B. 1.261E+01 s
   C. 1.387E+01 s
   D. 1.525E+01 s
   E. 1.678E+01 s

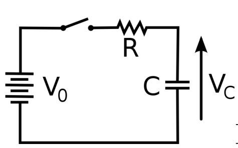
d_cp2.10 Q4

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 213 V. If the combined external and internal resistance is 118 Ω and the capacitance is 61 mF, how long will it take for the capacitor's voltage to reach 142.0 V?

   A. 5.401E+00 s
   B. 5.941E+00 s
   C. 6.535E+00 s
   D. 7.189E+00 s
   E. 7.908E+00 s

d_cp2.10 Q5

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 543 V. If the combined external and internal resistance is 201 Ω and the capacitance is 82 mF, how long will it take for the capacitor's voltage to reach 281.0 V?

A. 9.024E+00 s

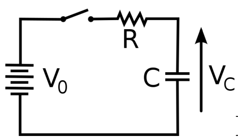
B. 9.927E+00 s

C. 1.092E+01 s

D. 1.201E+01 s

E. 1.321E+01 s

d_cp2.10 Q6



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 554 V. If the combined external and internal resistance is 228 Ω and the capacitance is 93 mF, how long will it take for the capacitor's voltage to reach 450.0 V?

A. 3.224E+01 s

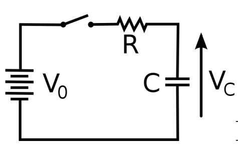
B. 3.547E+01 s

C. 3.902E+01 s

D. 4.292E+01 s

E. 4.721E+01 s

d_cp2.10 Q7



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 569 V. If the combined external and internal resistance is 137 Ω and the capacitance is 76 mF, how long will it take for the capacitor's voltage to reach 419.0 V?

A. 1.043E+01 s

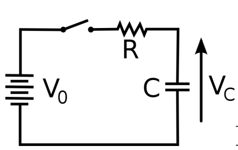
B. 1.147E+01 s

C. 1.262E+01 s

D. 1.388E+01 s

E. 1.527E+01 s

d_cp2.10 Q8



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 505 V. If the combined external and internal resistance is 189 Ω and the capacitance is 74 mF, how long will it take for the capacitor's voltage to reach 374.0 V?

A. 1.560E+01 s

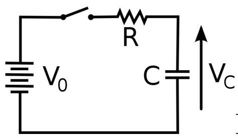
B. 1.716E+01 s

C. 1.887E+01 s

D. 2.076E+01 s

E. 2.284E+01 s

d_cp2.10 Q9

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 130 V. If the combined external and internal resistance is 109 Ω and the capacitance is 59 mF, how long will it take for the capacitor's voltage to reach 69.9 V?

A. 3.728E+00 s

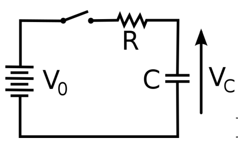
B. 4.101E+00 s

C. 4.511E+00 s

D. 4.962E+00 s

E. 5.458E+00 s

d_cp2.10 Q10

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 190 V. If the combined external and internal resistance is 255 Ω and the capacitance is 54 mF, how long will it take for the capacitor's voltage to reach 101.0 V?

A. 1.044E+01 s

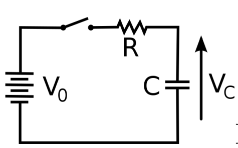
B. 1.149E+01 s

C. 1.264E+01 s

D. 1.390E+01 s

E. 1.529E+01 s

d_cp2.10 Q11

1. 

In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 466 V. If the combined external and internal resistance is 123 Ω and the capacitance is 76 mF, how long will it take for the capacitor's voltage to reach 331.0 V?

A. 9.571E+00 s

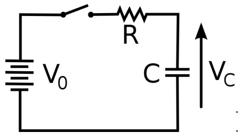
B. 1.053E+01 s

C. 1.158E+01 s

D. 1.274E+01 s

E. 1.401E+01 s

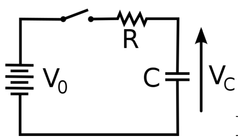
d_cp2.10 Q12

1. 

In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 598 V. If the combined external and internal resistance is 170 Ω and the capacitance is 73 mF, how long will it take for the capacitor's voltage to reach 436.0 V?

   A. 1.218E+01 s
   B. 1.339E+01 s
   C. 1.473E+01 s
   D. 1.621E+01 s
   E. 1.783E+01 s

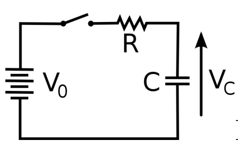
d_cp2.10 Q13

1. 

In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 301 V. If the combined external and internal resistance is 245 Ω and the capacitance is 63 mF, how long will it take for the capacitor's voltage to reach 192.0 V?

   A. 1.296E+01 s
   B. 1.425E+01 s
   C. 1.568E+01 s
   D. 1.725E+01 s
   E. 1.897E+01 s

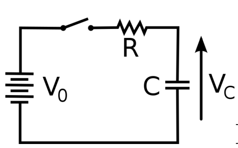
d_cp2.10 Q14

1. 

In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 327 V. If the combined external and internal resistance is 204 Ω and the capacitance is 68 mF, how long will it take for the capacitor's voltage to reach 218.0 V?

   A. 1.385E+01 s
   B. 1.524E+01 s
   C. 1.676E+01 s
   D. 1.844E+01 s
   E. 2.028E+01 s

d_cp2.10 Q15

1. 

In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 129 V. If the combined external and internal resistance is 169 Ω and the capacitance is 76 mF, how long will it take for the capacitor's voltage to reach 109.0 V?

A. 2.177E+01 s

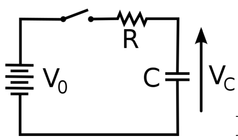
B. 2.394E+01 s

C. 2.634E+01 s

D. 2.897E+01 s

E. 3.187E+01 s

d_cp2.10 Q16



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 467 V. If the combined external and internal resistance is 172 Ω and the capacitance is 74 mF, how long will it take for the capacitor's voltage to reach 258.0 V?

A. 7.688E+00 s

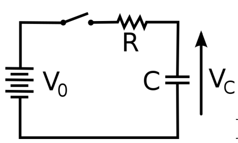
B. 8.457E+00 s

C. 9.303E+00 s

D. 1.023E+01 s

E. 1.126E+01 s

d_cp2.10 Q17



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 433 V. If the combined external and internal resistance is 275 Ω and the capacitance is 61 mF, how long will it take for the capacitor's voltage to reach 223.0 V?

A. 1.104E+01 s

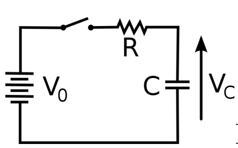
B. 1.214E+01 s

C. 1.335E+01 s

D. 1.469E+01 s

E. 1.616E+01 s

d_cp2.10 Q18



1. In the circuit shown the voltage across the capaciator is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 351 V. If the combined external and internal resistance is 148 Ω and the capacitance is 60 mF, how long will it take for the capacitor's voltage to reach 227.0 V?

A. 9.240E+00 s

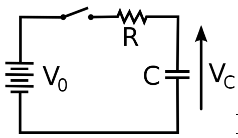
B. 1.016E+01 s

C. 1.118E+01 s

D. 1.230E+01 s

E. 1.353E+01 s

d_cp2.10 Q19



1. In the circuit shown the voltage across the capacitor is zero at time t=0 when a switch is closed putting the capacitor into contact with a power supply of 439 V. If the combined external and internal resistance is 221 Ω and the capacitance is 54 mF, how long will it take for the capacitor's voltage to reach 350.0 V?

    A. 1.905E+01 s

    B. 2.095E+01 s

    C. 2.304E+01 s

    D. 2.535E+01 s

    E. 2.788E+01 s

92 d_cp2.11

1. An alpha-particle (q=3.2x10^{-19}C) moves through a uniform magnetic field that is parallel to the positive z-axis with magnitude 1.5 T. What is the x-component of the force on the alpha-particle if it is moving with a velocity
$(2.2\,\mathbf{i} + 3.3\,\mathbf{j}\ + 1.1\,\mathbf{k})\,\text{x}\,10^4$ m/s?[920]

    A. 1.440E-14 N

    B. 1.584E-14 N

    C. 1.742E-14 N

    D. 1.917E-14 N

    E. 2.108E-14 N

2. A charged particle in a magnetic field of 1.000E-04 T is moving perpendicular to the magnetic field with a speed of 5.000E+05 m/s. What is the period of orbit if orbital radius is 0.5 m?[921]

    A. 4.721E-06 s

    B. 5.193E-06 s

    C. 5.712E-06 s

    D. 6.283E-06 s

    E. 6.912E-06 s

3. An alpha-particle (m=6.64x10^{-27}kg, q=3.2x10^{-19}C) briefly enters a uniform magnetic field of magnitude 0.05 T . It emerges after being deflected by 45° from its original direction. How much time did it spend in that magnetic field?[922]

    A. 3.259E-07 s

    B. 3.585E-07 s

    C. 3.944E-07 s

    D. 4.338E-07 s

E. 4.772E-07 s

4. A 50 cm-long horizontal wire is maintained in static equilibrium by a horizontally directed magnetic field that is perpendicular to the wire (and to Earth's gravity). The mass of the wire is 10 g, and the magnitude of the magnetic field is 0.5 T. What current is required to maintain this balance?[923]

   A. 3.920E-01 A
   B. 4.312E-01 A
   C. 4.743E-01 A
   D. 5.218E-01 A
   E. 5.739E-01 A

5. A long rigid wire carries a 5 A current. What is the magnetic force per unit length on the wire if a 0.3 T magnetic field is directed 60° away from the wire?[924]

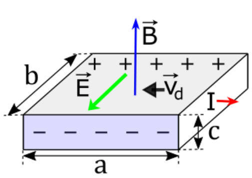
   A. 1.074E+00 N/m
   B. 1.181E+00 N/m
   C. 1.299E+00 N/m
   D. 1.429E+00 N/m
   E. 1.572E+00 N/m

6. A circular current loop of radius 2 cm carries a current of 2 mA. What is the magnitude of the torque if the dipole is oriented at 30° to a uniform magnetic fied of 0.5 T? [925]

   A. 4.292E-07 N m
   B. 4.721E-07 N m
   C. 5.193E-07 N m
   D. 5.712E-07 N m
   E. 6.283E-07 N m

7. An electron beam (m=9.1 x 10^{-31}kg, q=1.6 x 10^{-19}C) enters a crossed-field velocity selector with magnetic and electric fields of 2 mT and 6.000E+03 N/C, respectively. What must the velocity of the electron beam be to transverse the crossed fields undeflected ?[926]

   A. 2.254E+06 m/s
   B. 2.479E+06 m/s
   C. 2.727E+06 m/s
   D. 3.000E+06 m/s
   E. 3.300E+06 m/s

8. 

The silver ribbon shown are a=3.5 cm, b=2 cm, and c= 0.2 cm. The current carries a current of 100 A and it lies in a uniform magnetic field of 1.5 T. Using the density of 5.900E+28 electrons per cubic meter for silver, find the Hall potential between the edges of the ribbon.[927]

   A. 5.419E-06 V
   B. 5.961E-06 V
   C. 6.557E-06 V
   D. 7.213E-06 V

E. 7.934E-06 V

9. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.5 m and a magneticfield of 1.8 T. What is their maximum kinetic energy?[928]

   A. 3.904E+01 MeV

   B. 4.294E+01 MeV

   C. 4.723E+01 MeV

   D. 5.196E+01 MeV

   E. 5.715E+01 MeV

92.1 Renditions

d_cp2.11 Q1

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.398 m and a magneticfield of 0.855 T. What is their maximum kinetic energy?

   A. 5.581E+00 MeV

   B. 6.139E+00 MeV

   C. 6.753E+00 MeV

   D. 7.428E+00 MeV

   E. 8.171E+00 MeV

d_cp2.11 Q2

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.378 m and a magneticfield of 0.835 T. What is their maximum kinetic energy?

   A. 4.365E+00 MeV

   B. 4.801E+00 MeV

   C. 5.281E+00 MeV

   D. 5.809E+00 MeV

   E. 6.390E+00 MeV

d_cp2.11 Q3

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.388 m and a magneticfield of 1.19 T. What is their maximum kinetic energy?

   A. 8.491E+00 MeV

   B. 9.340E+00 MeV

   C. 1.027E+01 MeV

   D. 1.130E+01 MeV

   E. 1.243E+01 MeV

d_cp2.11 Q4

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.355 m and a magneticfield of 1.28 T. What is their maximum kinetic energy?

   A. 7.476E+00 MeV
   B. 8.224E+00 MeV
   C. 9.046E+00 MeV
   D. 9.951E+00 MeV
   E. 1.095E+01 MeV

d_cp2.11 Q5

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.145 m and a magneticfield of 1.03 T. What is their maximum kinetic energy?

   A. 7.342E-01 MeV
   B. 8.076E-01 MeV
   C. 8.884E-01 MeV
   D. 9.772E-01 MeV
   E. 1.075E+00 MeV

d_cp2.11 Q6

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.419 m and a magneticfield of 1.45 T. What is their maximum kinetic energy?

   A. 1.336E+01 MeV
   B. 1.470E+01 MeV
   C. 1.617E+01 MeV
   D. 1.779E+01 MeV
   E. 1.957E+01 MeV

d_cp2.11 Q7

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.118 m and a magneticfield of 1.48 T. What is their maximum kinetic energy?

   A. 1.004E+00 MeV
   B. 1.104E+00 MeV
   C. 1.215E+00 MeV
   D. 1.336E+00 MeV
   E. 1.470E+00 MeV

d_cp2.11 Q8

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.295 m and a magneticfield of 1.44 T. What is their maximum kinetic energy?

   A. 6.534E+00 MeV
   B. 7.187E+00 MeV
   C. 7.906E+00 MeV
   D. 8.697E+00 MeV
   E. 9.566E+00 MeV

d_cp2.11 Q9

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.44 m and a magneticfield of 1.31 T. What is their maximum kinetic energy?
   - A. 1.323E+01 MeV
   - B. 1.456E+01 MeV
   - **C. 1.601E+01 MeV**
   - D. 1.761E+01 MeV
   - E. 1.937E+01 MeV

d_cp2.11 Q10

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.436 m and a magneticfield of 0.881 T. What is their maximum kinetic energy?
   - A. 5.342E+00 MeV
   - B. 5.877E+00 MeV
   - C. 6.464E+00 MeV
   - **D. 7.111E+00 MeV**
   - E. 7.822E+00 MeV

d_cp2.11 Q11

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.448 m and a magneticfield of 0.812 T. What is their maximum kinetic energy?
   - A. 5.798E+00 MeV
   - **B. 6.377E+00 MeV**
   - C. 7.015E+00 MeV
   - D. 7.717E+00 MeV
   - E. 8.488E+00 MeV

d_cp2.11 Q12

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.409 m and a magneticfield of 1.27 T. What is their maximum kinetic energy?
   - A. 8.881E+00 MeV
   - B. 9.769E+00 MeV
   - C. 1.075E+01 MeV
   - D. 1.182E+01 MeV
   - **E. 1.300E+01 MeV**

d_cp2.11 Q13

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.125 m and a magneticfield of 0.932 T. What is their maximum kinetic energy?
   - A. 4.914E-01 MeV
   - B. 5.406E-01 MeV
   - C. 5.946E-01 MeV
   - **D. 6.541E-01 MeV**
   - E. 7.195E-01 MeV

d_cp2.11 Q14

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.232 m and a magneticfield of 1.1 T. What is their maximum kinetic energy?
   - A. 2.853E+00 MeV
   - **B. 3.139E+00 MeV**
   - C. 3.453E+00 MeV
   - D. 3.798E+00 MeV
   - E. 4.178E+00 MeV

d_cp2.11 Q15

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.449 m and a magneticfield of 0.81 T. What is their maximum kinetic energy?
   - A. 5.795E+00 MeV
   - **B. 6.374E+00 MeV**
   - C. 7.012E+00 MeV
   - D. 7.713E+00 MeV
   - E. 8.484E+00 MeV

d_cp2.11 Q16

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.157 m and a magneticfield of 0.512 T. What is their maximum kinetic energy?
   - A. 2.574E-01 MeV
   - B. 2.831E-01 MeV
   - **C. 3.114E-01 MeV**
   - D. 3.425E-01 MeV
   - E. 3.768E-01 MeV

d_cp2.11 Q17

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.157 m and a magneticfield of 1.03 T. What is their maximum kinetic energy?
   - A. 8.608E-01 MeV
   - B. 9.468E-01 MeV
   - C. 1.042E+00 MeV
   - D. 1.146E+00 MeV
   - **E. 1.260E+00 MeV**

d_cp2.11 Q18

1. A cyclotron used to accelerate alpha particlesm=6.64 x 10^{-27}kg, q=3.2 x 10^{-19}C) has a radius of 0.376 m and a magneticfield of 0.786 T. What is their maximum kinetic energy?
   - A. 2.875E+00 MeV
   - B. 3.162E+00 MeV
   - C. 3.479E+00 MeV
   - D. 3.827E+00 MeV
   - **E. 4.209E+00 MeV**

d_cp2.11 Q19

1. A cyclotron used to accelerate alpha particlesm=6.64×10^{-27}kg, q=3.2×10^{-19}C) has a radius of 0.413 m and a magneticfield of 0.988 T. What is their maximum kinetic energy?

   A. 6.029E+00 MeV

   B. 6.631E+00 MeV

   C. 7.295E+00 MeV

   D. 8.024E+00 MeV

   E. 8.827E+00 MeV

93 d_cp2.12

1. A wire carries a current of 200 A in a circular arc with radius 2 cm swept through 40 degrees. Assuming that the rest of the current is 100% shielded by mu-metal, what is the magnetic field at the center of the arc?[929]

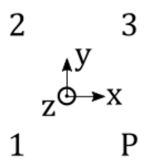
   A. 2.083E+00 Tesla

   B. 2.292E+00 Tesla

   C. 2.521E+00 Tesla

   D. 2.773E+00 Tesla

   E. 3.050E+00 Tesla



2. Three wires sit at the corners of a square of length 1 cm. The currents all are in the positive-z direction (i.e. all come out of the paper in the figure shown.) The currents (I_1, I_2, I_2) are (1.9 A, 2.0 A, 2.1 A), respectively. What is the x-component of the magnetic field at point P?[930]

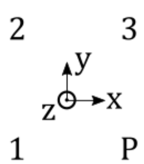
   A. B_x= 5.124E-05 T

   B. B_x= 5.636E-05 T

   C. B_x= 6.200E-05 T

   D. B_x= 6.820E-05 T

   E. B_x= 7.502E-05 T



3. Three wires sit at the corners of a square of length 1 cm. The currents all are in the positive-z direction (i.e. all come out of the paper in the figure shown.) The currents (I_1, I_2, I_2) are (1.9 A, 2.0 A, 2.1 A), respectively. What is the y-component of the magnetic field at point P?[931]

   A. B_y= 5.273E-05 T

   B. B_y= 5.800E-05 T

   C. B_y= 6.380E-05 T

   D. B_y= 7.018E-05 T

   E. B_y= 7.720E-05 T

4. Two parallel wires each carry a 5.0 mA current and are oriented in the z direction. The first wire is located in the x-y plane at (3.0 cm, 0.9 cm), while the other is located at (0.000E+00 cm, 4.0 cm). What is the force per unit length between the wires?[932]

   A. 7.916E-11 N/m
   B. 8.708E-11 N/m
   C. 9.579E-11 N/m
   D. 1.054E-10 N/m
   E. 1.159E-10 N/m

5. Two loops of wire carry the same current of 10 kA, and flow in the same direction. They share a common axis and orientation. One loop has a radius of 0.5 m while the other has a radius of 1.0 m. What is the magnitude of the magnetic field at a point on the axis of both loops, situated between the loops at a distance 0.25 m from the first (smaller) loopif the disance between the loops is 1.0 m?[933]

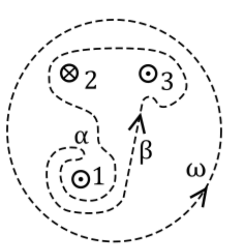
   A. 1.110E-02 T
   B. 1.221E-02 T
   C. 1.343E-02 T
   D. 1.477E-02 T
   E. 1.625E-02 T

6. Under most conditions the current is distributed uniformly over the cross section of the wire. What is the magnetic field 0.8 mm from the center of a wire of radius 2 mm if the current is 1A?[934]

   A. 2.732E-05 T
   B. 3.005E-05 T
   C. 3.306E-05 T
   D. 3.636E-05 T
   E. 4.000E-05 T

7. The Z-pinch is an (often unstable) cylindrical plasma in which a aximuthal magnetic field is produced by a current in the z direction. A simple model for the magnetic field, valid for $r < a$ is, $B_\theta(r) = \left(\frac{2r}{a} - \frac{r^2}{a^2}\right) B_{max}$, where B_{max} is the maximum magnetic field (at $r = a$). If $a = 0.5$ m and $B_{max} = 0.3$ T, then how much current (in the z-direction) flows through a circle of radius $r = 0.25$ m that is centered on the axis with its plane perpendicular to the axis?[935]

   A. 2.812E+05 A
   B. 3.094E+05 A
   C. 3.403E+05 A
   D. 3.743E+05 A
   E. 4.118E+05 A

8. 

The numbers (1,2,3) in the figure shown represent three currents flowing in or out of the page: I_1 and I_3 flow out of the page, and I_2 flows into the page, as shown. Two closed paths are shown, labeled β and ω. If I_1=2.5 kA, I_2=0.75 kA, and I_3=1.5 kA, take the β path and evalulate the line integral, $\oint \vec{B} \cdot d\vec{\ell}$:[936]

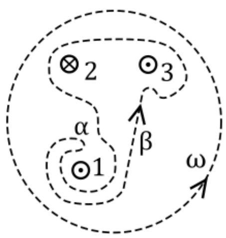
A. 6.437E-04 T-m

B. 7.081E-04 T-m

C. 7.789E-04 T-m

D. 8.568E-04 T-m

E. 9.425E-04 T-m

9. 

The numbers (1,2,3) in the figure shown represent three currents flowing in or out of the page: I_1 and I_3 flow out of the page, and I_2 flows into the page, as shown. Two closed paths are shown, labeled β and ω. If I_1=2.5 kA, I_2=0.75 kA, and I_3=1.5 kA, take the ω path and evalulate the line integral, $\oint \vec{B} \cdot d\vec{\ell}$:[937]

A. 3.713E-03 T-m

B. 4.084E-03 T-m

C. 4.492E-03 T-m

D. 4.942E-03 T-m

E. 5.436E-03 T-m

10. A solenoid has 3.000E+04 turns wound around a cylinder of diameter 1.2 cm and length 14 m. The current through the coils is 0.41 A. Define the origin to be the center of the solenoid and neglect end effects as you calculate the line integral $\int \vec{B} \cdot \vec{\ell}$ alongthe axis from z=-2 cm to z=+8 cm [938]

A. 7.541E-05 T-m

B. 8.295E-05 T-m

C. 9.124E-05 T-m

D. 1.004E-04 T-m

E. 1.104E-04 T-m

11. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 20 turns per centimeter and the current applied to the solenoid is 200 mA, the net magnetic field is measured to be 1.4 T. What is the magnetic susceptibility for this case?[939]

A. χ (chi) = 2.301E+03

B. χ (chi) = 2.531E+03

C. χ (chi) = 2.784E+03

D. χ (chi) = 3.063E+03

E. χ (chi) = 3.369E+03

93.1 Renditions

d_cp2.12 Q1

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 20 turns per centimeter and the current applied to the solenoid is 598 mA, the net magnetic field is measured to be 1.38 T. What is the magnetic susceptibility for this case?

A. χ (chi) = 8.338E+02

B. χ (chi) = 9.172E+02

C. χ (chi) $= 1.009E+03$
D. χ (chi) $= 1.110E+03$
E. χ (chi) $= 1.221E+03$

d_cp2.12 Q2

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 20 turns per centimeter and the current applied to the solenoid is 344 mA, the net magnetic field is measured to be 1.24 T. What is the magnetic susceptibility for this case?
   A. χ (chi) $= 1.185E+03$
   B. χ (chi) $= 1.303E+03$
   C. χ (chi) $= 1.433E+03$
   D. χ (chi) $= 1.577E+03$
   E. χ (chi) $= 1.734E+03$

d_cp2.12 Q3

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 18 turns per centimeter and the current applied to the solenoid is 582 mA, the net magnetic field is measured to be 1.15 T. What is the magnetic susceptibility for this case?
   A. χ (chi) $= 7.211E+02$
   B. χ (chi) $= 7.932E+02$
   C. χ (chi) $= 8.726E+02$
   D. χ (chi) $= 9.598E+02$
   E. χ (chi) $= 1.056E+03$

d_cp2.12 Q4

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 22 turns per centimeter and the current applied to the solenoid is 568 mA, the net magnetic field is measured to be 1.29 T. What is the magnetic susceptibility for this case?
   A. χ (chi) $= 8.205E+02$
   B. χ (chi) $= 9.026E+02$
   C. χ (chi) $= 9.928E+02$
   D. χ (chi) $= 1.092E+03$
   E. χ (chi) $= 1.201E+03$

d_cp2.12 Q5

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 20 turns per centimeter and the current applied to the solenoid is 525 mA, the net magnetic field is measured to be 1.45 T. What is the magnetic susceptibility for this case?
   A. χ (chi) $= 8.249E+02$
   B. χ (chi) $= 9.074E+02$
   C. χ (chi) $= 9.981E+02$
   D. χ (chi) $= 1.098E+03$
   E. χ (chi) $= 1.208E+03$

d_cp2.12 Q6

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 22 turns per centimeter and the current applied to the solenoid is 265 mA, the net magnetic field is measured to be 1.11 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 1.376E+03

   B. χ (chi) = 1.514E+03

   C. χ (chi) = 1.666E+03

   D. χ (chi) = 1.832E+03

   E. χ (chi) = 2.015E+03

d_cp2.12 Q7

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 27 turns per centimeter and the current applied to the solenoid is 344 mA, the net magnetic field is measured to be 1.12 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 7.922E+02

   B. χ (chi) = 8.714E+02

   C. χ (chi) = 9.586E+02

   D. χ (chi) = 1.054E+03

   E. χ (chi) = 1.160E+03

d_cp2.12 Q8

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 19 turns per centimeter and the current applied to the solenoid is 421 mA, the net magnetic field is measured to be 1.31 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 1.302E+03

   B. χ (chi) = 1.432E+03

   C. χ (chi) = 1.576E+03

   D. χ (chi) = 1.733E+03

   E. χ (chi) = 1.907E+03

d_cp2.12 Q9

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 24 turns per centimeter and the current applied to the solenoid is 595 mA, the net magnetic field is measured to be 1.46 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 6.716E+02

   B. χ (chi) = 7.387E+02

   C. χ (chi) = 8.126E+02

   D. χ (chi) = 8.939E+02

   E. χ (chi) = 9.833E+02

d_cp2.12 Q10

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 23 turns per centimeter and the current applied to the solenoid is 534 mA, the net magnetic field is measured to be 1.48 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 7.917E+02

   B. χ (chi) = 8.708E+02

   C. χ (chi) = 9.579E+02

   D. χ (chi) = 1.054E+03

   E. χ (chi) = 1.159E+03

d_cp2.12 Q11

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 24 turns per centimeter and the current applied to the solenoid is 242 mA, the net magnetic field is measured to be 1.38 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 1.718E+03

   B. χ (chi) = 1.890E+03

   C. χ (chi) = 2.079E+03

   D. χ (chi) = 2.287E+03

   E. χ (chi) = 2.515E+03

d_cp2.12 Q12

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 17 turns per centimeter and the current applied to the solenoid is 455 mA, the net magnetic field is measured to be 1.14 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 8.804E+02

   B. χ (chi) = 9.685E+02

   C. χ (chi) = 1.065E+03

   D. χ (chi) = 1.172E+03

   E. χ (chi) = 1.289E+03

d_cp2.12 Q13

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 16 turns per centimeter and the current applied to the solenoid is 536 mA, the net magnetic field is measured to be 1.47 T. What is the magnetic susceptibility for this case?

   A. χ (chi) = 9.310E+02

   B. χ (chi) = 1.024E+03

   C. χ (chi) = 1.126E+03

   D. χ (chi) = 1.239E+03

   E. χ (chi) = 1.363E+03

d_cp2.12 Q14

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 17 turns per centimeter and the current applied to the solenoid is 331 mA, the net magnetic field is measured to be 1.24 T. What is the magnetic susceptibility for this case?
   - A. χ (chi) = 1.593E+03
   - **B. χ (chi) = 1.753E+03**
   - C. χ (chi) = 1.928E+03
   - D. χ (chi) = 2.121E+03
   - E. χ (chi) = 2.333E+03

d_cp2.12 Q15

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 27 turns per centimeter and the current applied to the solenoid is 280 mA, the net magnetic field is measured to be 1.13 T. What is the magnetic susceptibility for this case?
   - **A. χ (chi) = 1.188E+03**
   - B. χ (chi) = 1.307E+03
   - C. χ (chi) = 1.438E+03
   - D. χ (chi) = 1.582E+03
   - E. χ (chi) = 1.740E+03

d_cp2.12 Q16

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 27 turns per centimeter and the current applied to the solenoid is 525 mA, the net magnetic field is measured to be 1.44 T. What is the magnetic susceptibility for this case?
   - A. χ (chi) = 5.515E+02
   - B. χ (chi) = 6.066E+02
   - C. χ (chi) = 6.673E+02
   - D. χ (chi) = 7.340E+02
   - **E. χ (chi) = 8.074E+02**

d_cp2.12 Q17

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 16 turns per centimeter and the current applied to the solenoid is 424 mA, the net magnetic field is measured to be 1.24 T. What is the magnetic susceptibility for this case?
   - A. χ (chi) = 1.092E+03
   - B. χ (chi) = 1.201E+03
   - C. χ (chi) = 1.321E+03
   - **D. χ (chi) = 1.454E+03**
   - E. χ (chi) = 1.599E+03

d_cp2.12 Q18

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 26 turns per centimeter and the current applied to the solenoid is 533 mA, the net magnetic field is measured to be 1.31 T. What is the magnetic susceptibility for this case?
   A. χ (chi) = 7.512E+02
   B. χ (chi) = 8.264E+02
   C. χ (chi) = 9.090E+02
   D. χ (chi) = 9.999E+02
   E. χ (chi) = 1.100E+03

d_cp2.12 Q19

1. A long coil is tightly wound around a (hypothetical) ferromagnetic cylinder. If n= 26 turns per centimeter and the current applied to the solenoid is 359 mA, the net magnetic field is measured to be 1.32 T. What is the magnetic susceptibility for this case?
   A. χ (chi) = 1.124E+03
   B. χ (chi) = 1.237E+03
   C. χ (chi) = 1.360E+03
   D. χ (chi) = 1.497E+03
   E. χ (chi) = 1.646E+03

94 d_cp2.13

1. A square coil has sides that are L= 0.25 m long and is tightly wound with N=200 turns of wire. The resistance of the coil is R=5 Ω . The coil is placed in a spacially uniform magnetic field that is directed perpendicular to the face of the coil and whose magnitude is increasing at a rate dB/dt=0.04 T/s. If R represents the only impedance of the coil, what is the magnitude of the current circulting through it? [940]
   A. 1.000E-01 A
   B. 1.100E-01 A
   C. 1.210E-01 A
   D. 1.331E-01 A
   E. 1.464E-01 A

2. A time dependent magnetic field is directed perpendicular to the plane of a circular coil with a radius of 0.5 m. The magnetic field is spatially uniform but decays in time according to $(1.5)e^{-\alpha t}$ at time t = 0.05 seconds, and α =5 s^{-1}. What is the current in the coil if the impedance of the coil is 10 Ω ?[941]
   A. 3.791E-01 A
   B. 4.170E-01 A
   C. 4.588E-01 A
   D. 5.046E-01 A
   E. 5.551E-01 A

3. The current through the windings of a solenoid with n= 2.000E+03 turns per meter is changing at a rate dI/dt=3 A/s. The solenoid is 50 cm long and has a cross-sectional diameter of 3 cm. A small coil consisting of N=20turns wraped in a circle of diameter 1 cm is placed in the middle of the solenoid such that the plane of the coil is perpendicular to the central axis of the solenoid. Assume that the infinite-solenoid approximation is valid inside the small coil. What is the emf induced in the coil?[942]

A. 9.788E-06 V

B. 1.077E-05 V

C. 1.184E-05 V

D. 1.303E-05 V

E. 1.433E-05 V

4. Calculate the motional emf induced along a 20 km conductor moving at an orbital speed of 7.8 km/s perpendicular to Earth's 5.000E-05 Tesla magnetic field.[943]

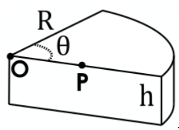
   A. 7.091E+03 V

   B. 7.800E+03 V

   C. 8.580E+03 V

   D. 9.438E+03 V

   E. 1.038E+04 V

5. 

A cylinder of height 1.1 cm and radius 3.1 cm is cut into a wedge as shown. Now imagine that the volume grows as θ increases while the radius R and height h remains constant. What is the volume's rate of change if point P is 2.1 cm from point O and moves at a speed of 5.1 cm/s? Assume that the wedge grows in such a way as the front face moves by rotating around the axis (that contains point O.)] [944]

   A. 8.767E+00 cm^3/s

   B. 9.644E+00 cm^3/s

   C. 1.061E+01 cm^3/s

   D. 1.167E+01 cm^3/s

   E. 1.284E+01 cm^3/s

6. A recangular coil with an area of 0.5 m^2 and 10 turns is placed in a uniform magnetic field of 1.5 T. The coil is rotated about an axis that is perpendicular to this field. At time t=0 the normal to the coil is oriented parallel to the magnetic field and the coil is rotating with a constant angular frequency of 2.000E+03 s^{-1}. What is the "magnitude" (absolute value) of the induced emf at t = 50 s?[945]

   A. 4.029E+02 V

   B. 4.432E+02 V

   C. 4.875E+02 V

   D. 5.362E+02 V

   E. 5.899E+02 V

7. A spatially uniform magnetic points in the z-direction and oscilates with time as $\vec{B}(t) = B_0 \sin \omega t$ where B_0 =1.5 T and ω =2.000E+03 s^{-1}. Suppose the electric field is always zero at point $\mathcal{O}$, and consider a circle of radius 0.5 m that is centered at that point and oriented in a plane perpendicular to the magnetic field. Evaluate the maximum value of the line integral $\oint \vec{E} \cdot d\vec{s}$ around the circle.[946]

   A. 9.425E+03 V

   B. 1.037E+04 V

   C. 1.140E+04 V

   D. 1.254E+04 V

   E. 1.380E+04 V

8. A long solenoid has a radius of 0.7 m and 50 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =3 A and α =25 s^{-1}.What is the induced electric fied at a distance 2.0 m from the axis at time t=0.04 s ?[947]

    A. 2.124E-04 V/m

    B. 2.336E-04 V/m

    C. 2.570E-04 V/m

    D. 2.827E-04 V/m

    E. 3.109E-04 V/m

9. A long solenoid has a radius of 0.7 m and 50 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =3 A and α =25 s^{-1}.What is the induced electric fied at a distance 0.15 m from the axis at time t=0.04 s ?[948]

    A. 1.300E-04 V/m

    B. 1.430E-04 V/m

    C. 1.573E-04 V/m

    D. 1.731E-04 V/m

    E. 1.904E-04 V/m

94.1 Renditions

d_cp2.13 Q1

1. A long solenoid has a radius of 0.508 m and 90 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =7 A and α =25 s^{-1}.What is the induced electric fied at a distance 0.145 m from the axis at time t=0.0643 s ?

    A. 2.614E-04 V/m

    B. 2.875E-04 V/m

    C. 3.163E-04 V/m

    D. 3.479E-04 V/m

    E. 3.827E-04 V/m

d_cp2.13 Q2

1. A long solenoid has a radius of 0.732 m and 55 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =9 A and α =25 s^{-1}.What is the induced electric fied at a distance 0.203 m from the axis at time t=0.0448 s ?

    A. 5.150E-04 V/m

    B. 5.665E-04 V/m

    C. 6.232E-04 V/m

    D. 6.855E-04 V/m

    E. 7.540E-04 V/m

d_cp2.13 Q3

1. A long solenoid has a radius of 0.682 m and 38 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =2 A and α =27 s^{-1}.What is the induced electric fied at a distance 0.16 m from the axis at time t=0.0736 s ?

    A. 2.571E-05 V/m

B. 2.828E-05 V/m
C. 3.111E-05 V/m
D. 3.422E-05 V/m
E. 3.764E-05 V/m

d_cp2.13 Q4

1. A long solenoid has a radius of 0.887 m and 45 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =3 A and α =25 s^{-1}.What is the induced electric fied at a distance 0.169 m from the axis at time t=0.072 s ?

A. 4.896E-05 V/m
B. 5.385E-05 V/m
C. 5.924E-05 V/m
D. 6.516E-05 V/m
E. 7.168E-05 V/m

d_cp2.13 Q5

1. A long solenoid has a radius of 0.845 m and 78 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =3 A and α =20 s^{-1}.What is the induced electric fied at a distance 0.214 m from the axis at time t=0.0655 s ?

A. 1.160E-04 V/m
B. 1.276E-04 V/m
C. 1.403E-04 V/m
D. 1.544E-04 V/m
E. 1.698E-04 V/m

d_cp2.13 Q6

1. A long solenoid has a radius of 0.851 m and 12 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =3 A and α =30 s^{-1}.What is the induced electric fied at a distance 0.14 m from the axis at time t=0.0531 s ?

A. 1.319E-05 V/m
B. 1.451E-05 V/m
C. 1.596E-05 V/m
D. 1.756E-05 V/m
E. 1.932E-05 V/m

d_cp2.13 Q7

1. A long solenoid has a radius of 0.447 m and 85 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =7 A and α =23 s^{-1}.What is the induced electric fied at a distance 0.212 m from the axis at time t=0.0819 s ?

A. 1.893E-04 V/m
B. 2.082E-04 V/m
C. 2.290E-04 V/m
D. 2.519E-04 V/m
E. 2.771E-04 V/m

d_cp2.13 Q8

1. A long solenoid has a radius of 0.596 m and 19 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =5 A and α =29 s^{-1}.What is the induced electric fied at a distance 0.209 m from the axis at time t=0.0604 s ?

   A. 6.277E-05 V/m

   B. 6.904E-05 V/m

   C. 7.595E-05 V/m

   D. 8.354E-05 V/m

   E. 9.190E-05 V/m

d_cp2.13 Q9

1. A long solenoid has a radius of 0.645 m and 37 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =9 A and α =23 s^{-1}.What is the induced electric fied at a distance 0.189 m from the axis at time t=0.0698 s ?

   A. 1.372E-04 V/m

   B. 1.509E-04 V/m

   C. 1.660E-04 V/m

   D. 1.826E-04 V/m

   E. 2.009E-04 V/m

d_cp2.13 Q10

1. A long solenoid has a radius of 0.857 m and 58 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =1 A and α =21 s^{-1}.What is the induced electric fied at a distance 0.144 m from the axis at time t=0.0898 s ?

   A. 1.256E-05 V/m

   B. 1.382E-05 V/m

   C. 1.520E-05 V/m

   D. 1.672E-05 V/m

   E. 1.839E-05 V/m

d_cp2.13 Q11

1. A long solenoid has a radius of 0.436 m and 87 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =4 A and α =27 s^{-1}.What is the induced electric fied at a distance 0.153 m from the axis at time t=0.02 s ?

   A. 4.785E-04 V/m

   B. 5.264E-04 V/m

   C. 5.790E-04 V/m

   D. 6.369E-04 V/m

   E. 7.006E-04 V/m

d_cp2.13 Q12

1. A long solenoid has a radius of 0.793 m and 45 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =2 A and α =29 s^{-1}.What is the induced electric fied at a distance 0.216 m from the axis at time t=0.0208 s ?
   - A. 1.456E-04 V/m
   - B. 1.601E-04 V/m
   - C. 1.762E-04 V/m
   - **D. 1.938E-04 V/m**
   - E. 2.132E-04 V/m

d_cp2.13 Q13

1. A long solenoid has a radius of 0.517 m and 23 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =1 A and α =30 s^{-1}.What is the induced electric fied at a distance 0.162 m from the axis at time t=0.0679 s ?
   - A. 6.256E-06 V/m
   - B. 6.882E-06 V/m
   - C. 7.570E-06 V/m
   - D. 8.327E-06 V/m
   - **E. 9.160E-06 V/m**

d_cp2.13 Q14

1. A long solenoid has a radius of 0.861 m and 28 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =1 A and α =20 s^{-1}.What is the induced electric fied at a distance 0.106 m from the axis at time t=0.055 s ?
   - A. 1.026E-05 V/m
   - B. 1.129E-05 V/m
   - **C. 1.242E-05 V/m**
   - D. 1.366E-05 V/m
   - E. 1.502E-05 V/m

d_cp2.13 Q15

1. A long solenoid has a radius of 0.749 m and 62 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =9 A and α =25 s^{-1}.What is the induced electric fied at a distance 0.139 m from the axis at time t=0.071 s ?
   - **A. 2.065E-04 V/m**
   - B. 2.271E-04 V/m
   - C. 2.499E-04 V/m
   - D. 2.748E-04 V/m
   - E. 3.023E-04 V/m

d_cp2.13 Q16

1. A long solenoid has a radius of 0.591 m and 41 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =1 A and α =30 s^{-1}.What is the induced electric fied at a distance 0.234 m from the axis at time t=0.0208 s ?

   A. 6.618E-05 V/m

   B. 7.280E-05 V/m

   C. 8.008E-05 V/m

   D. 8.809E-05 V/m

   E. 9.689E-05 V/m

d_cp2.13 Q17

1. A long solenoid has a radius of 0.603 m and 51 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =2 A and α =26 s^{-1}.What is the induced electric fied at a distance 0.105 m from the axis at time t=0.0659 s ?

   A. 2.154E-05 V/m

   B. 2.369E-05 V/m

   C. 2.606E-05 V/m

   D. 2.867E-05 V/m

   E. 3.154E-05 V/m

d_cp2.13 Q18

1. A long solenoid has a radius of 0.613 m and 75 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =2 A and α =22 s^{-1}.What is the induced electric fied at a distance 0.206 m from the axis at time t=0.0387 s ?

   A. 1.370E-04 V/m

   B. 1.507E-04 V/m

   C. 1.657E-04 V/m

   D. 1.823E-04 V/m

   E. 2.005E-04 V/m

d_cp2.13 Q19

1. A long solenoid has a radius of 0.442 m and 41 turns per meter; its current decreases with time according to $I_0 e^{-\alpha t}$, where I_0 =4 A and α =20 s^{-1}.What is the induced electric fied at a distance 0.2 m from the axis at time t=0.0833 s ?

   A. 6.438E-05 V/m

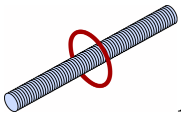
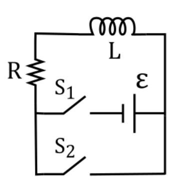
   B. 7.082E-05 V/m

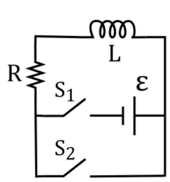
   C. 7.790E-05 V/m

   D. 8.569E-05 V/m

   E. 9.426E-05 V/m

95 d_cp2.14

1.  A long solenoid has a length 0.75 meters, radius 3.1 cm, and 500 turns. It surrounds coil of radius 5.9 meters and 10turns. If the current in the solenoid is changing at a rate of 200 A/s, what is the emf induced in the surounding coil?[949]
   - A. 1.445E-02 V
   - **B. 1.589E-02 V**
   - C. 1.748E-02 V
   - D. 1.923E-02 V
   - E. 2.115E-02 V
2. An induced emf of 2.0V is measured across a coil of 50 closely wound turns while the current throuth it increases uniformly from 0.0 to 5.0A in 0.1s. What is the self-inductance of the coil?[950]
   - A. 3.306E-02 H
   - B. 3.636E-02 H
   - **C. 4.000E-02 H**
   - D. 4.400E-02 H
   - E. 4.840E-02 H
3. A washer has an inner diameter of 2.5 cm and an outer diamter of 4.5 cm. The thickness is $h = Cr^{-n}$ where r is measured in cm, $C = 3.5mm$, and $n = 2.7$. What is the volume of the washer?[951]
   - A. 6.191E-01 cm^3
   - B. 6.810E-01 cm^3
   - C. 7.491E-01 cm^3
   - D. 8.240E-01 cm^3
   - **E. 9.065E-01 cm^3**
4. 

Suppose switch S_1 is suddenly closed at time t=0 in the figure shown. What is the current at t =2.0 s if ε= 2.0 V , R = 4.0 Ω , and L = 4.0 H?[952]
   - A. 3.603E-01 V
   - **B. 4.323E-01 V**
   - C. 5.188E-01 V
   - D. 6.226E-01 V
   - E. 7.471E-01 V
5. 

Suppose switch S_1 in the figure shown was closed and remained closed long enough to acheive steady state. At t=0 S_1 is opened as as S_2 is closed. How long will it take for the energy stored in the inductor to be reduced to 1.0% of its maximum value if ε= 2.0 V , R = 4.0 Ω , and L = 4.0 H?[953]

A. -1.730E+00 s
B. -1.903E+00 s
C. -2.093E+00 s
D. -2.303E+00 s
E. -2.533E+00 s

6. In an LC circuit, the self-inductance is 0.02 H and the capacitance is 8.000E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 1.200E-05 C. How long does it take for the capacitor to become completely discharged?[954]
   A. 6.283E-04 s
   B. 6.912E-04 s
   C. 7.603E-04 s
   D. 8.363E-04 s
   E. 9.199E-04 s

95.1 Renditions

d_cp2.14 Q1

1. In an LC circuit, the self-inductance is 0.0134 H and the capacitance is 3.280E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 5.930E-05 C. How long does it take for the capacitor to become completely discharged?
   A. 2.722E-04 s
   B. 2.994E-04 s
   C. 3.293E-04 s
   D. 3.622E-04 s
   E. 3.985E-04 s

d_cp2.14 Q2

1. In an LC circuit, the self-inductance is 0.0424 H and the capacitance is 7.790E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 6.230E-05 C. How long does it take for the capacitor to become completely discharged?
   A. 6.166E-04 s
   B. 6.783E-04 s
   C. 7.461E-04 s
   D. 8.207E-04 s
   E. 9.028E-04 s

d_cp2.14 Q3

1. In an LC circuit, the self-inductance is 0.0126 H and the capacitance is 3.350E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 7.420E-05 C. How long does it take for the capacitor to become completely discharged?
   A. 2.204E-04 s
   B. 2.425E-04 s
   C. 2.667E-04 s
   D. 2.934E-04 s
   E. 3.227E-04 s

d_cp2.14 Q4

1. In an LC circuit, the self-inductance is 0.0216 H and the capacitance is 6.450E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 1.240E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.846E-04 s

   B. 5.330E-04 s

   C. 5.863E-04 s

   D. 6.449E-04 s

   E. 7.094E-04 s

d_cp2.14 Q5

1. In an LC circuit, the self-inductance is 0.0735 H and the capacitance is 2.300E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 3.220E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.411E-04 s

   B. 4.852E-04 s

   C. 5.338E-04 s

   D. 5.871E-04 s

   E. 6.458E-04 s

d_cp2.14 Q6

1. In an LC circuit, the self-inductance is 0.025 H and the capacitance is 3.530E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 7.770E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 3.856E-04 s

   B. 4.242E-04 s

   C. 4.666E-04 s

   D. 5.133E-04 s

   E. 5.646E-04 s

d_cp2.14 Q7

1. In an LC circuit, the self-inductance is 0.0689 H and the capacitance is 2.110E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 7.220E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.950E-04 s

   B. 5.445E-04 s

   C. 5.989E-04 s

   D. 6.588E-04 s

   E. 7.247E-04 s

d_cp2.14 Q8

1. In an LC circuit, the self-inductance is 0.0464 H and the capacitance is 7.350E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 3.280E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 8.339E-04 s

   B. 9.173E-04 s

   C. 1.009E-03 s

   D. 1.110E-03 s

   E. 1.221E-03 s

d_cp2.14 Q9

1. In an LC circuit, the self-inductance is 0.0237 H and the capacitance is 6.140E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 8.260E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.093E-04 s

   B. 4.502E-04 s

   C. 4.952E-04 s

   D. 5.447E-04 s

   E. 5.992E-04 s

d_cp2.14 Q10

1. In an LC circuit, the self-inductance is 0.0815 H and the capacitance is 6.520E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 8.410E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 7.821E-04 s

   B. 8.603E-04 s

   C. 9.463E-04 s

   D. 1.041E-03 s

   E. 1.145E-03 s

d_cp2.14 Q11

1. In an LC circuit, the self-inductance is 0.0795 H and the capacitance is 7.930E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 2.420E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 9.370E-04 s

   B. 1.031E-03 s

   C. 1.134E-03 s

   D. 1.247E-03 s

   E. 1.372E-03 s

d_cp2.14 Q12

1. In an LC circuit, the self-inductance is 0.0116 H and the capacitance is 7.040E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 6.140E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.489E-04 s

   B. 4.938E-04 s

   C. 5.432E-04 s

   D. 5.975E-04 s

   E. 6.572E-04 s

d_cp2.14 Q13

1. In an LC circuit, the self-inductance is 0.0307 H and the capacitance is 5.330E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 1.840E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 5.251E-04 s

   B. 5.776E-04 s

   C. 6.354E-04 s

   D. 6.989E-04 s

   E. 7.688E-04 s

d_cp2.14 Q14

1. In an LC circuit, the self-inductance is 0.0273 H and the capacitance is 6.440E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 6.620E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 5.443E-04 s

   B. 5.988E-04 s

   C. 6.586E-04 s

   D. 7.245E-04 s

   E. 7.969E-04 s

d_cp2.14 Q15

1. In an LC circuit, the self-inductance is 0.0156 H and the capacitance is 6.950E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 4.830E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 3.886E-04 s

   B. 4.275E-04 s

   C. 4.702E-04 s

   D. 5.172E-04 s

   E. 5.689E-04 s

d_cp2.14 Q16

1. In an LC circuit, the self-inductance is 0.035 H and the capacitance is 4.620E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 8.250E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 6.316E-04 s

   B. 6.948E-04 s

   C. 7.643E-04 s

   D. 8.407E-04 s

   E. 9.248E-04 s

d_cp2.14 Q17

1. In an LC circuit, the self-inductance is 0.0399 H and the capacitance is 8.450E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 6.480E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 6.230E-04 s

   B. 6.853E-04 s

   C. 7.538E-04 s

   D. 8.292E-04 s

   E. 9.121E-04 s

d_cp2.14 Q18

1. In an LC circuit, the self-inductance is 0.0262 H and the capacitance is 4.540E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 4.700E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 4.070E-04 s

   B. 4.477E-04 s

   C. 4.925E-04 s

   D. 5.417E-04 s

   E. 5.959E-04 s

d_cp2.14 Q19

1. In an LC circuit, the self-inductance is 0.0776 H and the capacitance is 6.940E-06 F. At t=0 all the energy is stored in the capacitor, which has a charge of 3.400E-05 C. How long does it take for the capacitor to become completely discharged?

   A. 1.048E-03 s

   B. 1.153E-03 s

   C. 1.268E-03 s

   D. 1.395E-03 s

   E. 1.534E-03 s

96 d_cp2.15

1. An ac generator produces an emf of amplitude 10 V at a frequency of 60 Hz. What is the maximum amplitude of the current if the generator is connected to a 15 mF inductor?[955]

    A. 1.208E+00 A

    B. 1.329E+00 A

    C. 1.461E+00 A

    D. 1.608E+00 A

    E. 1.768E+00 A

2. An ac generator produces an emf of amplitude 10 V at a frequency of 60 Hz. What is the maximum amplitude of the current if the generator is connected to a 10 mF capacitor?[956]

    A. 3.770E-02 A

    B. 4.147E-02 A

    C. 4.562E-02 A

    D. 5.018E-02 A

    E. 5.520E-02 A

3. The output of an ac generator connected to an RLC series combination has a frequency of 200 Hz and an amplitude of 0.1 V;. If R =4 Ω , L= 3.00E-03H , and C=8.00E-04 F, what is the impedance?[957]

    A. 4.024E+00 Ω

    B. 4.426E+00 Ω

    C. 4.868E+00 Ω

    D. 5.355E+00 Ω

    E. 5.891E+00 Ω

4. The output of an ac generator connected to an RLC series combination has a frequency of 200 Hz and an amplitude of 0.1 V;. If R =4 Ω , L= 3.00E-03H , and C=8.00E-04 F, what is the magnitude (absolute value) of the phase difference between current and emf?[958]

    A. 5.514E-01 rad

    B. 6.066E-01 rad

    C. 6.672E-01 rad

    D. 7.339E-01 rad

    E. 8.073E-01 rad

5. The output of an ac generator connected to an RLC series combination has a frequency of 1.00E+04 Hz and an amplitude of 4 V. If R =5 Ω , L= 2.00E-03H , and C=4.00E-06 F, what is the rms power transferred to the resistor?[959]

    A. 7.273E-01 Watts

    B. 8.000E-01 Watts

    C. 8.800E-01 Watts

    D. 9.680E-01 Watts

    E. 1.065E+00 Watts

6. An RLC series combination is driven with an applied voltage of of $V=V_0\sin(\omega\ t)$, where V_0=0.1 V. The resistance, inductance, and capacitance are R =4 Ω , L= 3.00E-03H , and C=8.00E-04 F, respectively. What is the amplitude of the current?[960]

A. 2.066E-02 A
B. 2.273E-02 A
C. 2.500E-02 A
D. 2.750E-02 A
E. 3.025E-02 A

7. The quality factor Q is a dimensionless paramater involving the relative values of the magnitudes of the at three impedances (R, X_L, X_C). Since Q is calculatedat resonance, X_L, X_C and only twoimpedances are involved, Q= ω $_0$L/R is defined so that Q is large if the resistance is low. Calculate the Q of an LRC series driven at resonance by an applied voltage of of $V=V_0\sin(\omega\ t)$, where $V_0=4$ V. The resistance, inductance, and capacitance are R =0.2 Ω , L= 4.00E-03H , and C=2.00E-06 F, respectively.[961]
   A. Q = 1.278E+02
   B. Q = 1.470E+02
   C. Q = 1.691E+02
   D. Q = 1.944E+02
   E. Q = 2.236E+02

8. A step-down transformer steps 12 kV down to 240 V. The high-voltage input is provided by a 200 Ω power line that carries 2 A of currentWhat is the output current (at the 240 V side ?)[962]
   A. 1.000E+02 A
   B. 1.100E+02 A
   C. 1.210E+02 A
   D. 1.331E+02 A
   E. 1.464E+02 A

96.1 Renditions

d_cp2.15 Q1

1. A step-down transformer steps 19 kV down to 220 V. The high-voltage input is provided by a 250 Ω power line that carries 4 A of currentWhat is the output current (at the 220 V side ?)
   A. 2.595E+02 A
   B. 2.855E+02 A
   C. 3.140E+02 A
   D. 3.455E+02 A
   E. 3.800E+02 A

d_cp2.15 Q2

1. A step-down transformer steps 14 kV down to 210 V. The high-voltage input is provided by a 240 Ω power line that carries 3 A of currentWhat is the output current (at the 210 V side ?)
   A. 2.000E+02 A
   B. 2.200E+02 A
   C. 2.420E+02 A
   D. 2.662E+02 A
   E. 2.928E+02 A

d_cp2.15 Q3

1. A step-down transformer steps 18 kV down to 260 V. The high-voltage input is provided by a 290 Ω power line that carries 3 A of currentWhat is the output current (at the 260 V side ?)
   - A. 1.888E+02 A
   - **B. 2.077E+02 A**
   - C. 2.285E+02 A
   - D. 2.513E+02 A
   - E. 2.764E+02 A

d_cp2.15 Q4

1. A step-down transformer steps 9 kV down to 210 V. The high-voltage input is provided by a 170 Ω power line that carries 5 A of currentWhat is the output current (at the 210 V side ?)
   - A. 1.948E+02 A
   - **B. 2.143E+02 A**
   - C. 2.357E+02 A
   - D. 2.593E+02 A
   - E. 2.852E+02 A

d_cp2.15 Q5

1. A step-down transformer steps 18 kV down to 230 V. The high-voltage input is provided by a 250 Ω power line that carries 8 A of currentWhat is the output current (at the 230 V side ?)
   - A. 5.174E+02 A
   - B. 5.692E+02 A
   - **C. 6.261E+02 A**
   - D. 6.887E+02 A
   - E. 7.576E+02 A

d_cp2.15 Q6

1. A step-down transformer steps 19 kV down to 220 V. The high-voltage input is provided by a 230 Ω power line that carries 5 A of currentWhat is the output current (at the 220 V side ?)
   - A. 3.244E+02 A
   - B. 3.569E+02 A
   - C. 3.926E+02 A
   - **D. 4.318E+02 A**
   - E. 4.750E+02 A

d_cp2.15 Q7

1. A step-down transformer steps 8 kV down to 220 V. The high-voltage input is provided by a 110 Ω power line that carries 8 A of currentWhat is the output current (at the 220 V side ?)
   - A. 2.404E+02 A
   - B. 2.645E+02 A
   - **C. 2.909E+02 A**
   - D. 3.200E+02 A
   - E. 3.520E+02 A

d_cp2.15 Q8

1. A step-down transformer steps 15 kV down to 240 V. The high-voltage input is provided by a 200 Ω power line that carries 4 A of currentWhat is the output current (at the 240 V side ?)
   - A. 1.708E+02 A
   - B. 1.878E+02 A
   - C. 2.066E+02 A
   - D. 2.273E+02 A
   - **E. 2.500E+02 A**

d_cp2.15 Q9

1. A step-down transformer steps 12 kV down to 170 V. The high-voltage input is provided by a 140 Ω power line that carries 9 A of currentWhat is the output current (at the 170 V side ?)
   - A. 4.773E+02 A
   - B. 5.250E+02 A
   - C. 5.775E+02 A
   - **D. 6.353E+02 A**
   - E. 6.988E+02 A

d_cp2.15 Q10

1. A step-down transformer steps 16 kV down to 210 V. The high-voltage input is provided by a 200 Ω power line that carries 7 A of currentWhat is the output current (at the 210 V side ?)
   - A. 4.007E+02 A
   - B. 4.408E+02 A
   - C. 4.848E+02 A
   - **D. 5.333E+02 A**
   - E. 5.867E+02 A

d_cp2.15 Q11

1. A step-down transformer steps 18 kV down to 170 V. The high-voltage input is provided by a 240 Ω power line that carries 5 A of currentWhat is the output current (at the 170 V side ?)
   - **A. 5.294E+02 A**
   - B. 5.824E+02 A
   - C. 6.406E+02 A
   - D. 7.046E+02 A
   - E. 7.751E+02 A

d_cp2.15 Q12

1. A step-down transformer steps 15 kV down to 240 V. The high-voltage input is provided by a 120 Ω power line that carries 3 A of currentWhat is the output current (at the 240 V side ?)
   - A. 1.550E+02 A
   - B. 1.705E+02 A
   - **C. 1.875E+02 A**
   - D. 2.063E+02 A
   - E. 2.269E+02 A

d_cp2.15 Q13

1. A step-down transformer steps 18 kV down to 170 V. The high-voltage input is provided by a 230 Ω power line that carries 5 A of currentWhat is the output current (at the 170 V side ?)
   - A. 4.375E+02 A
   - B. 4.813E+02 A
   - **C. 5.294E+02 A**
   - D. 5.824E+02 A
   - E. 6.406E+02 A

d_cp2.15 Q14

1. A step-down transformer steps 6 kV down to 190 V. The high-voltage input is provided by a 130 Ω power line that carries 6 A of currentWhat is the output current (at the 190 V side ?)
   - A. 1.424E+02 A
   - B. 1.566E+02 A
   - C. 1.722E+02 A
   - **D. 1.895E+02 A**
   - E. 2.084E+02 A

d_cp2.15 Q15

1. A step-down transformer steps 7 kV down to 190 V. The high-voltage input is provided by a 240 Ω power line that carries 5 A of currentWhat is the output current (at the 190 V side ?)
   - A. 1.675E+02 A
   - **B. 1.842E+02 A**
   - C. 2.026E+02 A
   - D. 2.229E+02 A
   - E. 2.452E+02 A

d_cp2.15 Q16

1. A step-down transformer steps 9 kV down to 160 V. The high-voltage input is provided by a 260 Ω power line that carries 7 A of currentWhat is the output current (at the 160 V side ?)
   - **A. 3.938E+02 A**
   - B. 4.331E+02 A
   - C. 4.764E+02 A
   - D. 5.241E+02 A
   - E. 5.765E+02 A

d_cp2.15 Q17

1. A step-down transformer steps 12 kV down to 230 V. The high-voltage input is provided by a 140 Ω power line that carries 5 A of currentWhat is the output current (at the 230 V side ?)
   - A. 2.156E+02 A
   - B. 2.372E+02 A
   - **C. 2.609E+02 A**
   - D. 2.870E+02 A
   - E. 3.157E+02 A

d_cp2.15 Q18

1. A step-down transformer steps 19 kV down to 260 V. The high-voltage input is provided by a 290 Ω power line that carries 6 A of currentWhat is the output current (at the 260 V side ?)

   A. 3.294E+02 A

   B. 3.624E+02 A

   C. 3.986E+02 A

   D. 4.385E+02 A

   E. 4.823E+02 A

d_cp2.15 Q19

1. A step-down transformer steps 15 kV down to 250 V. The high-voltage input is provided by a 130 Ω power line that carries 4 A of currentWhat is the output current (at the 250 V side ?)

   A. 1.983E+02 A

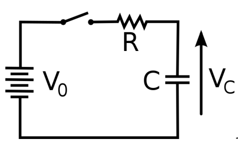
   B. 2.182E+02 A

   C. 2.400E+02 A

   D. 2.640E+02 A

   E. 2.904E+02 A

97 d_cp2.16

1. 

A parallel plate capacitor with a capicatnce C=1.00E-06 F whose plates have an area A=225.9 m^2 and separation d=2.00E-03 m is connected via a swith to a 2 Ω resistor and a battery of voltage V_0=2 V as shown in the figure. The current starts to flow at time t=0 when the switch is closed. What is the voltage at time t=4.00E-06?[963]

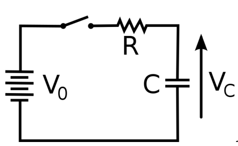
   A. 1.729E+00 V

   B. 1.902E+00 V

   C. 2.092E+00 V

   D. 2.302E+00 V

   E. 2.532E+00 V

2. 

A parallel plate capacitor with a capicatnce C=1.00E-06 F whose plates have an area A=225.9 m^2 and separation d=2.00E-03 m is connected via a swith to a 2 Ω resistor and a battery of voltage V_0=2 V as shown in the figure. The current starts to flow at time t=0 when the switch is closed. What is the magnitude of the electric field at time t=4.00E-06?[964]

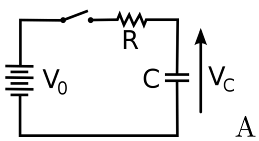
   A. 8.647E+02 V/m

   B. 9.511E+02 V/m

   C. 1.046E+03 V/m

   D. 1.151E+03 V/m

   E. 1.266E+03 V/m

3. 

A parallel plate capacitor with a capicatnce C=1.00E-06 F whose plates have an area A=225.9 m^2 and separation d=2.00E-03 m is connected via a swith to a 2 Ω resistor and a battery of voltage V_0=2 V as shown in the figure. The current starts to flow at time t=0 when the switch is closed. What is the magnitude of the displacement current at time t=4.00E-06?[965]

   A. 1.230E-01 A
   B. 1.353E-01 A
   C. 1.489E-01 A
   D. 1.638E-01 A
   E. 1.801E-01 A

4. A 60 kW radio transmitter on Earth sends it signal to a satellite 100 km away. At what distance in the same direction would the signal have the same maximum field strength if the transmitter's output power were increased to 90 kW?[966]

   A. 9.202E+01 km
   B. 1.012E+02 km
   C. 1.113E+02 km
   D. 1.225E+02 km
   E. 1.347E+02 km

5. What is the radiation pressure on an object that is 9.00E+10 m away from the sun and has cross-sectional area of 0.04 m^2? The average power output of the Sun is 3.80E+26 W.[967]

   A. 1.701E-05 N/m^2
   B. 1.871E-05 N/m^2
   C. 2.058E-05 N/m^2
   D. 2.264E-05 N/m^2
   E. 2.491E-05 N/m^2

6. What is the radiation force on an object that is 9.00E+10 m away from the sun and has cross-sectional area of 0.04 m^2? The average power output of the Sun is 3.80E+26 W.[968]

   A. 8.233E-07 N
   B. 9.056E-07 N
   C. 9.962E-07 N
   D. 1.096E-06 N
   E. 1.205E-06 N

97.1 Renditions

d_cp2.16 Q1

1. What is the radiation force on an object that is 5.20E+11 m away from the sun and has cross-sectional area of 0.04 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 2.242E-08 N
   B. 2.466E-08 N
   C. 2.713E-08 N
   D. 2.984E-08 N
   E. 3.283E-08 N

d_cp2.16 Q2

1. What is the radiation force on an object that is 3.80E+11 m away from the sun and has cross-sectional area of 0.094 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 8.969E-08 N
   - B. 9.866E-08 N
   - C. 1.085E-07 N
   - D. 1.194E-07 N
   - **E. 1.313E-07 N**

d_cp2.16 Q3

1. What is the radiation force on an object that is 1.70E+11 m away from the sun and has cross-sectional area of 0.033 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 1.904E-07 N
   - B. 2.094E-07 N
   - **C. 2.303E-07 N**
   - D. 2.534E-07 N
   - E. 2.787E-07 N

d_cp2.16 Q4

1. What is the radiation force on an object that is 5.50E+11 m away from the sun and has cross-sectional area of 0.096 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 4.373E-08 N
   - B. 4.810E-08 N
   - C. 5.291E-08 N
   - D. 5.820E-08 N
   - **E. 6.402E-08 N**

d_cp2.16 Q5

1. What is the radiation force on an object that is 2.00E+11 m away from the sun and has cross-sectional area of 0.053 m^2? The average power output of the Sun is 3.80E+26 W.
   - **A. 2.673E-07 N**
   - B. 2.940E-07 N
   - C. 3.234E-07 N
   - D. 3.558E-07 N
   - E. 3.913E-07 N

d_cp2.16 Q6

1. What is the radiation force on an object that is 1.60E+11 m away from the sun and has cross-sectional area of 0.081 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 5.275E-07 N
   - B. 5.803E-07 N
   - **C. 6.383E-07 N**
   - D. 7.021E-07 N
   - E. 7.723E-07 N

d_cp2.16 Q7

1. What is the radiation force on an object that is 5.50E+11 m away from the sun and has cross-sectional area of 0.075 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 5.002E-08 N
   B. 5.502E-08 N
   C. 6.052E-08 N
   D. 6.657E-08 N
   E. 7.323E-08 N

d_cp2.16 Q8

1. What is the radiation force on an object that is 3.60E+11 m away from the sun and has cross-sectional area of 0.069 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 7.336E-08 N
   B. 8.069E-08 N
   C. 8.876E-08 N
   D. 9.764E-08 N
   E. 1.074E-07 N

d_cp2.16 Q9

1. What is the radiation force on an object that is 5.40E+11 m away from the sun and has cross-sectional area of 0.021 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 9.923E-09 N
   B. 1.092E-08 N
   C. 1.201E-08 N
   D. 1.321E-08 N
   E. 1.453E-08 N

d_cp2.16 Q10

1. What is the radiation force on an object that is 7.60E+11 m away from the sun and has cross-sectional area of 0.052 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 1.501E-08 N
   B. 1.651E-08 N
   C. 1.816E-08 N
   D. 1.998E-08 N
   E. 2.198E-08 N

d_cp2.16 Q11

1. What is the radiation force on an object that is 7.40E+11 m away from the sun and has cross-sectional area of 0.082 m^2? The average power output of the Sun is 3.80E+26 W.

   A. 2.063E-08 N
   B. 2.270E-08 N
   C. 2.497E-08 N
   D. 2.746E-08 N
   E. 3.021E-08 N

d_cp2.16 Q12

1. What is the radiation force on an object that is 4.70E+11 m away from the sun and has cross-sectional area of 0.015 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 1.029E-08 N
   - B. 1.132E-08 N
   - C. 1.245E-08 N
   - **D. 1.370E-08 N**
   - E. 1.507E-08 N

d_cp2.16 Q13

1. What is the radiation force on an object that is 9.70E+11 m away from the sun and has cross-sectional area of 0.044 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 7.088E-09 N
   - B. 7.796E-09 N
   - C. 8.576E-09 N
   - **D. 9.434E-09 N**
   - E. 1.038E-08 N

d_cp2.16 Q14

1. What is the radiation force on an object that is 2.50E+11 m away from the sun and has cross-sectional area of 0.045 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 1.200E-07 N
   - B. 1.320E-07 N
   - **C. 1.452E-07 N**
   - D. 1.598E-07 N
   - E. 1.757E-07 N

d_cp2.16 Q15

1. What is the radiation force on an object that is 8.10E+11 m away from the sun and has cross-sectional area of 0.053 m^2? The average power output of the Sun is 3.80E+26 W.
   - **A. 1.630E-08 N**
   - B. 1.793E-08 N
   - C. 1.972E-08 N
   - D. 2.169E-08 N
   - E. 2.386E-08 N

d_cp2.16 Q16

1. What is the radiation force on an object that is 4.70E+11 m away from the sun and has cross-sectional area of 0.098 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 7.396E-08 N
   - B. 8.136E-08 N
   - **C. 8.950E-08 N**
   - D. 9.845E-08 N
   - E. 1.083E-07 N

d_cp2.16 Q17

1. What is the radiation force on an object that is 9.90E+11 m away from the sun and has cross-sectional area of 0.083 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 1.167E-08 N
   - B. 1.284E-08 N
   - C. 1.412E-08 N
   - D. 1.553E-08 N
   - **E. 1.708E-08 N**

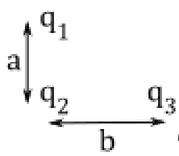
d_cp2.16 Q18

1. What is the radiation force on an object that is 1.20E+11 m away from the sun and has cross-sectional area of 0.055 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 5.263E-07 N
   - B. 5.789E-07 N
   - C. 6.368E-07 N
   - D. 7.005E-07 N
   - **E. 7.705E-07 N**

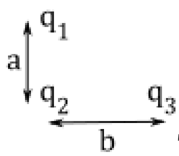
d_cp2.16 Q19

1. What is the radiation force on an object that is 6.70E+11 m away from the sun and has cross-sectional area of 0.095 m^2? The average power output of the Sun is 3.80E+26 W.
   - A. 3.528E-08 N
   - B. 3.881E-08 N
   - **C. 4.269E-08 N**
   - D. 4.696E-08 N
   - E. 5.166E-08 N

98 d_cp2.5



1. Three small charged objects are placed as shown, where $b = 2a$, and $a = 2 \times 10^{-7}$m. What is the magnitude of the net force on q_2 if $q_1 = 2e$, $q_2 = -3e$, and $q_3 = 5e$?[969]
   - A. 3.710E-14 N
   - **B. 4.081E-14 N**
   - C. 4.489E-14 N
   - D. 4.938E-14 N
   - E. 5.432E-14 N



2. Three small charged objects are placed as shown, where $b = 2a$, and $a = 2 \times 10^{-7}$m.what angle does the force on q_2 make above the $-x$ axis if $q_1 = 2e$, $q_2 = -3e$, and $q_3 = 5e$?[970]

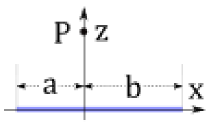
A. 3.961E+01 degrees

B. 4.357E+01 degrees

C. 4.793E+01 degrees

D. 5.272E+01 degrees

E. 5.799E+01 degrees

3. 

$E_z(x=0,z) = \int_{-a}^{b} f(x,z)dx$is an integral that calculates the z-component of the electric field at point P situated above the x-axis where a charged rod of length (a+b) is located. The distance between point P and the x-axis is z=1.5 m. Evaluate $f(x,y)$ at x=1 m if a=0.7 m, b=1.2 m. The total charge on the rod is 2 nC.[971]

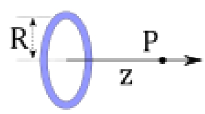
A. 2.422E+00 V/m^2

B. 2.664E+00 V/m^2

C. 2.931E+00 V/m^2

D. 3.224E+00 V/m^2

E. 3.546E+00 V/m^2

4. 

A ring is uniformly charged with a net charge of 2 nC. The radius of the ring is R=1.1 m, with its center at the origin and oriented normal to the z axis as shown. what is the magnitude of the electric field at a distance z=0.5 m (on axis) away from the loop's center?[972]

A. 4.210E+09 N/C^2

B. 4.631E+09 N/C^2

C. 5.095E+09 N/C^2

D. 5.604E+09 N/C^2

E. 6.164E+09 N/C^2

5. $E(z) = \int_0^R f(r',z)dr'$is an integral that calculates the magnitude of the electric field at a distance z fromthe center of a thin circular disk as measured along a line normal to the plane of the disk. The disk's radius is $R = 2$ m and the surface charge density is $\sigma = 1$ nC/m^3. Evaluate $f(r',z)$ at $r' = 1$ m.[973]

A. 1.364E+01 V/m^2

B. 1.500E+01 V/m^2

C. 1.650E+01 V/m^2

D. 1.815E+01 V/m^2

E. 1.997E+01 V/m^2

6. A large thin isolated square plate has an area of 2 m^2. It is uniformly charged with 3 nC of charge. What is the magnitude of the electric field 2 mm from the center of the plate's surface?[974]

A. 8.471E+01 N/C

B. 9.318E+01 N/C

C. 1.025E+02 N/C

D. 1.127E+02 N/C

E. 1.240E+02 N/C

98.1 Renditions

d_cp2.5 Q1

1. A large thin isolated square plate has an area of 9 m^2. It is uniformly charged with 8 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?

   A. 5.020E+01 N/C
   B. 5.522E+01 N/C
   C. 6.074E+01 N/C
   D. 6.681E+01 N/C
   E. 7.349E+01 N/C

d_cp2.5 Q2

1. A large thin isolated square plate has an area of 3 m^2. It is uniformly charged with 9 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?

   A. 1.694E+02 N/C
   B. 1.864E+02 N/C
   C. 2.050E+02 N/C
   D. 2.255E+02 N/C
   E. 2.480E+02 N/C

d_cp2.5 Q3

1. A large thin isolated square plate has an area of 3 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?

   A. 9.412E+01 N/C
   B. 1.035E+02 N/C
   C. 1.139E+02 N/C
   D. 1.253E+02 N/C
   E. 1.378E+02 N/C

d_cp2.5 Q4

1. A large thin isolated square plate has an area of 4 m^2. It is uniformly charged with 9 nC of charge. What is the magnitude of the electric field 2 mm from the center of the plate's surface?

   A. 9.546E+01 N/C
   B. 1.050E+02 N/C
   C. 1.155E+02 N/C
   D. 1.271E+02 N/C
   E. 1.398E+02 N/C

d_cp2.5 Q5

1. A large thin isolated square plate has an area of 9 m^2. It is uniformly charged with 6 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 2.571E+01 N/C
   B. 2.828E+01 N/C

C. 3.111E+01 N/C

D. 3.422E+01 N/C

E. 3.765E+01 N/C

d_cp2.5 Q6

1. A large thin isolated square plate has an area of 5 m^2. It is uniformly charged with 7 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 6.534E+01 N/C

   B. 7.187E+01 N/C

   C. 7.906E+01 N/C

   D. 8.696E+01 N/C

   E. 9.566E+01 N/C

d_cp2.5 Q7

1. A large thin isolated square plate has an area of 4 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 4.821E+01 N/C

   B. 5.303E+01 N/C

   C. 5.834E+01 N/C

   D. 6.417E+01 N/C

   E. 7.059E+01 N/C

d_cp2.5 Q8

1. A large thin isolated square plate has an area of 8 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 2.652E+01 N/C

   B. 2.917E+01 N/C

   C. 3.209E+01 N/C

   D. 3.529E+01 N/C

   E. 3.882E+01 N/C

d_cp2.5 Q9

1. A large thin isolated square plate has an area of 5 m^2. It is uniformly charged with 8 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?

   A. 6.171E+01 N/C

   B. 6.788E+01 N/C

   C. 7.467E+01 N/C

   D. 8.214E+01 N/C

   E. 9.035E+01 N/C

d_cp2.5 Q10

1. A large thin isolated square plate has an area of 9 m^2. It is uniformly charged with 8 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?
   - A. 3.428E+01 N/C
   - B. 3.771E+01 N/C
   - C. 4.148E+01 N/C
   - D. 4.563E+01 N/C
   - **E. 5.020E+01 N/C**

d_cp2.5 Q11

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 9 nC of charge. What is the magnitude of the electric field 2 mm from the center of the plate's surface?
   - A. 7.000E+01 N/C
   - B. 7.701E+01 N/C
   - **C. 8.471E+01 N/C**
   - D. 9.318E+01 N/C
   - E. 1.025E+02 N/C

d_cp2.5 Q12

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 2 mm from the center of the plate's surface?
   - A. 3.214E+01 N/C
   - B. 3.536E+01 N/C
   - C. 3.889E+01 N/C
   - D. 4.278E+01 N/C
   - **E. 4.706E+01 N/C**

d_cp2.5 Q13

1. A large thin isolated square plate has an area of 8 m^2. It is uniformly charged with 7 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?
   - A. 4.492E+01 N/C
   - **B. 4.941E+01 N/C**
   - C. 5.435E+01 N/C
   - D. 5.979E+01 N/C
   - E. 6.577E+01 N/C

d_cp2.5 Q14

1. A large thin isolated square plate has an area of 9 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?
   - A. 2.357E+01 N/C
   - B. 2.593E+01 N/C
   - C. 2.852E+01 N/C
   - **D. 3.137E+01 N/C**
   - E. 3.451E+01 N/C

d_cp2.5 Q15

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 5 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 3.214E+01 N/C

   B. 3.536E+01 N/C

   C. 3.889E+01 N/C

   D. 4.278E+01 N/C

   E. 4.706E+01 N/C

d_cp2.5 Q16

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 6 nC of charge. What is the magnitude of the electric field 2 mm from the center of the plate's surface?

   A. 5.647E+01 N/C

   B. 6.212E+01 N/C

   C. 6.833E+01 N/C

   D. 7.516E+01 N/C

   E. 8.268E+01 N/C

d_cp2.5 Q17

1. A large thin isolated square plate has an area of 8 m^2. It is uniformly charged with 6 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 3.500E+01 N/C

   B. 3.850E+01 N/C

   C. 4.235E+01 N/C

   D. 4.659E+01 N/C

   E. 5.125E+01 N/C

d_cp2.5 Q18

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 9 nC of charge. What is the magnitude of the electric field 1 mm from the center of the plate's surface?

   A. 7.701E+01 N/C

   B. 8.471E+01 N/C

   C. 9.318E+01 N/C

   D. 1.025E+02 N/C

   E. 1.127E+02 N/C

d_cp2.5 Q19

1. A large thin isolated square plate has an area of 6 m^2. It is uniformly charged with 9 nC of charge. What is the magnitude of the electric field 3 mm from the center of the plate's surface?

   A. 8.471E+01 N/C

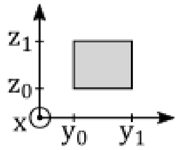
   B. 9.318E+01 N/C

   C. 1.025E+02 N/C

   D. 1.127E+02 N/C

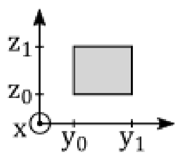
   E. 1.240E+02 N/C

99 d_cp2.6

1. 

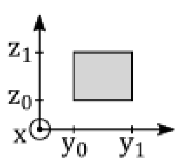
Each surface of the rectangular box shown is aligned with the xyz coordinate system. Two surfaces occupy identical rectangles in the planes x=0 and x=x_1=3 m. The other four surfaces are rectangles in y=y_0=1 m, y=y_1=5 m, z=z_0=1 m, and z=z_1=3 m. The surfaces in the yz plane each have area 8m^2. Those in the xy plane have area 12m^2 ,and those in the zx plane have area 6m^2. An electric field of magnitude 10 N/C has components in the y and z directions and is directed at 30° above the xy-plane (i.e. above the y axis.) What is the magnitude (absolute value) of the electric flux through a surface aligned parallel to the xz plane?[975]

   A. 3.549E+01 N· m^2/C
   B. 3.904E+01 N· m^2/C
   C. 4.294E+01 N· m^2/C
   D. 4.724E+01 N· m^2/C
   E. 5.196E+01 N· m^2/C

2. 

Each surface of the rectangular box shown is aligned with the xyz coordinate system. Two surfaces occupy identical rectangles in the planes x=0 and x=x_1=3 m. The other four surfaces are rectangles in y=y_0=1 m, y=y_1=5 m, z=z_0=1 m, and z=z_1=3 m. The surfaces in the yz plane each have area 8m^2. Those in the xy plane have area 12m^2 ,and those in the zx plane have area 6m^2. An electric field of magnitude 10 N/C has components in the y and z directions and is directed at 60° from the z-axis. What is the magnitude (absolute value) of the electric flux through a surface aligned parallel to the xz plane?[976]

   A. 4.724E+01 N· m^2/C
   B. 5.196E+01 N· m^2/C
   C. 5.716E+01 N· m^2/C
   D. 6.287E+01 N· m^2/C
   E. 6.916E+01 N· m^2/C

3. 

Each surface of the rectangular box shown is aligned with the xyz coordinate system. Two surfaces occupy identical rectangles in the planes x=0 and x=x_1=3 m. The other four surfaces are rectangles in y=y_0=1 m, y=y_1=5 m, z=z_0=1 m, and z=z_1=3 m. The surfaces in the yz plane each have area 8m^2. Those in the xy plane have area 12m^2 ,and those in the zx plane have area 6m^2. An electric field has the xyz components $(0, 8.7, 5.0)$ N/C. What is the magnitude (absolute value) of the electric flux through a surface aligned parallel to the xz plane?[977]

   A. 4.745E+01 N· m^2/C
   B. 5.220E+01 N· m^2/C
   C. 5.742E+01 N· m^2/C
   D. 6.316E+01 N· m^2/C
   E. 6.948E+01 N· m^2/C

4. What is the magnetude (absolute value) of the electric flux through a rectangle that occupies the z=0 plane with corners at (x,y)= (x=0, y=0), (x=3, y=0), (x=0, y=2), and (x=3, y=2), where x and y are measured in meters. The electric field is, $\vec{E} = 1y^1\hat{i} + 2x^3\hat{j} + 3y^2\hat{k}$. [978]

   A. 1.983E+01 V· m

   B. 2.182E+01 V· m

   C. 2.400E+01 V· m

   D. 2.640E+01 V· m

   E. 2.904E+01 V· m

5. Five concentric spherical shells have radius of exactly (1m, 2m, 3m, 4m, 5m).Each is uniformly charged with 5 nano-Coulombs. What is the magnitude of the electric field at a distance of 3.5 m from the center of the shells?[979]

   A. 1.102E+01 N/C

   B. 1.212E+01 N/C

   C. 1.333E+01 N/C

   D. 1.467E+01 N/C

   E. 1.613E+01 N/C

6. A non-conducting sphere of radius R=2 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar^2 (rxR) where a=1 nC· m^{-1}. What is the magnitude of the electric field at a distance of 1 m from the center? [980]

   A. 1.867E+01 N/C

   B. 2.053E+01 N/C

   C. 2.259E+01 N/C

   D. 2.485E+01 N/C

   E. 2.733E+01 N/C

99.1 Renditions

d_cp2.6 Q1

1. A non-conducting sphere of radius R=1.7 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.6}$ (rxR) where a=3 nC· m$^{-1.4}$. What is the magnitude of the electric field at a distance of 1.4 m from the center?

   A. 1.327E+02 N/C

   B. 1.460E+02 N/C

   C. 1.606E+02 N/C

   D. 1.767E+02 N/C

   E. 1.943E+02 N/C

d_cp2.6 Q2

1. A non-conducting sphere of radius R=2.2 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.4}$ (rxR) where a=3 nC· m$^{-1.6}$. What is the magnitude of the electric field at a distance of 0.86 m from the center?

   A. 4.874E+01 N/C

   B. 5.362E+01 N/C

C. 5.898E+01 N/C

D. 6.488E+01 N/C

E. 7.137E+01 N/C

d_cp2.6 Q3

1. A non-conducting sphere of radius R=3.5 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=2 nC$\cdot$ m$^{-1.5}$. What is the magnitude of the electric field at a distance of 2.2 m from the center?

   A. 3.604E+02 N/C

   B. 3.964E+02 N/C

   C. 4.360E+02 N/C

   D. 4.796E+02 N/C

   E. 5.276E+02 N/C

d_cp2.6 Q4

1. A non-conducting sphere of radius R=3.5 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.2}$ (rxR) where a=2 nC$\cdot$ m$^{-1.8}$. What is the magnitude of the electric field at a distance of 2.3 m from the center?

   A. 2.777E+02 N/C

   B. 3.055E+02 N/C

   C. 3.361E+02 N/C

   D. 3.697E+02 N/C

   E. 4.066E+02 N/C

d_cp2.6 Q5

1. A non-conducting sphere of radius R=2.9 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=2 nC$\cdot$ m$^{-1.5}$. What is the magnitude of the electric field at a distance of 1.5 m from the center?

   A. 1.383E+02 N/C

   B. 1.522E+02 N/C

   C. 1.674E+02 N/C

   D. 1.841E+02 N/C

   E. 2.025E+02 N/C

d_cp2.6 Q6

1. A non-conducting sphere of radius R=3.8 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=2 nC$\cdot$ m$^{-1.5}$. What is the magnitude of the electric field at a distance of 3.0 m from the center?

   A. 7.825E+02 N/C

   B. 8.607E+02 N/C

   C. 9.468E+02 N/C

   D. 1.041E+03 N/C

   E. 1.146E+03 N/C

d_cp2.6 Q7

1. A non-conducting sphere of radius R=3.3 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.4}$ (rxR) where a=2 nC$\cdot$ m$^{-1.6}$. What is the magnitude of the electric field at a distance of 1.5 m from the center?

   A. 1.123E+02 N/C

   B. 1.235E+02 N/C

   C. 1.358E+02 N/C

   D. 1.494E+02 N/C

   E. 1.644E+02 N/C

d_cp2.6 Q8

1. A non-conducting sphere of radius R=3.1 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.2}$ (rxR) where a=2 nC$\cdot$ m$^{-1.8}$. What is the magnitude of the electric field at a distance of 2.7 m from the center?

   A. 4.782E+02 N/C

   B. 5.260E+02 N/C

   C. 5.787E+02 N/C

   D. 6.365E+02 N/C

   E. 7.002E+02 N/C

d_cp2.6 Q9

1. A non-conducting sphere of radius R=1.7 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.2}$ (rxR) where a=3 nC$\cdot$ m$^{-1.8}$. What is the magnitude of the electric field at a distance of 0.71 m from the center?

   A. 3.797E+01 N/C

   B. 4.177E+01 N/C

   C. 4.595E+01 N/C

   D. 5.054E+01 N/C

   E. 5.560E+01 N/C

d_cp2.6 Q10

1. A non-conducting sphere of radius R=1.4 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.6}$ (rxR) where a=3 nC$\cdot$ m$^{-1.4}$. What is the magnitude of the electric field at a distance of 1.3 m from the center?

   A. 1.457E+02 N/C

   B. 1.603E+02 N/C

   C. 1.763E+02 N/C

   D. 1.939E+02 N/C

   E. 2.133E+02 N/C

d_cp2.6 Q11

1. A non-conducting sphere of radius R=3.9 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.4}$ (rxR) where a=2 nC· m$^{-1.6}$. What is the magnitude of the electric field at a distance of 2.6 m from the center?

   A. 3.821E+02 N/C

   B. 4.203E+02 N/C

   C. 4.624E+02 N/C

   D. 5.086E+02 N/C

   E. 5.594E+02 N/C

d_cp2.6 Q12

1. A non-conducting sphere of radius R=1.5 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=2 nC· m$^{-1.5}$. What is the magnitude of the electric field at a distance of 0.73 m from the center?

   A. 2.285E+01 N/C

   B. 2.514E+01 N/C

   C. 2.765E+01 N/C

   D. 3.042E+01 N/C

   E. 3.346E+01 N/C

d_cp2.6 Q13

1. A non-conducting sphere of radius R=3.7 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.4}$ (rxR) where a=2 nC· m$^{-1.6}$. What is the magnitude of the electric field at a distance of 3.1 m from the center?

   A. 6.411E+02 N/C

   B. 7.052E+02 N/C

   C. 7.757E+02 N/C

   D. 8.533E+02 N/C

   E. 9.386E+02 N/C

d_cp2.6 Q14

1. A non-conducting sphere of radius R=3.8 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.7}$ (rxR) where a=3 nC· m$^{-1.3}$. What is the magnitude of the electric field at a distance of 3.1 m from the center?

   A. 1.390E+03 N/C

   B. 1.530E+03 N/C

   C. 1.682E+03 N/C

   D. 1.851E+03 N/C

   E. 2.036E+03 N/C

d_cp2.6 Q15

1. A non-conducting sphere of radius R=1.7 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=3 nC$\cdot$ m$^{-1.5}$. What is the magnitude of the electric field at a distance of 0.64 m from the center?

   A. 2.039E+01 N/C

   B. 2.243E+01 N/C

   C. 2.467E+01 N/C

   D. 2.714E+01 N/C

   E. 2.985E+01 N/C

d_cp2.6 Q16

1. A non-conducting sphere of radius R=1.2 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.6}$ (rxR) where a=2 nC$\cdot$ m$^{-1.4}$. What is the magnitude of the electric field at a distance of 0.76 m from the center?

   A. 2.406E+01 N/C

   B. 2.646E+01 N/C

   C. 2.911E+01 N/C

   D. 3.202E+01 N/C

   E. 3.522E+01 N/C

d_cp2.6 Q17

1. A non-conducting sphere of radius R=2.5 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.8}$ (rxR) where a=2 nC$\cdot$ m$^{-1.2}$. What is the magnitude of the electric field at a distance of 1.7 m from the center?

   A. 2.079E+02 N/C

   B. 2.287E+02 N/C

   C. 2.516E+02 N/C

   D. 2.767E+02 N/C

   E. 3.044E+02 N/C

d_cp2.6 Q18

1. A non-conducting sphere of radius R=2.9 m has a non-uniform charge density that varies with the distnce from its center as given by ρ(r)=ar$^{1.5}$ (rxR) where a=3 nC$\cdot$ m$^{-1.5}$. What is the magnitude of the electric field at a distance of 1.7 m from the center?

   A. 2.579E+02 N/C

   B. 2.837E+02 N/C

   C. 3.121E+02 N/C

   D. 3.433E+02 N/C

   E. 3.776E+02 N/C

d_cp2.6 Q19

1. A non-conducting sphere of radius R=3.0 m has a non-uniform charge density that varies with the distnce from its center as given by $\rho(r)=ar^{1.2}$ (rxR) where a=2 nC$\cdot$ m$^{-1.8}$. What is the magnitude of the electric field at a distance of 2.1 m from the center?

   A. 2.274E+02 N/C

   B. 2.501E+02 N/C

   C. 2.751E+02 N/C

   D. 3.026E+02 N/C

   E. 3.329E+02 N/C

100 d_cp2.7

1. A 3 C charge is separated from a 5 C charge by distance of 10 cm. What is the work done by increasing this separation to 15 cm?[981]

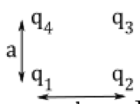
   A. 4.494E-07 J

   B. 4.943E-07 J

   C. 5.437E-07 J

   D. 5.981E-07 J

   E. 6.579E-07 J



2. Four charges lie at the corners of a 1 cm by 1 cm square as shown (i.e., "a"="b"=1 cm.) The charges are q_1=2 µ C, q_2=3 µ C, q_3=4 µ C, and q_4=5 µ C. How much work was required to assemble these four charges from infinity?[982]

   A. 3.945E+01 J

   B. 4.339E+01 J

   C. 4.773E+01 J

   D. 5.251E+01 J

   E. 5.776E+01 J

3. A 12.0 V battery can move 5,000 C of charge. How many Joules does it deliver?[983]

   A. 6.000E+04 J

   B. 6.600E+04 J

   C. 7.260E+04 J

   D. 7.986E+04 J

   E. 8.785E+04 J

4. When a 12 V battery operates a 30 W bulb, how many electrons pass through it each second?[984]

   A. 1.560E+19 electrons

   B. 1.716E+19 electrons

   C. 1.888E+19 electrons

   D. 2.077E+19 electrons

   E. 2.285E+19 electrons

5. Calculate the final speed of a free electron accelerated from rest through a potential difference of 100 V.[985]

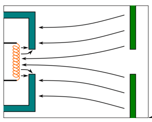
   A. 4.902E+06 m/s

   B. 5.392E+06 m/s

   C. 5.931E+06 m/s

   D. 6.524E+06 m/s

   E. 7.176E+06 m/s

6. An electron gun has parallel plates separated by 4 cm and gives electrons 25 keV of energy. What force would the field between the plates exert on a 0.5 µ C charge that gets between the plates?[986]

   A. 3.125E-01 N

   B. 3.437E-01 N

   C. 3.781E-01 N

   D. 4.159E-01 N

   E. 4.575E-01 N

7. Assume that a 2 nC charge is situated at the origin. Calculate the the magnitude (absolute value) of the potential difference between points P_1 and P_2 where the polar coordinates (r,φ) of P_1 are (4 cm, 0°) and P_2 is at (12 cm, 24°).[987]

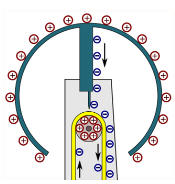
   A. 2.046E+02 V

   B. 2.251E+02 V

   C. 2.476E+02 V

   D. 2.723E+02 V

   E. 2.996E+02 V

8. A Van de Graff generator has a 25 cm diameter metal sphere that produces 100 kV near its surface. What is the excess charge on the sphere?[988]

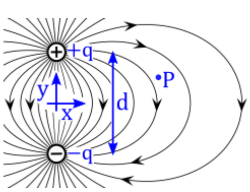
   A. 1.149E+00 µ C

   B. 1.264E+00 µ C

   C. 1.391E+00 µ C

   D. 1.530E+00 µ C

   E. 1.683E+00 µ C

9. 

A diploe has a charge magnitude of q=3 nC and a separation distance of d=4 cm. The dipole is centered at the origin and points in the y-direction as shown. What is the electric potential at the point (x=3 cm, y=2 cm)? Note that following the textbook's example, the y-value of the field point at 2 cm matches the disance of the positive charge above the x-axis.[989]

   A. 3.268E+02 V

B. 3.595E+02 V

C. 3.955E+02 V

D. 4.350E+02 V

E. 4.785E+02 V

10. If a 10 nC charge is situated at the origin, the equipotential surface for V(x,y,z)=100 V is $x^2 + y^2 + z^2 = R^2$, where R= [990]

    A. 8.988E-01 m

    B. 9.886E-01 m

    C. 1.087E+00 m

    D. 1.196E+00 m

    E. 1.316E+00 m

11. Two large parallel conducting plates are separated by 6.5 mm. Equal and opposite surface charges of 6.810E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 100 V?[991]

    A. 8.549E-01 mm

    B. 9.831E-01 mm

    C. 1.131E+00 mm

    D. 1.300E+00 mm

    E. 1.495E+00 mm

100.1 Renditions

d_cp2.7 Q1

1. Two large parallel conducting plates are separated by 7.57 mm. Equal and opposite surface charges of 7.830E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 57 V?

    A. 6.446E-01 mm

    B. 7.412E-01 mm

    C. 8.524E-01 mm

    D. 9.803E-01 mm

    E. 1.127E+00 mm

d_cp2.7 Q2

1. Two large parallel conducting plates are separated by 8.7 mm. Equal and opposite surface charges of 7.220E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 67 V?

    A. 4.698E-01 mm

    B. 5.402E-01 mm

    C. 6.213E-01 mm

    D. 7.145E-01 mm

    E. 8.216E-01 mm

d_cp2.7 Q3

1. Two large parallel conducting plates are separated by 7.93 mm. Equal and opposite surface charges of 7.720E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 77 V?

   A. 6.678E-01 mm

   B. 7.679E-01 mm

   C. 8.831E-01 mm

   D. 1.016E+00 mm

   E. 1.168E+00 mm

d_cp2.7 Q4

1. Two large parallel conducting plates are separated by 7.81 mm. Equal and opposite surface charges of 7.440E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 80 V?

   A. 9.521E-01 mm

   B. 1.095E+00 mm

   C. 1.259E+00 mm

   D. 1.448E+00 mm

   E. 1.665E+00 mm

d_cp2.7 Q5

1. Two large parallel conducting plates are separated by 6.86 mm. Equal and opposite surface charges of 7.540E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 79 V?

   A. 6.100E-01 mm

   B. 7.015E-01 mm

   C. 8.067E-01 mm

   D. 9.277E-01 mm

   E. 1.067E+00 mm

d_cp2.7 Q6

1. Two large parallel conducting plates are separated by 8.0 mm. Equal and opposite surface charges of 7.520E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 61 V?

   A. 5.431E-01 mm

   B. 6.245E-01 mm

   C. 7.182E-01 mm

   D. 8.260E-01 mm

   E. 9.499E-01 mm

d_cp2.7 Q7

1. Two large parallel conducting plates are separated by 7.01 mm. Equal and opposite surface charges of 7.330E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 55 V?

   A. 3.799E-01 mm

   B. 4.368E-01 mm

   C. 5.024E-01 mm

   D. 5.777E-01 mm

   E. 6.644E-01 mm

d_cp2.7 Q8

1. Two large parallel conducting plates are separated by 6.95 mm. Equal and opposite surface charges of 7.360E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 83 V?

   A. 6.565E-01 mm

   B. 7.550E-01 mm

   C. 8.683E-01 mm

   D. 9.985E-01 mm

   E. 1.148E+00 mm

d_cp2.7 Q9

1. Two large parallel conducting plates are separated by 9.71 mm. Equal and opposite surface charges of 7.550E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 73 V?

   A. 7.444E-01 mm

   B. 8.561E-01 mm

   C. 9.845E-01 mm

   D. 1.132E+00 mm

   E. 1.302E+00 mm

d_cp2.7 Q10

1. Two large parallel conducting plates are separated by 6.67 mm. Equal and opposite surface charges of 7.080E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 60 V?

   A. 6.525E-01 mm

   B. 7.504E-01 mm

   C. 8.629E-01 mm

   D. 9.923E-01 mm

   E. 1.141E+00 mm

d_cp2.7 Q11

1. Two large parallel conducting plates are separated by 7.14 mm. Equal and opposite surface charges of 7.660E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 61 V?

   A. 4.031E-01 mm

   B. 4.636E-01 mm

   C. 5.332E-01 mm

   D. 6.131E-01 mm

   E. 7.051E-01 mm

d_cp2.7 Q12

1. Two large parallel conducting plates are separated by 9.58 mm. Equal and opposite surface charges of 7.360E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 84 V?

   A. 6.644E-01 mm

   B. 7.641E-01 mm

   C. 8.787E-01 mm

   D. 1.011E+00 mm

   E. 1.162E+00 mm

d_cp2.7 Q13

1. Two large parallel conducting plates are separated by 7.42 mm. Equal and opposite surface charges of 7.760E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 61 V?

   A. 3.979E-01 mm

   B. 4.576E-01 mm

   C. 5.263E-01 mm

   D. 6.052E-01 mm

   E. 6.960E-01 mm

d_cp2.7 Q14

1. Two large parallel conducting plates are separated by 7.83 mm. Equal and opposite surface charges of 7.530E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 86 V?

   A. 8.793E-01 mm

   B. 1.011E+00 mm

   C. 1.163E+00 mm

   D. 1.337E+00 mm

   E. 1.538E+00 mm

d_cp2.7 Q15

1. Two large parallel conducting plates are separated by 7.77 mm. Equal and opposite surface charges of 7.280E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 70 V?

   A. 8.514E-01 mm

   B. 9.791E-01 mm

   C. 1.126E+00 mm

   D. 1.295E+00 mm

   E. 1.489E+00 mm

d_cp2.7 Q16

1. Two large parallel conducting plates are separated by 7.77 mm. Equal and opposite surface charges of 7.310E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 73 V?

   A. 5.814E-01 mm

   B. 6.686E-01 mm

   C. 7.689E-01 mm

   D. 8.842E-01 mm

   E. 1.017E+00 mm

d_cp2.7 Q17

1. Two large parallel conducting plates are separated by 8.13 mm. Equal and opposite surface charges of 7.540E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 92 V?

   A. 9.394E-01 mm

   B. 1.080E+00 mm

   C. 1.242E+00 mm

   D. 1.429E+00 mm

   E. 1.643E+00 mm

d_cp2.7 Q18

1. Two large parallel conducting plates are separated by 9.87 mm. Equal and opposite surface charges of 7.610E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 66 V?

   A. 4.391E-01 mm

   B. 5.049E-01 mm

   C. 5.806E-01 mm

   D. 6.677E-01 mm

   E. 7.679E-01 mm

d_cp2.7 Q19

1. Two large parallel conducting plates are separated by 9.6 mm. Equal and opposite surface charges of 7.610E-07 C/m^2 exist on the surfaces between the plates. What is the distance between equipotential planes which differ by 71 V?

   A. 4.723E-01 mm

   B. 5.432E-01 mm

   C. 6.246E-01 mm

   D. 7.183E-01 mm

   E. 8.261E-01 mm

101 d_cp2.8

1. An empty parallel-plate capacitor with metal plates has an area of 1.0 m^2, separated by 1.0 mm. How much charge does it store if the voltage is 3.000E+03 V?[992]

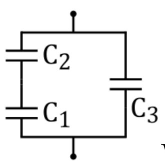
   A. 2.195E+01 µ C

   B. 2.415E+01 µ C

   C. 2.656E+01 µ C

   D. 2.922E+01 µ C

   E. 3.214E+01 µ C

2. 

What is the net capacitance if C_1=1 µ F, C_2=5 µ F, and C_3=8 µ F in the configuration shown?[993]

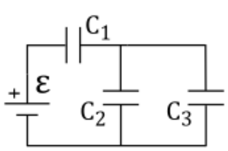
   A. 8.030E+00 µ F

   B. 8.833E+00 µ F

   C. 9.717E+00 µ F

   D. 1.069E+01 µ F

   E. 1.176E+01 µ F

3. 

In the figure shown C_1=12 µ F, C_2=2 µ F, and C_3=4 µ F. The voltage source provides ε =12 V. What is the charge on C_1?[994]

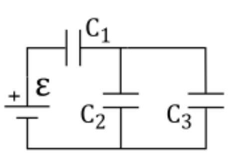
   A. 3.606E+01 µ C

   B. 3.967E+01 µ C

   C. 4.364E+01 µ C

   D. 4.800E+01 µ C

   E. 5.280E+01 µ C

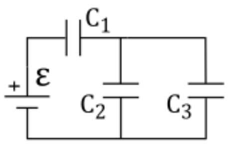
4. 

In the figure shown C_1=12 µ F, C_2=2 µ F, and C_3=4 µ F. The voltage source provides ε =12 V. What is the energy stored in C_2?[995]

A. 1.600E+01 μ J
B. 1.760E+01 μ J
C. 1.936E+01 μ J
D. 2.130E+01 μ J
E. 2.343E+01 μ J

101.1 Renditions

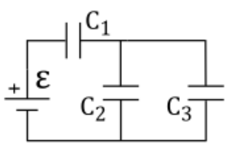
d_cp2.8 Q1

1. 

In the figure shown C_1=15.5 μ F, C_2=2.72 μ F, and C_3=5.1 μ F. The voltage source provides ε =5.89 V. What is the energy stored in C_2?

A. 8.800E+00 μ J
B. 9.680E+00 μ J
C. 1.065E+01 μ J
D. 1.171E+01 μ J
E. 1.288E+01 μ J

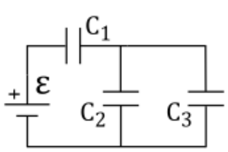
d_cp2.8 Q2

1. 

In the figure shown C_1=17.6 μ F, C_2=2.12 μ F, and C_3=4.72 μ F. The voltage source provides ε =5.35 V. What is the energy stored in C_2?

A. 6.750E+00 μ J
B. 7.425E+00 μ J
C. 8.168E+00 μ J
D. 8.984E+00 μ J
E. 9.883E+00 μ J

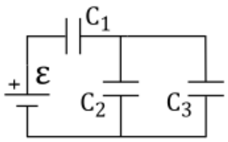
d_cp2.8 Q3

1. 

In the figure shown C_1=18.1 μ F, C_2=2.89 μ F, and C_3=4.2 μ F. The voltage source provides ε =9.19 V. What is the energy stored in C_2?

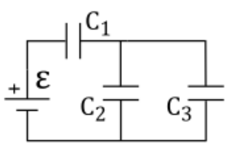
A. 1.303E+01 μ J
B. 1.434E+01 μ J
C. 1.577E+01 μ J
D. 1.735E+01 μ J
E. 1.908E+01 μ J

d_cp2.8 Q4

1. 

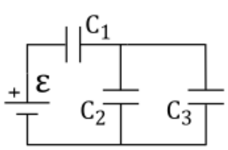
In the figure shown C_1=15.4 μ F, C_2=2.6 μ F, and C_3=5.17 μ F. The voltage source provides ε =9.6 V. What is the energy stored in C_2?
    A. 1.508E+01 μ J
    B. 1.659E+01 μ J
    C. 1.825E+01 μ J
    D. 2.007E+01 μ J
    E. 2.208E+01 μ J

d_cp2.8 Q5

1. 

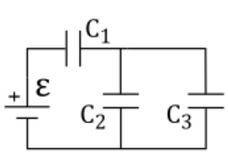
In the figure shown C_1=17.2 μ F, C_2=2.71 μ F, and C_3=5.28 μ F. The voltage source provides ε =13.2 V. What is the energy stored in C_2?
    A. 2.443E+01 μ J
    B. 2.687E+01 μ J
    C. 2.955E+01 μ J
    D. 3.251E+01 μ J
    E. 3.576E+01 μ J

d_cp2.8 Q6

1. 

In the figure shown C_1=20.7 μ F, C_2=2.79 μ F, and C_3=5.18 μ F. The voltage source provides ε =15.0 V. What is the energy stored in C_2?
    A. 2.064E+01 μ J
    B. 2.270E+01 μ J
    C. 2.497E+01 μ J
    D. 2.747E+01 μ J
    E. 3.022E+01 μ J

d_cp2.8 Q7

1. 

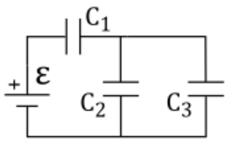
In the figure shown C_1=16.5 μ F, C_2=2.7 μ F, and C_3=4.82 μ F. The voltage source provides ε =15.7 V. What is the energy stored in C_2?
    A. 2.188E+01 μ J
    B. 2.407E+01 μ J

C. 2.647E+01 μ J

D. 2.912E+01 μ J

E. 3.203E+01 μ J

d_cp2.8 Q8

1. 

In the figure shown C_1=18.2 μ F, C_2=2.44 μ F, and C_3=5.0 μ F. The voltage source provides ε =7.78 V. What is the energy stored in C_2?

A. 1.225E+01 μ J

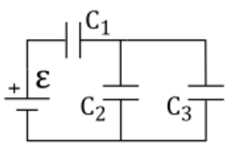
B. 1.347E+01 μ J

C. 1.482E+01 μ J

D. 1.630E+01 μ J

E. 1.793E+01 μ J

d_cp2.8 Q9

1. 

In the figure shown C_1=16.7 μ F, C_2=2.26 μ F, and C_3=4.53 μ F. The voltage source provides ε =10.7 V. What is the energy stored in C_2?

A. 1.292E+01 μ J

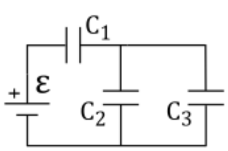
B. 1.421E+01 μ J

C. 1.563E+01 μ J

D. 1.719E+01 μ J

E. 1.891E+01 μ J

d_cp2.8 Q10

1. 

In the figure shown C_1=18.7 μ F, C_2=2.15 μ F, and C_3=4.88 μ F. The voltage source provides ε =11.9 V. What is the energy stored in C_2?

A. 1.270E+01 μ J

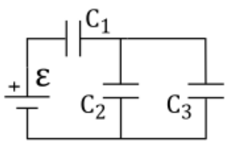
B. 1.397E+01 μ J

C. 1.537E+01 μ J

D. 1.690E+01 μ J

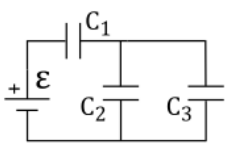
E. 1.859E+01 μ J

d_cp2.8 Q11

1. 

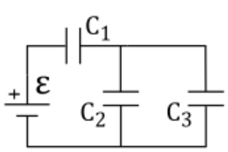
In the figure shown C_1=15.7 μ F, C_2=2.87 μ F, and C_3=5.46 μ F. The voltage source provides ε =5.38 V. What is the energy stored in C_2?
   A. 6.890E+00 μ J
   B. 7.579E+00 μ J
   C. 8.337E+00 μ J
   D. 9.171E+00 μ J
   E. 1.009E+01 μ J

d_cp2.8 Q12

1. 

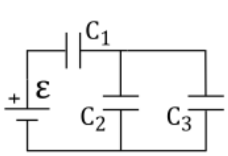
In the figure shown C_1=17.7 μ F, C_2=2.48 μ F, and C_3=4.68 μ F. The voltage source provides ε =12.7 V. What is the energy stored in C_2?
   A. 2.242E+01 μ J
   B. 2.467E+01 μ J
   C. 2.713E+01 μ J
   D. 2.985E+01 μ J
   E. 3.283E+01 μ J

d_cp2.8 Q13

1. 

In the figure shown C_1=16.3 μ F, C_2=2.17 μ F, and C_3=4.67 μ F. The voltage source provides ε =8.35 V. What is the energy stored in C_2?
   A. 8.718E+00 μ J
   B. 9.589E+00 μ J
   C. 1.055E+01 μ J
   D. 1.160E+01 μ J
   E. 1.276E+01 μ J

d_cp2.8 Q14

1. 

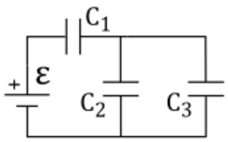
In the figure shown C_1=18.1 μ F, C_2=2.13 μ F, and C_3=5.48 μ F. The voltage source provides ε =14.6 V. What is the energy stored in C_2?
   A. 1.645E+01 μ J
   B. 1.809E+01 μ J

C. 1.990E+01 µ J

D. 2.189E+01 µ J

E. 2.408E+01 µ J

d_cp2.8 Q15

1. 

In the figure shown C_1=16.1 µ F, C_2=2.14 µ F, and C_3=5.76 µ F. The voltage source provides ε =8.35 V. What is the energy stored in C_2?

A. 1.199E+01 µ J

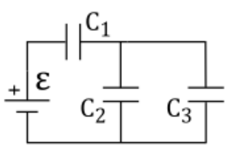
B. 1.319E+01 µ J

C. 1.450E+01 µ J

D. 1.595E+01 µ J

E. 1.755E+01 µ J

d_cp2.8 Q16

1. 

In the figure shown C_1=19.2 µ F, C_2=2.71 µ F, and C_3=5.52 µ F. The voltage source provides ε =15.0 V. What is the energy stored in C_2?

A. 2.138E+01 µ J

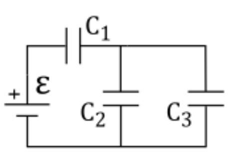
B. 2.352E+01 µ J

C. 2.587E+01 µ J

D. 2.845E+01 µ J

E. 3.130E+01 µ J

d_cp2.8 Q17

1. 

In the figure shown C_1=19.2 µ F, C_2=2.24 µ F, and C_3=4.93 µ F. The voltage source provides ε =11.7 V. What is the energy stored in C_2?

A. 1.303E+01 µ J

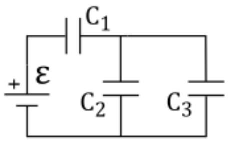
B. 1.434E+01 µ J

C. 1.577E+01 µ J

D. 1.735E+01 µ J

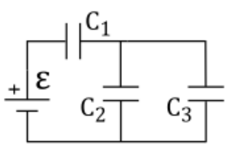
E. 1.908E+01 µ J

d_cp2.8 Q18

1. 

In the figure shown C_1=16.9 μ F, C_2=2.86 μ F, and C_3=5.1 μ F. The voltage source provides ε =9.98 V. What is the energy stored in C_2?
    - A. 1.764E+01 μ J
    - **B. 1.940E+01 μ J**
    - C. 2.134E+01 μ J
    - D. 2.348E+01 μ J
    - E. 2.583E+01 μ J

d_cp2.8 Q19

1. 

In the figure shown C_1=21.1 μ F, C_2=2.69 μ F, and C_3=4.78 μ F. The voltage source provides ε =12.8 V. What is the energy stored in C_2?
    - A. 2.102E+01 μ J
    - B. 2.312E+01 μ J
    - **C. 2.543E+01 μ J**
    - D. 2.797E+01 μ J
    - E. 3.077E+01 μ J

102 d_cp2.9

1. What is the average current involved when a truck battery sets in motion 720 C of charge in 4 s while starting an engine? [996]
    - A. 1.229E+02 A
    - B. 1.352E+02 A
    - C. 1.488E+02 A
    - D. 1.636E+02 A
    - **E. 1.800E+02 A**
2. The charge passing a plane intersecting a wire is $Q(t) = Q_0\left(1 - e^{-t/\tau}\right)$, where Q_0=10 C and τ =0.02 s. What is the current at t =1.000E-02 s?[997]
    - A. 2.506E+02 A
    - B. 2.757E+02 A
    - **C. 3.033E+02 A**
    - D. 3.336E+02 A
    - E. 3.670E+02 A
3. Calculate the drift speed of electrons in a copper wire with a diameter of 2.053 mm carrying a 20 A current, given that there is one free electron per copper atom. The density of copper is 8.80×10^3 kg/m^3 and the atomic mass of copper is 63.54 g/mol. Avagadro's number is 6.02×10^{23} atoms/mol.[998]

A. 4.111E-04 m/s

B. 4.522E-04 m/s

C. 4.974E-04 m/s

D. 5.472E-04 m/s

E. 6.019E-04 m/s

4. A make-believe metal has a density of 8.800E+03 kg/m^3 and an atomic mass of 63.54 g/mol. Taking Avogadro's number to be 6.020E+23 atoms/mol and assuming one free electron per atom, calculate the number of free electrons per cubic meter.[999]

A. 5.695E+28 e$^-$/m^3

B. 6.264E+28 e$^-$/m^3

C. 6.890E+28 e$^-$/m^3

D. 7.579E+28 e$^-$/m^3

E. 8.337E+28 e$^-$/m^3

5. A device requires consumes 100 W of power and requires 0.87 A of current which is supplied by a single core 10-guage (2.588 mm diameter) wire. Find the magnitude of the average current density.[1000]

A. 1.367E+05 A/m^2

B. 1.504E+05 A/m^2

C. 1.654E+05 A/m^2

D. 1.819E+05 A/m^2

E. 2.001E+05 A/m^2

6. Calculate the resistance of a 12-gauge copper wire that is 5 m long and carries a current of 10 mA. The resistivity of copper is 1.680E-08 $\Omega \cdot$ m and 12-gauge wire as a cross-sectional area of 3.31 mm^2.[1001]

A. 1.907E-02 Ω

B. 2.097E-02 Ω

C. 2.307E-02 Ω

D. 2.538E-02 Ω

E. 2.792E-02 Ω

7. Calculate the electric field in a 12-gauge copper wire that is 5 m long and carries a current of 10 mA. The resistivity of copper is 1.680E-08 $\Omega \cdot$ m and 12-gauge wire as a cross-sectional area of 3.31 mm^2.[1002]

A. 5.076E-05 V/m

B. 5.583E-05 V/m

C. 6.141E-05 V/m

D. 6.756E-05 V/m

E. 7.431E-05 V/m

8. Imagine a substance could be made into a very hot filament. Suppose the resitance is 3.5 Ω at a temperature of 20°C and that the temperature coefficient of expansion is 4.500E-03 $(°C)^{-1}$). What is the resistance at a temperature of 2.850E+03 °C?[1003]

A. 4.578E+01 Ω

B. 4.807E+01 Ω

C. 5.048E+01 Ω

D. 5.300E+01 Ω

E. 5.565E+01 Ω

9. A DC winch moter draws 20 amps at 115 volts as it lifts a 4.900E+03 N weight at a constant speed of 0.333 m/s. Assuming that all the electrical power is either converted into gravitational potential energy or ohmically heats the motor's coils, calculate the coil's resistance.[1004]
   - A. 1.255E+00 Ω
   - B. 1.381E+00 Ω
   - C. 1.519E+00 Ω
   - **D. 1.671E+00 Ω**
   - E. 1.838E+00 Ω

10. What is consumer cost to operate one 100-W incandescent bulb for 3 hours per day for 1 year (365 days) if the cost of electricity is $0.1 per kilowatt-hour?[1005]
   - A. $8.227E+00
   - B. $9.050E+00
   - C. $9.955E+00
   - **D. $1.095E+01**
   - E. $1.205E+01

102.1 Renditions

d_cp2.9 Q1

1. What is consumer cost to operate one 77-W incandescent bulb for 12 hours per day for 1 year (365 days) if the cost of electricity is $0.134 per kilowatt-hour?
   - A. $3.087E+01
   - B. $3.395E+01
   - C. $3.735E+01
   - D. $4.108E+01
   - **E. $4.519E+01**

d_cp2.9 Q2

1. What is consumer cost to operate one 102-W incandescent bulb for 6 hours per day for 1 year (365 days) if the cost of electricity is $0.127 per kilowatt-hour?
   - A. $2.131E+01
   - B. $2.345E+01
   - C. $2.579E+01
   - **D. $2.837E+01**
   - E. $3.121E+01

d_cp2.9 Q3

1. What is consumer cost to operate one 65-W incandescent bulb for 12 hours per day for 1 year (365 days) if the cost of electricity is $0.134 per kilowatt-hour?
   - A. $2.866E+01
   - B. $3.153E+01
   - C. $3.468E+01
   - **D. $3.815E+01**
   - E. $4.196E+01

d_cp2.9 Q4

1. What is consumer cost to operate one 89-W incandescent bulb for 10 hours per day for 1 year (365 days) if the cost of electricity is $0.141 per kilowatt-hour?
   - A. $3.785E+01
   - B. $4.164E+01
   - **C. $4.580E+01**
   - D. $5.038E+01
   - E. $5.542E+01

d_cp2.9 Q5

1. What is consumer cost to operate one 87-W incandescent bulb for 11 hours per day for 1 year (365 days) if the cost of electricity is $0.117 per kilowatt-hour?
   - A. $2.791E+01
   - B. $3.071E+01
   - C. $3.378E+01
   - D. $3.715E+01
   - **E. $4.087E+01**

d_cp2.9 Q6

1. What is consumer cost to operate one 73-W incandescent bulb for 11 hours per day for 1 year (365 days) if the cost of electricity is $0.113 per kilowatt-hour?
   - **A. $3.312E+01**
   - B. $3.643E+01
   - C. $4.007E+01
   - D. $4.408E+01
   - E. $4.849E+01

d_cp2.9 Q7

1. What is consumer cost to operate one 57-W incandescent bulb for 11 hours per day for 1 year (365 days) if the cost of electricity is $0.146 per kilowatt-hour?
   - A. $2.282E+01
   - B. $2.510E+01
   - C. $2.761E+01
   - D. $3.038E+01
   - **E. $3.341E+01**

d_cp2.9 Q8

1. What is consumer cost to operate one 74-W incandescent bulb for 9 hours per day for 1 year (365 days) if the cost of electricity is $0.119 per kilowatt-hour?
   - A. $1.976E+01
   - B. $2.173E+01
   - C. $2.391E+01
   - D. $2.630E+01
   - **E. $2.893E+01**

d_cp2.9 Q9

1. What is consumer cost to operate one 91-W incandescent bulb for 10 hours per day for 1 year (365 days) if the cost of electricity is $0.131 per kilowatt-hour?
   - A. $2.972E+01
   - B. $3.269E+01
   - C. $3.596E+01
   - D. $3.956E+01
   - **E. $4.351E+01**

d_cp2.9 Q10

1. What is consumer cost to operate one 56-W incandescent bulb for 6 hours per day for 1 year (365 days) if the cost of electricity is $0.13 per kilowatt-hour?
   - A. $1.198E+01
   - B. $1.318E+01
   - C. $1.449E+01
   - **D. $1.594E+01**
   - E. $1.754E+01

d_cp2.9 Q11

1. What is consumer cost to operate one 59-W incandescent bulb for 10 hours per day for 1 year (365 days) if the cost of electricity is $0.132 per kilowatt-hour?
   - A. $2.584E+01
   - **B. $2.843E+01**
   - C. $3.127E+01
   - D. $3.440E+01
   - E. $3.784E+01

d_cp2.9 Q12

1. What is consumer cost to operate one 79-W incandescent bulb for 9 hours per day for 1 year (365 days) if the cost of electricity is $0.142 per kilowatt-hour?
   - A. $2.517E+01
   - B. $2.769E+01
   - C. $3.046E+01
   - D. $3.350E+01
   - **E. $3.685E+01**

d_cp2.9 Q13

1. What is consumer cost to operate one 115-W incandescent bulb for 12 hours per day for 1 year (365 days) if the cost of electricity is $0.128 per kilowatt-hour?
   - A. $5.328E+01
   - B. $5.861E+01
   - **C. $6.447E+01**
   - D. $7.092E+01
   - E. $7.801E+01

d_cp2.9 Q14

1. What is consumer cost to operate one 102-W incandescent bulb for 5 hours per day for 1 year (365 days) if the cost of electricity is $0.149 per kilowatt-hour?
   - A. $2.292E+01
   - B. $2.521E+01
   - **C. $2.774E+01**
   - D. $3.051E+01
   - E. $3.356E+01

d_cp2.9 Q15

1. What is consumer cost to operate one 77-W incandescent bulb for 12 hours per day for 1 year (365 days) if the cost of electricity is $0.124 per kilowatt-hour?
   - A. $3.142E+01
   - B. $3.456E+01
   - C. $3.802E+01
   - **D. $4.182E+01**
   - E. $4.600E+01

d_cp2.9 Q16

1. What is consumer cost to operate one 76-W incandescent bulb for 9 hours per day for 1 year (365 days) if the cost of electricity is $0.144 per kilowatt-hour?
   - **A. $3.595E+01**
   - B. $3.955E+01
   - C. $4.350E+01
   - D. $4.785E+01
   - E. $5.264E+01

d_cp2.9 Q17

1. What is consumer cost to operate one 104-W incandescent bulb for 6 hours per day for 1 year (365 days) if the cost of electricity is $0.136 per kilowatt-hour?
   - A. $2.116E+01
   - B. $2.327E+01
   - C. $2.560E+01
   - D. $2.816E+01
   - **E. $3.098E+01**

d_cp2.9 Q18

1. What is consumer cost to operate one 69-W incandescent bulb for 7 hours per day for 1 year (365 days) if the cost of electricity is $0.117 per kilowatt-hour?
   - **A. $2.063E+01**
   - B. $2.269E+01
   - C. $2.496E+01
   - D. $2.745E+01
   - E. $3.020E+01

d_cp2.9 Q19

1. What is consumer cost to operate one 105-W incandescent bulb for 11 hours per day for 1 year (365 days) if the cost of electricity is \$0.131 per kilowatt-hour?

    A. \$5.021E+01

    B. \$5.523E+01

    C. \$6.075E+01

    D. \$6.682E+01

    E. \$7.351E+01

103 d_cp2.gaussC

1. If Gauss' law can be reduced to an algebraic expression that easily calculates the electric field ($\varepsilon_0 EA^* = \rho V^*$), $\vec{E}$ was calculated inside the Gaussian surface[1006]

    A. True

    B. False

2. If Gauss' law can be reduced to an algebraic expression that easily calculates the electric field ($\varepsilon_0 EA^* = \rho V^*$), $\vec{E}$ was calculated outside the Gaussian surface[1007]

    A. True

    B. False

3. If Gauss' law can be reduced to an algebraic expression that easily calculates the electric field ($\varepsilon_0 EA^* = \rho V^*$), $\vec{E}$ was calculated on the Gaussian surface[1008]

    A. True

    B. False

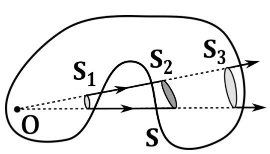
4. If Gauss' law can be reduced to an algebraic expression that easily calculates the electric field ($\varepsilon_0 EA^* = \rho V^*$), $\vec{E}$ had[1009]

    A. constant direction and magnitude over the entire Gaussian surface

    B. constant magnitude over a portion of the Gaussian surface

    C. constant direction over a portion of the Gaussian surface

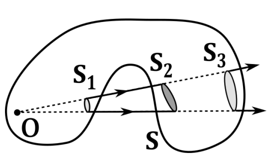
    D. constant in direction over the entire Gaussian surface

5. 

In this description of the flux element, $d\vec{S} = \hat{n} dA_j$ (j=1,2,3) where $\hat{n}$ is the outward unit normal, and a positive charge is assumed at point "'O"', inside the Gaussian surface shown. The field lines exit at S_1 and S_3 but enter at S_2. In this figure, $dA_1 = dA_3$[1010]

    A. True

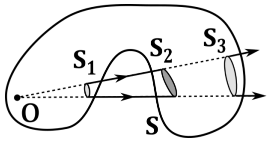
    B. False

6. 

In this description of the flux element, $d\vec{S} = \hat{n} dA_j$ (j=1,2,3) where $\hat{n}$ is the outward unit normal, and a positive charge is assumed at point "'O"', inside the Gaussian surface shown. The field lines exit at S_1 and S_3 but enter at S_2. In this figure, $\vec{E}_1 \cdot d\vec{A}_1 = \vec{E}_3 \cdot d\vec{A}_3$ [1011]

A. True

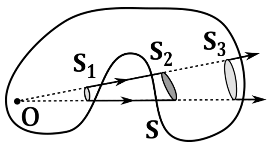
B. False

7. 

In this description of the flux element, $d\vec{S} = \hat{n} dA_j$ (j=1,2,3) where $\hat{n}$ is the outward unit normal, and a positive charge is assumed at point "'O"', inside the Gaussian surface shown. The field lines exit at S_1 and S_3 but enter at S_2. In this figure, $\vec{E}_1 \cdot d\vec{A}_1 + \vec{E}_3 \cdot d\vec{A}_3 = 0$[1012]

A. True

B. False

8. 

In this description of the flux element, $d\vec{S} = \hat{n} dA_j$ (j=1,2,3) where $\hat{n}$ is the outward unit normal, and a positive charge is assumed at point "'O"', inside the Gaussian surface shown. The field lines exit at S_1 and S_3 but enter at S_2. In this figure, $\vec{E}_1 \cdot d\vec{A}_1 + \vec{E}_2 \cdot d\vec{A}_3 = 0$ [1013]

A. True

B. False