template:Study

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Contents

1 up1-05

1. Two teenagers are pulling on ropes attached to a tree. The angle between the ropes is 30°. David pulls with a force of 4.000E+02 N, and Stephanie pulls with a force of 3.000E+02 N. Find magnitude of the net force. [1]

A. 6.27E+02 N
B. 6.77E+02 N
C. 7.31E+02 N
D. 7.89E+02 N
E. 8.52E+02 N

2. Two teenagers are pulling on ropes attached to a tree. The angle between the ropes is 30°. David pulls with a force of 4.000E+02 N, and Stephanie pulls with a force of 3.000E+02 N. What angle does the net force make with David's rope? [2]

A. 9.41E+00 degrees
B. 1.02E+01 degrees
C. 1.10E+01 degrees
D. 1.19E+01 degrees
E. 1.28E+01 degrees

3. Two teenagers are pulling on ropes attached to a tree. The angle between the ropes is 30°. David pulls with a force of 4.000E+02 N, and Stephanie pulls with a force of 3.000E+02 N. What angle does the net force make with Stephanie's rope? [3]

A. 1.36E+01 degrees
B. 1.47E+01 degrees
C. 1.59E+01 degrees
D. 1.72E+01 degrees
E. 1.86E+01 degrees

4. A powerful motorcycle can produce an acceleration of 3.5 m/s^2 while travelling at 90 km/h. At that speed, the forces resisting motion (e.g. friction and air drag) total 4.000E+02 N. What is the magnitude of the force that motorcycle exert backward on the ground to produce its acceleration if the mass of the motorcycle with rider is 2.450E+02kg? [4]

A. 9.24E+02 N
B. 9.98E+02 N
C. 1.08E+03 N
D. 1.16E+03 N
E. 1.26E+03 N

5. An object of mass 5 kg experiences an upward force of 4 N, as well as two horizontal forces of magnitude 10 N in the positive direction, and 2 N in the opposite (horizontal) direction. What is the magnitude of the object's acceleration? [5]

A. 1.66E+00 m/s^2
B. 1.79E+00 m/s^2
C. 1.93E+00 m/s^2
D. 2.09E+00 m/s^2
E. 2.25E+00 m/s^2

6. An object of mass 5 kg experiences an upward force of 4 N, as well as two horizontal forces of magnitude 10 N in the positive direction, and 2 N in the opposite (horizontal) direction. What angle does the object's acceleration make above the horizontal? [6]

The next page might contain more answer choices for this question

A. 1.58E+01 degrees

B. 1.71E+01 degrees

C. 1.84E+01 degrees

D. 1.99E+01 degrees

E. 2.15E+01 degrees

7. A baseball catcher is performing a stunt for a television commercial. He will catch a baseball (mass 145 g) dropped from a height of 60 m above his glove. His glove stops the ball in1.000E-02 s. What is the force exerted by his glove on the ball? [7]

A. 3.65E+02 N

B. 3.95E+02 N

C. 4.26E+02 N

D. 4.60E+02 N

E. 4.97E+02 N

8. Two forces of 25 and 45N act on an object. Their directions differ by 70°. The resulting acceleration has a magnitude of 10 m/s^2. What is the object's mass? [8]

A. 4.64E+00 kg

B. 5.01E+00 kg

C. 5.41E+00 kg

D. 5.85E+00 kg

E. 6.32E+00 kg

9. Find the magnitude of the net force if the mass of the car is 1.050E+03 kg, the intial speed is 40 km/hr, and the stopping distance is 25 m. [9]

A. 2.40E+03 N

B. 2.59E+03 N

C. 2.80E+03 N

D. 3.02E+03 N

E. 3.27E+03 N

10. Two forces are applied to a 5-kg object, and it accelerates at a rate of $2m/s^2$ in the positive y-direction. If one of the forces acts in the positive x-direction with magnitude12 N, find the magnitude of the other force. [10]

A. 1.56E+01 N

B. 1.69E+01 N

C. 1.82E+01 N

D. 1.97E+01 N

E. 2.13E+01 N

11. Suppose you are viewing a soccer game a helicopter above the playing field. Two soccer players simultaneously kick a stationary soccer ball on the flat field; the soccer ball has mass 0.42-kg. The first player kicks with force 1.620E+02 N at 9° north of west. At the same instant, the second player kicks with force 2.150E+02 N at 15° east of south. Find the magnitude of the acceleration. [11]

A. 4.29E+02 m/s^2

The next page might contain more answer choices for this question

B. 4.63E+02 m/s^2

C. 5.00E+02 m/s^2

D. 5.40E+02 m/s^2

E. 5.83E+02 m/s^2

12. A 0.0502-kg pair of fuzzy dice is attached to the rearview mirror of a car by a short string. The car accelerates at constant rate, and the dice hang at an angle of 3.2° from the vertical because of the carś acceleration. What is the magnitude of the acceleration of the car? [12]

A. 4.03E-01 m/s^2

B. 4.35E-01 m/s^2

C. 4.70E-01 m/s^2

D. 5.07E-01 m/s^2

E. 5.48E-01 m/s^2

13. An object is acted on by three simultaneous forces: $\vec{F_1} = \left(-3\hat{\imath} + 2\hat{\jmath}\right) N$, $\vec{F_2} = \left(6\hat{\imath} + -4\hat{\jmath}\right) N$, $\vec{F_3} = \left(2\hat{\imath} + 5\hat{\jmath}\right) N$. The object experiences acceleration of 4.23 m/s^2. Find the mass of the object. [13]

A. 5.32E+01 kg

B. 5.74E+01 kg

C. 6.20E+01 kg

D. 6.70E+01 kg

E. 7.24E+01 kg

14. A drone is being directed across a frictionless ice-covered lake. The mass of the drone is 1.5-kg, and its velocity is $3\hat{i}m/s$. After 10 s, the velocity is $9\hat{i} + 4\hat{j}m/s$. If a constant force is causing this change in motion, find the magnitude of the force (assume a force directed in the xy plane.) [14]

A. 5.30E-01 $kg \cdot m/s^2$

B. 5.72E-01 $kg \cdot m/s^2$

C. 6.18E-01 $kg \cdot m/s^2$

D. 6.68E-01 $kg \cdot m/s^2$

E. 7.21E-01 $kg \cdot m/s^2$

2 up1-06

1. A 30-kg girl in a swing is pushed to one side and held at rest by a horizontal force $\vec{F}$ so that the swing ropes are 30° with respect to the vertical. Calculate the tension in each of the two ropes supporting the swing under these conditions. [15]

A. 1.70E+02 N

B. 1.84E+02 N

C. 1.98E+02 N

D. 2.14E+02 N

E. 2.31E+02 N

2. A 30-kg girl in a swing is pushed to one side and held at rest by a horizontal force $\vec{F}$ so that the swing ropes are 30° with respect to the vertical. Calculate the $||\vec{F}||$ under these conditions. [16]

The next page might contain more answer choices for this question

A. 1.35E+02 N

B. 1.46E+02 N

C. 1.57E+02 N

D. 1.70E+02 N

E. 1.84E+02 N

3. Three forces act on an object, considered to be a particle, which moves with constant velocity $\vec{v} = (3\hat{\imath} - 2\hat{\jmath})\ m/s$. Two of the forces are $(3\hat{\imath} + 5\hat{\jmath} - 6\hat{k})N$ and $(4\hat{\imath} - 7\hat{\jmath} + 2\hat{k})N$. Find the z component of the third force. [17]

   A. 4.00E+00 N

   B. 5.00E+00 N

   C. 6.00E+00 N

   D. 7.00E+00 N

   E. 8.00E+00 N

4. A35-kg dolphin decreases from 12 m/s to 7.5 m/s in 2.3 s to join another dolphin in play. What was the magnitude of the average force exerted to slow the first dolpin if it was moving horizontally? (The gravitational force is balanced by the buoyant force of the water.) [18]

   A. 5.87E+01 N

   B. 6.34E+01 N

   C. 6.85E+01 N

   D. 7.40E+01 N

   E. 7.99E+01 N

5. A large rocket has a mass of 2.000E+06-kg at takeoff, and its engines produce a thrust of 3.500E+07 N. How long does it take to reach a velocity of 1.200E+02 km/h straight up, assuming constant mass and thrust? [19]

   A. 3.44E+00 s

   B. 3.71E+00 s

   C. 4.01E+00 s

   D. 4.33E+00 s

   E. 4.68E+00 s

6. A 2.5-kg fireworks shell is fired straight up from a mortar at an initial speed that would reach a height of 1.100E+02 m if air resistance is neglected (not a reasonable assumption here.) If the mortar itself is a tube of 0.45 long, what is the ratio of the average force on the shell to the shell's weight? [20]

   A. 1.93E+02

   B. 2.08E+02

   C. 2.25E+02

   D. 2.43E+02

   E. 2.62E+02

7. An elevator filled with passengers has a mass of 1.700E+03-kg. The elevator is going up at a constant velocity of 1.2 m/s when it begins to slow down at a rate of $0.6m/s^2$ for 8.5 s.What is the tension in the cable after the elevator begins to slow down? [21]

   A. 1.44E+04 N

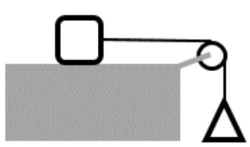
The next page might contain more answer choices for this question

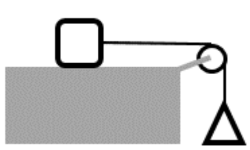
B. 1.56E+04 N
C. 1.68E+04 N
D. 1.82E+04 N
E. 1.97E+04 N

8. An elevator filled with passengers has a mass of 1.700E+03-kg. The elevator begins to rise with an acceleration of $1.2 m/s^2$ for 8.5 s. What is the tension in the cable 6.07 s after the elevator begins to move? [22]
A. 1.56E+04 N
B. 1.68E+04 N
C. 1.82E+04 N
D. 1.97E+04 N
E. 2.12E+04 N

9. A student' backpack, full of textbooks, is hung from a spring scale attached to the ceiling of an elevator. When the elevator is accelerating downward at 3.8 m/s^2, the scale reads 60 N. What is the mass of the backpack? [23]
A. 7.94E+00 kg
B. 8.57E+00 kg
C. 9.26E+00 kg
D. 1.00E+01 kg
E. 1.08E+01 kg

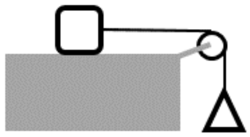
10. A roller coaster starts from rest at the top of a track 30-m long and inclined at 20° to the horizontal. How much time esapses before it reaches the bottom of the track if friction can be ignored? [24]
A. 4.23E+00 s
B. 4.57E+00 s
C. 4.93E+00 s
D. 5.33E+00 s
E. 5.75E+00 s

11. 
Two blocks are connected by a massless rope as shown above. The mass of the block on the table is 4-kg and the hanging mass is 1-kg. The table an pulley are frictionless. Find the acceleration of the system. [25]
A. 1.96E+00 m/s^2
B. 2.12E+00 m/s^2
C. 2.29E+00 m/s^2
D. 2.47E+00 m/s^2
E. 2.67E+00 m/s^2

12. 
Two blocks are connected by a massless rope as shown above. The mass of the block on the table is 4-kg and the hanging mass is 1-kg. The table an pulley are frictionless. Find the tension in the rope. [26]

The next page might contain more answer choices for this question

A. 6.22E+00 N
B. 6.72E+00 N
C. 7.26E+00 N
D. 7.84E+00 N
E. 8.47E+00 N

13. 

Two blocks are connected by a massless rope as shown above. The mass of the block on the table is 4-kg and the hanging mass is 1-kg. The table an pulley are frictionless. Find the speed with which the haning mass hits the floor if it starts from rest and is intially located 1 m from the floor [27]

A. 1.98E+00 m/s
B. 2.14E+00 m/s
C. 2.31E+00 m/s
D. 2.49E+00 m/s
E. 2.69E+00 m/s

3 up1-07

1. How much work does a supermarker checkout attendant do on a can of soup he pushes 0.6-m horizontally with a force of 5.0-N? [28]

A. 2.78E+00 J
B. 3.00E+00 J
C. 3.24E+00 J
D. 3.50E+00 J
E. 3.78E+00 J

2. Calculate the work done on a 1.500E+03-kg elevator car by its cable to lift it 40.0-m at constant speed, assuming friction averages 1.000E+02-N. [29]

A. 3.70E+03 J
B. 4.00E+03 J
C. 4.32E+03 J
D. 4.67E+03 J
E. 5.04E+03 J

3. Calculate the work done by the gravitational force on a 1.500E+03-kg elevator car by its cable to lift it 40.0-m at constant speed, assuming friction averages 1.000E+02-N. [30]

A. 4.64E+05 N
B. 5.01E+05 N
C. 5.41E+05 N
D. 5.85E+05 N
E. 6.31E+05 N

The next page might contain more answer choices for this question

4. What is the total work done on a 1.500E+03-kg elevator car by its cable to lift it 40.0-m at constant speed, assuming friction averages 1.000E+02-.? [31]

   A. 5.01E+05 J

   B. 5.41E+05 J

   C. 5.85E+05 J

   D. 6.31E+05 J

   E. 6.82E+05 J

5. A constant 20-N force pushes a small ball in the direction of the force over a distance of 5.0-m. What is the work done by the force? [32]

   A. 7.94E+01 J

   B. 8.57E+01 J

   C. 9.26E+01 J

   D. 1.00E+02 J

   E. 1.08E+02 J

6. A 5.0-kg box rests on a horizontal surface. The coefficient of kinetic friction between the box and surface is 0.5. A horizontal force pulls the box at constant velocity for 10.0-cm. Find the work done by the applied horizontal force. [33]

   A. 1.80E+02 J

   B. 1.95E+02 J

   C. 2.10E+02 J

   D. 2.27E+02 J

   E. 2.45E+02 J

7. A 5.0-kg box rests on a horizontal surface. The coefficient of kinetic friction between the box and surface is 0.5. A horizontal force pulls the box at constant velocity for 10.0-cm. Find the work done by the frictional force. [34]

   A. 2.27E+02 J

   B. 2.45E+02 J

   C. 2.65E+02 J

   D. 2.86E+02 J

   E. 3.09E+02 J

8. Suppose that a sled plus passenger weighs 50kg. The coefficientof kinetic friction between the box and surface is 0.2. It is pushed 20-m across the snow at constant velocity by a force directed 30 below the horizontal. Calculate the work done by the applied force. [35]

   A. 2.22E+03J

   B. 2.39E+03J

   C. 2.58E+03J

   D. 2.79E+03J

   E. 3.01E+03J

9. How fast must a 3.000E+03-kg elephant move to have the same kinetic energy as a 65.0-kg sprinter running at 10.0-m/s? [36]

The next page might contain more answer choices for this question

A. 1.08E+00m/s
B. 1.17E+00m/s
C. 1.26E+00m/s
D. 1.36E+00m/s
E. 1.47E+00m/s

10. Calculate the kinetic energies of a 2.000E+03-kg automobile moving at 1.000E+02-km/h. [37]
A. 9.26E+06J
B. 1.00E+07J
C. 1.08E+07J
D. 1.17E+07J
E. 1.26E+07J

11. Calculate the kinetic energies of an 80-kg runner sprinting at 10-m/s. [38]
A. 3.43E+03 J
B. 3.70E+03 J
C. 4.00E+03 J
D. 4.32E+03 J
E. 4.67E+03 J

12. An 8.0-g bullet has a speed of 8.000E+02-m/s. What is its kinetic energy? [39]
A. 2.03E+06 J
B. 2.19E+06 J
C. 2.37E+06 J
D. 2.56E+06 J
E. 2.76E+06 J

13. An 8.0-g bullet has a speed of 8.000E+02-m/s. What is its kinetic energy if the speed is halved? [40]
A. 4.70E+05 J
B. 5.08E+05 J
C. 5.49E+05 J
D. 5.93E+05 J
E. 6.40E+05 J

14. A cars bumper is designed to withstand a 4.0-km/h (1.1-m/s) collision with an immovable object without damage to the body of the car. The bumper cushions the shock by absorbing the force over a distance. Calculate the magnitude of the average force on a bumper that collapses 0.2-m while bringing a 9.000E+02-kg car to rest from an initial speed of 1.1-m/s. [41]
A. 3.93E+03N
B. 4.24E+03N
C. 4.58E+03N
D. 4.95E+03N
E. 5.35E+03N

The next page might contain more answer choices for this question

15. A constant 10-N horizontal force is applied to a 20-kg car at rest on a level floor. If friction is negligible, what is the speed of the cart when it has been pushed 8.0-m? [42]
    - A. 2.08E+00m/s
    - B. 2.25E+00m/s
    - C. 2.42E+00m/s
    - D. 2.62E+00m/s
    - **E. 2.83E+00m/s**

16. How long will it take an 8.500E+02-kg car with a useful power output of 40.0-hp (1 hp equals 746 W) to reach a speed of 15.0-m/s, neglecting friction? [43]
    - **A. 1.08E+04 s**
    - B. 1.17E+04 s
    - C. 1.26E+04 s
    - D. 1.36E+04 s
    - E. 1.47E+04 s

17. A man of mass 80-kg runs up a flight of stairs 20.0-m high in 10.0-s. How much power is used to lift the man? [44]
    - A. 1.35E+03 W
    - B. 1.45E+03 W
    - **C. 1.57E+03 W**
    - D. 1.70E+03 W
    - E. 1.83E+03 W

4 up1-08

1. A camera weighing 10-N falls from a small drone hovering 20.0-m overhead and enters free fall.What is the gravitational potential energy of the camera before it falls from the drone? [45]
    - A. 1.59E+02J
    - B. 1.71E+02J
    - C. 1.85E+02J
    - **D. 2.00E+02J**
    - E. 2.16E+02J

2. A cats crinkle ball toy of mass 15-g is thrown straight up with an initial speed of 3-m/s. Assume in the problem that air drag is negligible. What is the kinetic energy of the ball as it leaves the hand? [46]
    - A. 4.96E+01
    - B. 5.36E+01
    - C. 5.79E+01
    - D. 6.25E+01
    - **E. 6.75E+01**

3. A cats crinkle ball toy of mass 15-g is thrown straight up with an initial speed of 3-m/s. Assume in the problem that air drag is negligible. How much work is done by the gravitational force during the balls rise to its peak? [47]

The next page might contain more answer choices for this question

A. 4.96E+01
B. 5.36E+01
C. 5.79E+01
D. 6.25E+01
E. 6.75E+01

4. A cats crinkle ball toy of mass 15-g is thrown straight up with an initial speed of 3-m/s. Assume in the problem that air drag is negligible. What is the maximum height the ball reaches? [48]

A. 2.02E+00
B. 2.18E+00
C. 2.35E+00
D. 2.54E+00
E. 2.75E+00

5. A boy throws a ball of mass 0.25-kg straight upward with an initial speed of 20-m/s. When the ball returns to the boy, its speed is 17-m/s. How much work does air resistance do on the ball during its flight? [49]

A. 1.39E+01watts
B. 1.50E+01watts
C. 1.62E+01watts
D. 1.75E+01watts
E. 1.89E+01watts

5 up1-09

1. A skater of mass 40-kg is carrying a box of mass 5-kg. The skater has a speed of 5-m/s with respect to the floor and is gliding without any friction on a smooth surface. Find the momentum of the box with respect to the floor. [50]

A. 2.14E+01kg*m/s
B. 2.31E+01kg*m/s
C. 2.50E+01kg*m/s
D. 2.70E+01kg*m/s
E. 2.92E+01kg*m/s

2. A skater of mass 40-kg is carrying a box of mass 5-kg. The skater has a speed of 5-m/s with respect to the floor and is gliding without any friction on a smooth surface. Find the momentum of the box with respect to the floor after she puts the box down on the frictionless skating surface. [51]

A. 2.50E+01kg*m/s
B. 2.70E+01kg*m/s
C. 2.92E+01kg*m/s
D. 3.15E+01kg*m/s
E. 3.40E+01kg*m/s

3. What is the average momentum of an avalanche that moves a 40-cm-thick layer of snow over an area of 1.000E+02-m by 5.000E+02-m over a distance of 1.0-km down a hill in 5.5-s? Assume a density of 3.500E+02-kg/m^3 for the snow. [52]

The next page might contain more answer choices for this question

A. 1.27E+08kg*m/s
B. 1.37E+08kg*m/s
C. 1.48E+08kg*m/s
D. 1.60E+08kg*m/s
E. 1.73E+08kg*m/s

4. A 75-kg person is riding in a car moving at 20.0 when the car runs into a bridge abutment. Calculate the average force on the person if he is stopped by a padded dashboard that compresses an average of 1.0-cm. [53]

A. 2.78E+04N
B. 3.00E+04N
C. 3.24E+04N
D. 3.50E+04N
E. 3.78E+04N

5. A 75-kg person is riding in a car moving at 20.0when the car runs into a bridge abutment. Calculate the average force on the person if he is stopped by an air bag that compresses an average of 15.0-cm. [54]

A. 2.00E+03N
B. 2.16E+03N
C. 2.33E+03N
D. 2.52E+03N
E. 2.72E+03N

6. Water from a fire hose is directed horizontally against a wall at a rate of 50-kg/s and a speed of 42.0-m/s. Calculate the force exerted on the wall, assuming the waters horizontal momentum is reduced to zero. [55]

A. 1.94E+03N
B. 2.10E+03N
C. 2.27E+03N
D. 2.45E+03N
E. 2.65E+03N

7. A bullet of mass 2.000E+02-g traveling horizontally towards the east with speed 4.000E+02-m/s, which strikes a block of mass 1.5-kg that is initially at rest on a frictionless table. After striking the block, the bullet is embedded in the block and the block and the bullet move together as one unit. What is the magnitude and direction of the velocity of the block/bullet combination immediately after the impact? [56]

A. 3.68E+02m/s east
B. 3.97E+02m/s east
C. 4.29E+02m/s east
D. 4.63E+02m/s east
E. 5.00E+02m/s east

8. A bullet of mass 2.000E+02-g traveling horizontally towards the east with speed 4.000E+02-m/s, which strikes a block of mass 1.5-kg that is initially at rest on a frictionless table. After striking the block, the bullet is embedded in the block and the block and the bullet move together as one unit. What is the magnitude and direction of the impulse by the block on the bullet? [57]

The next page might contain more answer choices for this question

A. 4.38E+02N towards the bullet

B. 4.73E+02N towards the bullet

C. 5.11E+02N towards the bullet

D. 5.51E+02N towards the bullet

E. 5.96E+02N towards the bullet

9. A bullet of mass 2.000E+02-g traveling horizontally towards the east with speed 4.000E+02-m/s, which strikes a block of mass 1.5-kg that is initially at rest on a frictionless table. After striking the block, the bullet is embedded in the block and the block and the bullet move together as one unit. What is the magnitude and direction of the impulse from the bullet on the block? [58]

A. 4.73E+02N towards the block

B. 5.11E+02N towards the block

C. 5.51E+02N towards the block

D. 5.96E+02N towards the block

E. 6.43E+02N towards the block

10. Two figure skaters are coasting in the same direction, with the leading skater moving at 5.5-m/s and the trailing skater moving at 6.2-m/s. When the trailing skater catches up with the leading skater, he picks her up without applying any horizontal forces on his skates. If the trailing skater is 50% heavier than the 50-kg leading skater, what is their speed after he picks her up? [59]

A. 5.08E+00m/s

B. 5.48E+00m/s

C. 5.92E+00m/s

D. 6.39E+00m/s

E. 6.91E+00m/s

11. A 5.5-kg bowling ball moving at 9.0-m/s collides with a 0.85-kg bowling pin, which is scattered at an angle to the initial direction of the bowling ball and with a speed of 15.0-m/s. Verify that the collision is elastic and calculate the final speed of the bowling ball. [60]

A. Problem solved by 0.00E+00 students (to date.)

B. Problem solved by 0.00E+00 students (to date.)

C. Problem solved by 0.00E+00 students (to date.)

D. Problem solved by 0.00E+00 students (to date.)

E. Problem solved by 0.00E+00 students (to date.)

12. A 90.0-kg ice hockey player hits a 0.15-kg puck, giving the puck a velocity of 45.0-m/s. If both are initially at rest and if the ice is frictionless, how far does the player recoil in the time it takes the puck to reach the goal 15.0-m away? [61]

A. 1.98E-02m

B. 2.14E-02m

C. 2.31E-02m

D. 2.50E-02m

E. 2.70E-02m

The next page might contain more answer choices for this question

6 up1-10

1. A particle moves 3 m along a circle with a radius of 1.5 m in a time of +1 s. Through what angle does it rotate? [62]
   - A. 1.85E+00 rad
   - **B. 2.00E+00 rad**
   - C. 2.16E+00 rad
   - D. 2.33E+00 rad
   - E. 2.52E+00 rad
2. A particle moves 3 m along a circle with a radius of 1.5 m in 1.0 seconds. What is its angular velocity? [63]
   - **A. 2.00E+00 rad/s**
   - B. 2.16E+00 rad/s
   - C. 2.33E+00 rad/s
   - D. 2.52E+00 rad/s
   - E. 2.72E+00 rad/s
3. A particle moves 3 m along a circle with a radius of 1.5 m in 1.0 sec. What is its acceleration? [64]
   - A. 5.56E+00 m/s^2
   - **B. 6.00E+00** m/s^2
   - C. 6.48E+00 m/s^2
   - D. 7.00E+00 m/s^2
   - E. 7.56E+00 m/s^2
4. On takeoff, the propellers on a UAV increase their angularvelocity for 3.0 seconds from rest in such a way that the angular velocity obeys, ω = (25 t) rad/s, where t is measured in seconds. What is the instaneous angular velocity of the propellers at t = 2.0 s? [65]
   - A. 4.29E+01 rad/s
   - B. 4.63E+01 rad/s
   - **C. 5.00E+01 rad/s**
   - D. 5.40E+01 rad/s
   - E. 5.83E+01 rad/s
5. On takeoff, the propellers on a UAV increase their angularvelocity for 3.0 seconds from rest in such a way that the angular velocity obeys, ω = (25 t) rad/s, where t is measured in seconds. What is the angular acceleration of the propellers at t = 3.0 s? [66]
   - A. 1.84E+01 rad/s^2
   - B. 1.98E+01 rad/s^2
   - C. 2.14E+01 rad/s^2
   - D. 2.31E+01 rad/s^2
   - **E. 2.50E+01** rad/s^2
6. A wind turbine is rotating counterclockwise at 0.5 rev/s and slows to a stop in 10.0 s. Its blades are 20 m in length. What was the magnitude of the angular acceleration of the turbine? [67]

The next page might contain more answer choices for this question

A. 2.69E-01 rad/s^2
B. 2.91E-01 rad/s^2
C. 3.14E-01 rad/s^2
D. 3.39E-01 rad/s^2
E. 3.66E-01 rad/s^2

7. A wind turbine is rotating counterclockwise at 0.5 rev/s and slows to a stop in 10.0 s. Its blades are 20 m in length. What was the magnitude of the centripetal acceleration of the tip of the blades at t = 0s? [68]

A. 1.57E+02 m/s^2
B. 1.69E+02 m/s^2
C. 1.83E+02 m/s^2
D. 1.97E+02 m/s^2
E. 2.13E+02 m/s^2

8. A wind turbine is rotating counterclockwise at 0.5 rev/s and slows to a stop in 10.0 s. Its blades are 20 m in length. What was the magnitudeof the total linear acceleration of the tip of the blades at t = 0 s? [69]

A. 1.45E+02m/s^2
B. 1.57E+02m/s^2
C. 1.69E+02m/s^2
D. 1.83E+02m/s^2
E. 1.97E+02m/s^2

9. The moment of inertia of a solid disk is $I = \frac{1}{2}MR^2$ where M is mass and R is radius. Use this to model a wheel as a disk with a concentric hole and calculate the rotational kinetic energy of a 12-kg motorcycle wheel if its angular velocity is 1.200E+02 rad/s and its inner radius is 0.28 m and outer radius is 0.33 m. [70]

A. 1.05E+03 J
B. 1.13E+03 J
C. 1.22E+03 J
D. 1.32E+03 J
E. 1.42E+03 J

10. When opening a door, you push on it perperndicularlywith a force of 55.0 N at a distance of 0.85 m from thehinges. What torque are you exerting relative to the hinges? [71]

A. 4.01E+01Nm
B. 4.33E+01Nm
C. 4.68E+01Nm
D. 5.05E+01Nm
E. 5.45E+01Nm

11. Suppose you exert a force of 1.800E+02 N tangentialto a 0.28-m-radius, 75.0-kg grindstone (a solid disc).What torque is exerted? [72]

A. 4.67E+01Nm
B. 5.04E+01Nm
C. 5.44E+01Nm

The next page might contain more answer choices for this question

D. 5.88E+01Nm
E. 6.35E+01Nm

12. Suppose you exert a force of 1.800E+02 N tangentialto a 0.28-m-radius, 75.0-kg grindstone (a solid disc).What is the angular acceleration assuming negligible opposing friction? [73]

A. 1.71E+01rad/s^2
B. 1.85E+01rad/s^2
C. 2.00E+01rad/s^2
D. 2.16E+01rad/s^2
E. 2.33E+01rad/s^2

13. Suppose you exert a force of 1.800E+02 N tangentialto a 0.28-m-radius, 75.0-kg grindstone (a solid disc).What is the angular acceleration if there is an opposing frictionalforce of 20.0+ N exerted 1.5 1.50-cm from the axis? [74]

A. 1.70E+01 rad/s^2
B. 1.84E+01 rad/s^2
C. 1.99E+01 rad/s^2
D. 2.15E+01 rad/s^2
E. 2.32E+01 rad/s^2

14. A propeller is accelerated from rest to an angular velocity of 1.000E+03 rev/min over a period of 6.0 seconds by a constant torque of 2.000E+03 Nm. What is the moment of inertia on the propeller? [75]

A. 9.10E+01 $kg \cdot m^2$
B. 9.82E+01 $kg \cdot m^2$
C. 1.06E+02 $kg \cdot m^2$
D. 1.15E+02 $kg \cdot m^2$
E. 1.24E+02 $kg \cdot m^2$

15. A propeller is accelerated from rest to an angular velocity of 1.000E+03 rev/min over a period of 6.0 seconds by a constant torque of 2.000E+03 Nm. What power is being provided to the propeller 3.0 s after it starts rotating? [76]

A. 8.98E+04 W
B. 9.70E+04 W
C. 1.05E+05 W
D. 1.13E+05 W
E. 1.22E+05 W

7 up1-11

1. A marble rolls down an incline at 30 degrees from rest. What is its acceleration? [77]

A. 3.24E+00 m/s^2
B. 3.50E+00 m/s^2
C. 3.78E+00 m/s^2
D. 4.08E+00 m/s^2
E. 4.41E+00 m/s^2

The next page might contain more answer choices for this question

2. An airplane of mass 4.000E+04 kg flies horizontally at an altitude of 10 km with a constant speed of 2.500E+02 m/s relative to Earth. What is the magnitude of the airplane's angular momentum relative to a ground observer at the moment the plane is 15 km away from the observer? [78]
   - A. 7.94E+10 kg/m^2
   - B. 8.57E+10 kg/m^2
   - C. 9.26E+10 kg/m^2
   - **D. 1.00E+11** kg/m^2
   - E. 1.08E+11 kg/m^2

3. A boulder of mass 20 kg and radius 20 cm rolls down a hill 15 m high from rest. What is the angular momentum at the bottom of the hill? [79]
   - A. 1.70E+01 $kg \cdot m^2/s$
   - B. 1.84E+01 $kg \cdot m^2/s$
   - C. 1.99E+01 $kg \cdot m^2/s$
   - D. 2.15E+01 $kg \cdot m^2/s$
   - **E. 2.32E+01** $kg \cdot m^2/s$

4. A bug of mass 0.020 kg is at rest on the edge of a solid cylindrical disk (M=0.1kg,R=0.1m) rotating in a horizontal plane around the vertical axis through its center. The disk is rotating at 10 rad/s. The bug crawls to the center of the disk. What is the new angular velocity of the disk? [80]
   - A. 1.03E+01rad/s
   - B. 1.11E+01rad/s
   - C. 1.20E+01rad/s
   - D. 1.30E+01rad/s
   - **E. 1.40E+01rad/s**

5. A merry-go-round has a radius of 2.0 m and a moment of inertia 3.000E+02$kg \cdot m^2$. A boy of mass 50 kg runs tangent to the rim at a speed of 4 m/s and jumps on. If the merry-go-round is initially at rest, what is the angular velocity after the boy jumps on? [81]
   - A. 6.86E-01rad/sec
   - B. 7.41E-01rad/sec
   - **C. 8.00E-01rad/sec**
   - D. 8.64E-01rad/sec
   - E. 9.33E-01rad/sec

6. A gymnast does cartwheels along the floor and then launches herself into the air and executes several flips in a tuck while she is airborne. If her moment of inertia when executing the cartwheels is 13.5 $kg \cdot m^2$ and her spin rate is 0.5 rev/s, how many revolutions does she do in the air if her moment of inertia in the tuck is 3.4 $kg \cdot m^2$ and she has 2 s to do the flips in the air. [82]
   - **A. 3.97E+00 flips**
   - B. 4.29E+00 flips
   - C. 4.63E+00 flips
   - D. 5.00E+00 flips
   - E. 5.40E+00 flips

The next page might contain more answer choices for this question

7. A gyroscope has a 0.5-kg disk that spins at 40 rev/s. The center of mass of the disk is 10 cm from a pivot which is also the radius of the disk. What is the precession angular velocity? [83]

   A. 6.19E-01 rad/s
   B. 6.69E-01 rad/s
   C. 7.22E-01 rad/s
   D. 7.80E-01 rad/s
   E. 8.42E-01 rad/s

8 up1-12

1. When tightening a bolt, you push perpendicularly on a wrench with a force of 1.650E+02 N at a distance of 0.14 m from the center of the bolt. How much torque are you exerting relative to the center of the bolt? [84]

   A. 2.14E+01N
   B. 2.31E+01N
   C. 2.49E+01N
   D. 2.69E+01N
   E. 2.91E+01N

2. When opening a door, you push on it perpendicularly with a force of 55 N at a distance of 0.85 m from the hinges. What torque are you exerting relative to the hinges? [85]

   A. 3.44E+01N
   B. 3.71E+01N
   C. 4.01E+01N
   D. 4.33E+01N
   E. 4.68E+01N

3. A uniform 40 kg scaffold of length 6 m is supported by two light cables. A 80 kg painter stands 1 from the left end of the scaffold, and his painting equipment is 1.5 m from the right end. The tension in the left cable is twice that in the right cable. Find the tension in the right cable. [86]

   A. 4.11E+02 N
   B. 4.44E+02 N
   C. 4.80E+02 N
   D. 5.18E+02 N
   E. 5.60E+02 N

4. A uniform 40 kg scaffold of length 6 m is supported by two light cables. A 80 kg painter stands 1 from the left end of the scaffold, and his painting equipment is 1.5 m from the right end. The tension in the left cable is twice that in the right cable. Find the tension in the left cable. [87]

   A. 8.23E+02 N
   B. 8.89E+02 N
   C. 9.60E+02 N
   D. 1.04E+03 N
   E. 1.12E+03 N

The next page might contain more answer choices for this question

5. A uniform 40 kg scaffold of length 6 m is supported by two light cables. A 80 kg painter stands 1 from the left end of the scaffold, and his painting equipment is 1.5 m from the right end. The tension in the left cable is twice that in the right cable. Find the weight of the equipment. [88]

   A. 1.24E+02 N
   B. 1.34E+02 N
   C. 1.45E+02 N
   D. 1.57E+02 N
   E. 1.69E+02 N

6. To get up on the roof, a person (mass 70 kg) places a 6.00-m aluminum ladder (mass 10 kg) against the house on a concrete pad with the base of the ladder 2 m from the house. The ladder rests against a plastic rain gutter, which we can assume to be frictionless. The center of mass of the ladder is 2.00 m from the bottom of of the ladder. The person is standing 3.00 m from the ladder's bottom. Find the friction force on the ladder at its base. [89]

   A. 9.76E+01N
   B. 1.05E+02N
   C. 1.14E+02N
   D. 1.23E+02N
   E. 1.33E+02N

7. To get up on the roof, a person (mass 70 kg) places a 6.00-m aluminum ladder (mass 10 kg) against the house on a concrete pad with the base of the ladder 2 m from the house. The ladder rests against a plastic rain gutter, which we can assume to be frictionless. The center of mass of the ladder is 2.00 m from the bottom of of the ladder. The person is standing 3.00 m from the ladder extquotesingle s bottom. Find the normal force on the ladder at its base. [90]

   A. 6.72E+02N
   B. 7.26E+02N
   C. 7.84E+02N
   D. 8.47E+02N
   E. 9.14E+02N

8. A 20 m tall hollow aluminum flagpole is equivalent in strength to a solid cylinder 4.00 cm in diameter. A strong wind bends the pole as much as a horizontal 9.000E+02 N force on the top would do. How far to the side does the top of the pole flex? The shear modulus is 2×10^10 [91]

   A. 5.73E-01 mm
   B. 6.19E-01 mm
   C. 6.68E-01 mm
   D. 7.22E-01 mm
   E. 7.80E-01 mm

9. A 90 kg mountain climber hangs from a nylon rope and stretches it by 25 cm. If the rope was originally 30 m long and its diameter is 1 cm, what is Young's modulus for the nylon? [92]

   A. 1.35E+09Pa
   B. 1.46E+09Pa
   C. 1.57E+09Pa

The next page might contain more answer choices for this question

D. 1.70E+09Pa

E. 1.83E+09Pa

10. A copper wire is 1 m long and its diameter is 1 mm. If the wire hangs vertically, how much weight must be added to its free end in order to stretch it 3 mm? [93]

A. 1.91E+02 N

B. 2.06E+02 N

C. 2.22E+02 N

D. 2.40E+02 N

E. 2.59E+02 N

9 up1-13

1. Evaluate the magnitude of gravitational force between two 5 kg spherical steel balls separated by a center-to-center distance of 15 cm. [94]

A. 5.88E-08 N

B. 6.35E-08 N

C. 6.86E-08 N

D. 7.41E-08 N

E. 8.00E-08 N

2. The International Space Station has a mass of approximately 370,000 kg. What is the force on a 1.500E+02 kg suited astronaut if she is 20 m from the center of mass of the station? [95]

A. 6.80E-06N

B. 7.35E-06N

C. 7.93E-06N

D. 8.57E-06N

E. 9.25E-06N

3. The mass of a particle is 15 kg. What is its weight on Earth? [96]

A. 1.59E-02 N

B. 1.56E-01 N

C. 1.53E+00 N

D. 1.50E+01 N

E. 1.47E+02 N

4. The mass of a particle is 15 kg. What is its weight on the Moon (where the acceleration of gravity is $1.6m/s^2$?) [97]

A. 2.40E+01N

B. 3.84E+01N

C. 6.14E+01N

D. 9.83E+01N

E. 1.57E+02N

The next page might contain more answer choices for this question

5. The mass of a particle is 15 kg. What is its mass on the Moon (where the acceleration of gravity is $1.6 m/s^2$)? [98]
   - A. 9.38E+00 N
   - **B. 1.50E+01 N**
   - C. 2.40E+01 N
   - D. 3.84E+01 N
   - E. 6.14E+01 N
6. The acceleration due to gravity on the surface of a planet is 3 times as large as it is on the surface of Earth. The mass density of the planet is known to be 2 times that of Earth. What is the radius of this planet in terms of Earth's radius? [99]
   - **A. 1.50E+00 Earth radii**
   - B. 2.25E+00 Earth radii
   - C. 3.38E+00 Earth radii
   - D. 5.06E+00 Earth radii
   - E. 7.59E+00 Earth radii
7. Evaluate the gravitational potential energy between two 5 kg spherical steel balls separated by a center-to-center distance of 15 cm. [100]
   - A. 3.29E-09 J
   - B. 4.94E-09 J
   - C. 7.41E-09 J
   - **D. 1.11E-08 J**
   - E. 1.67E-08 J
8. A planet has a mass of 5.970E+24 kg. What would be the orbital radius of a satellite or moon that has a period of 3 hours? [101]
   - A. 9.77E+06 m
   - **B. 1.06E+07 m**
   - C. 1.14E+07 m
   - D. 1.23E+07 m
   - E. 1.33E+07 m
9. In order to keep a small satellite from drifting into a nearby asteroid, it is placed in a circular orbit around the with a period of 3.02 hours at a distance of 2.0 km from the center of the astroid. What is asteroid's mass? [102]
   - A. 2.94E+13 kg
   - B. 3.18E+13 kg
   - C. 3.43E+13 kg
   - D. 3.71E+13 kg
   - **E. 4.01E+13 kg**
10. What is the Schwarzschild radius for the black hole at the center of a galaxy if it has the mass of 4 million solar masses? Take the mass of the Sun to be 2×10^{30} kg. [103]
    - A. 1.02E+07 km
    - B. 1.10E+07 km
    - **C. 1.19E+07 km**
    - D. 1.28E+07 km
    - E. 1.39E+07 km

The next page might contain more answer choices for this question

10 up1-14

1. What is the mass of a deep breath of air having a volumeof 2.0 L? [104]
   A. 8.16E-02g
   B. 2.58E-01g
   C. 8.16E-01g
   D. 2.58E+00g
   E. 8.16E+00g

2. How tall must a water-filled manometer be to measureblood pressure as high as 3.000E+02 mm Hg? The density of mercury is $13.6g/cm^3$. [105]
   A. 3.78E+00 m
   B. 4.08E+00 m
   C. 4.41E+00 m
   D. 4.76E+00 m
   E. 5.14E+00 m

3. What force must be exerted on the master cylinder of ahydraulic lift to support the weight of a 2.100E+03-kg car resting ona second cylinder? The master cylinder has a 2.3-cm diameterand the second cylinder has a 21.0-cm diameter. [106]
   A. 2.12E+02 N
   B. 2.29E+02 N
   C. 2.47E+02 N
   D. 2.67E+02 N
   E. 2.88E+02 N

4. A certain hydaulic system is designed to exert a force 1.200E+02 times as large as the one put on it. What must be the ratio ofthe area of the cylinder that is being controlled to the area of the mastercylinder? [107]
   A. 4.24E+01
   B. 6.00E+01
   C. 8.49E+01
   D. 1.20E+02
   E. 1.70E+02

5. A certain hydaulic system is designed to exert a force 1.200E+02 times as large as the one put on it. What must be the ratio ofthe ratio of their diameters? [108]
   A. 7.75E+00
   B. 1.10E+01
   C. 1.55E+01
   D. 2.19E+01
   E. 3.10E+01

6. A certain hydaulic system is designed to exert a force 1.000E+02 times as large as the one put on it. By what factor is the distance through which the output force moves reduced relative to the distance through which the input force moves? Assume no losses due to friction. [109]

The next page might contain more answer choices for this question

A. 5.00E-03

B. 7.07E-03

C. 1.00E-02

D. 1.41E-02

E. 2.00E-02

7. Water emerges straight down from a faucet with a 1.5-cm diameter at a speed of 0.75 m/s. (Because of the construction of the faucet, there is no variation in speed across the stream.) What is the flow rate in cm^3/s? [110]

A. 1.33E+01 cm^3/s

B. 4.19E+01 cm^3/s

C. 1.33E+02 cm^3/s

D. 4.19E+02 cm^3/s

E. 1.33E+03 cm^3/s

11 Attribution

Notes

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