astrBnk:Study

https://bitbucket.org/Guy_vandegrift/qbwiki/wiki/Home
https://en.wikiversity.org/wiki/Quizbank
mixed quiz 154722896072

Friday 11th 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 will permit them to create, modify, and print their own versions of this document.

Contents

1 AstroApparentRetroMotion

1. ____ motion is in the usual direction, and _____ is motion that has temporarily reversed itself. [1]
   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? [2]
   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

The next page might contain more answer choices for this question

E. if the observer is below the equator

3. When the faster moving Earth overtakes a slower planet outside Earth's orbit[3]

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? [4]

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? [5]

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.[6]

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? [7]

A. 12

B. 1

C. 24

D. 6

E. 3

8. "Planet" comes from the Greek word for 'wanderer'. [8]

A. true

B. false

9. We know that Galileo saw Neptune, but is not credited with its discovery because[9]

A. he never published his drawing

The next page might contain more answer choices for this question

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

2 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? [10]

   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? [11]

   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?[12]

   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?[13]

   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?[14]

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

   B. the formula is valid for all launch angles

The next page might contain more answer choices for this question

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 $\frac{1}{2}m_{\rm atom}\langle v^2_{\rm atom}\rangle_{ave} = \frac{1}{2}k_{\rm B}T$?[15]

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. $\frac{1}{2}m_{\rm atom}\langle v^2_{\rm atom}\rangle_{ave} = \frac{1}{2}k_{\rm B}T$, where "T" is temperature on the Kelvin scale. This formula describes:[16]

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.

3 AstroChasingPluto

1. The trip by "New Horizons" from Earth to Pluto took almost a[17]

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[18]

A. mass

B. atmosphere

C. size

3. The "Chasing Pluto" video showed a stellar occultation that was observed[19]

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[20]

A. true

B. false

5. A stellar occultation occurs when the north or south pole of a planet is aligned with a star[21]

The next page might contain more answer choices for this question

A. true

B. false

6. Stellar occultation tells something about a planet because[22]

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[23]

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[24]

A. silicates

B. water

C. hydrocarbons

D. nitrogen

9. "Pepssi", "Rex", "Swap", "Lorri", "Alice" and "Ralf" are[25]

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?[26]

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 [27]

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"[28]

A. the Moon

B. Mars

The next page might contain more answer choices for this question

C. the asteroid belt

D. Jupiter

13. While close to Jupiter, "New Horizons" the most spectacular image was of[29]

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 _____[30]

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 [31]

A. photographed EARTH

B. photographed PLUTO

C. called MOM

D. adjusted the ORBIT

16. Clyde Tombaugh, who discovered Pluto back in the 1930s[32]

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[33]

A. a Nobel prize

B. a college education

C. an invitation to teach at Yale

18. The "blink comparator" compared[34]

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 [35]

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

The next page might contain more answer choices for this question

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?[36]

    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): [37]

    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 [38]

    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[39]

    A. true

    B. false

24. The influence of Jupiter's gravity on Pluto is that Jupiter gradually brings Pluto closer[40]

    A. true

    B. false

25. Which was NOT listed as one of the three things commonly considered necessary for the formation of life?[41]

    A. sunlight

    B. water

    C. energy

    D. organic matter

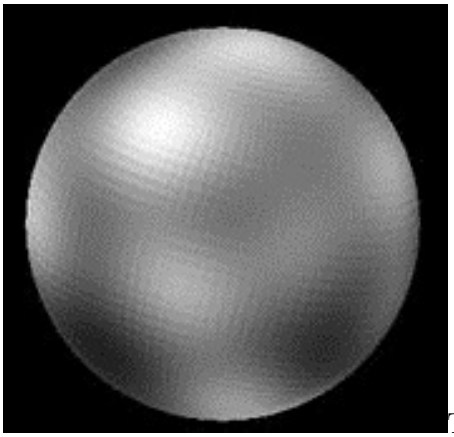
26. As "New Horizon" approached Jupiter, it looked for new Moons, and the ground crew was glad that[42]

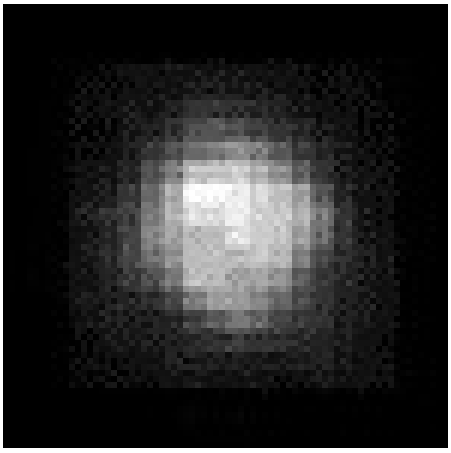
    A. the "New Horizon" discovered three new moons

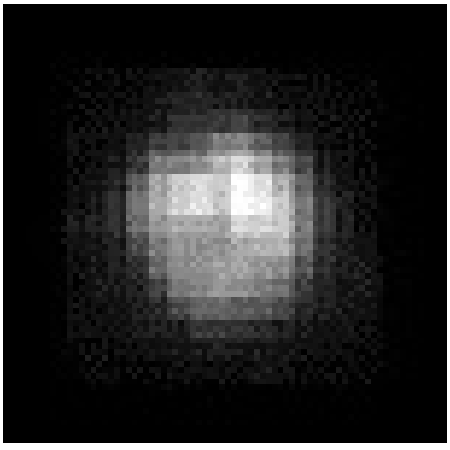
    B. there were no new moons because moons are debris generators

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

The next page might contain more answer choices for this question

27.  This corresponds to [43]

A. This image 

B. This image 

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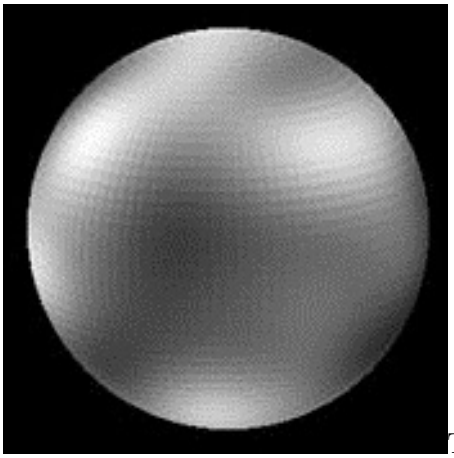
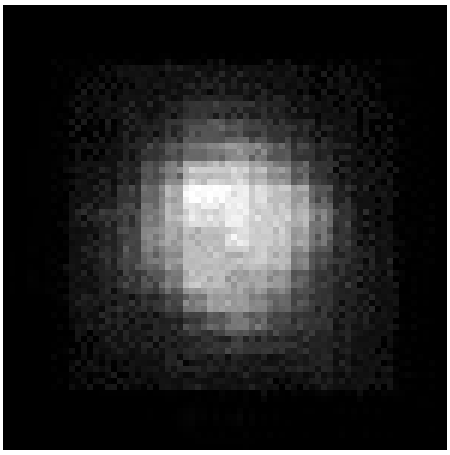
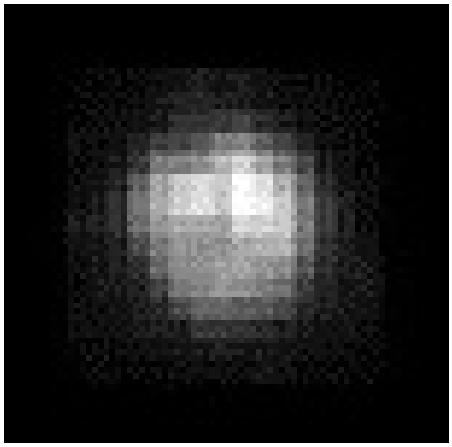
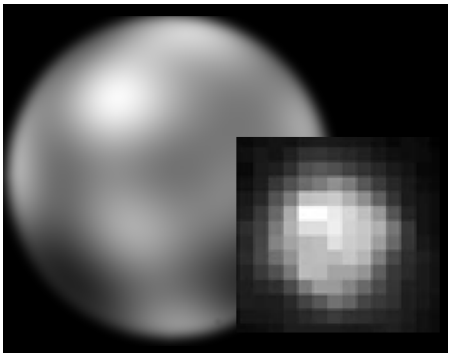
28.  This image corresponds to [44]

A. This image 

B. This image 

29.  These two images of Pluto represent:[45]

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

The next page might contain more answer choices for this question

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[46]

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[47]

A. lithium batteries

B. fuel cells

C. solar power

D. nuclear power

32. As it approached Pluto, "New Horizon" was slightly larger than[48]

A. a grand piano

B. the Hubble Space Telescope

C. a 10 story building

4 AstroGalileanMoons

1. How does the density of a Galilean moon depend on its distance from Jupiter? [49]

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? [50]

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? [51]

A. no, the surface is too new

B. yes, from impacts

C. yes, from volcanoes

The next page might contain more answer choices for this question

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 [52]

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? [53]

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. [54]

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? [55]

A. Europa

B. Ganymede

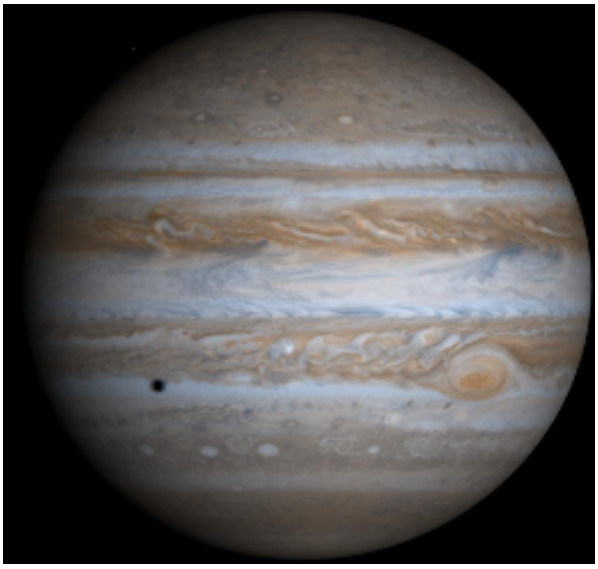
C. Two other answers are correct (making this the only true answer).

D. Io

E. Ganymede

The next page might contain more answer choices for this question

5 AstroJupiter

1.  The black spot in this image of Jupiter is[56]
   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[57]
   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[58]
   A. easterly and westerly
   B. updrafts and downdrafts
   C. both of these

4. As one descends down to Jupiter's core, the temperature[59]
   A. increases
   B. decreases
   C. stays about the same

5. Which of the following statements is FALSE?[60]
   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

The next page might contain more answer choices for this question

E. Jupiter has a system of rings

6. What is the mechanism that heats the interior of Jupiter? [61]

A. rain

B. tides

C. radioactivity

D. magnetism

E. electricity

7. Why is Jupiter an oblate spheroid?[62]

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)?[63]

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?[64]

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?[65]

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[66]

A. TRUE

B. FALSE

12. Knowing the barycenter of two stars is useful because it tells us the ratio of the two masses[67]

A. TRUE

B. FALSE

The next page might contain more answer choices for this question

6 AstroKepler

1. Kepler began his career as a teacher of[68]
   A. mathematics
   B. history
   C. philosophy
   D. theology
   E. astronomy

2. As a child, Kepler's interest in astronomy grew as a result of [69]
   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 [70]
   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[71]
   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[72]
   A. true
   B. false

6. As a planet orbits the Sun, the Sun is situated midway between the two focal points of the ellipse[73]
   A. true
   B. false

7. Newton was able to use the motion of the Moon to calculate the universal constant of gravity, G [74]
   A. true
   B. false

8. The force of (gravitational) attraction between you and a friend is small because neither of you possess significant mass [75]
   A. true

The next page might contain more answer choices for this question

B. false

9. Cavendish finally measured G by carefully weighing the force between[76]
   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[77]
   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[78]
   A. true
   B. false
12. In Kepler's era, astronomy was usually considered a part of mathematics[79]
   A. true
   B. false
13. In Kepler's era, astronomy closely linked to astrology[80]
   A. true
   B. false
14. In Kepler's era, physics (how and why things moved) was usually considered a part of natural philosophy[81]
   A. true
   B. false
15. Kepler incorporated religious arguments and reasoning into his work[82]
   A. true
   B. false
16. Kepler avoided religious arguments and reasoning in his work[83]
   A. true
   B. false
17. How would one describe the status of Kepler's family when he was a child?[84]
   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

The next page might contain more answer choices for this question

7 AstroLunarphasesAdvancedB

1. At 6am a waning crescent moon would be[85]
   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[86]
   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[87]
   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[88]
   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[89]
   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[90]
   A. below the eastern horizon
   B. below the western horizon
   C. overhead
   D. high in western sky
   E. nadir

The next page might contain more answer choices for this question

7. At 3am a waning gibbous moon would be[91]
   A. nadir
   B. overhead
   C. eastern horizon
   D. high in western sky
   E. western horizon

8. At 9am a third quarter moon would be[92]
   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[93]
   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[94]
    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[95]
    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[96]
    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[97]

The next page might contain more answer choices for this question

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[98]
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[99]
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[100]
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[101]
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[102]
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[103]
A. nadir

The next page might contain more answer choices for this question

B. overhead

C. eastern horizon

D. high in eastern sky

E. below the eastern horizon

20. At 9am a new moon would be[104]

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[105]

A. overhead

B. eastern horizon

C. below the eastern horizon

D. western horizon

E. nadir

22. At 9am a waxing gibbous moon would be[106]

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[107]

A. overhead

B. nadir

C. high in eastern sky

D. eastern horizon

E. western horizon

24. At midnight a waning crescent moon would be[108]

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[109]

A. overhead

B. nadir

The next page might contain more answer choices for this question

C. high in eastern sky

D. below the western horizon

E. eastern horizon

26. At 6am a waning gibbous moon would be[110]

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[111]

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[112]

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[113]

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[114]

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[115]

A. eastern horizon

B. nadir

C. western horizon

The next page might contain more answer choices for this question

D. below the western horizon

E. below the eastern horizon

32. At 3am a new moon would be[116]

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[117]

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[118]

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[119]

A. nadir

B. high in western sky

C. western horizon

D. overhead

E. eastern horizon

36. At 9am a full moon would be[120]

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[121]

A. high in eastern sky

B. eastern horizon

C. western horizon

D. below the western horizon

The next page might contain more answer choices for this question

E. nadir

38. At 9pm a third quarter moon would be[122]
    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[123]
    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[124]
    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[125]
    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[126]
    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[127]
    A. high in western sky
    B. overhead
    C. nadir
    D. eastern horizon
    E. western horizon

The next page might contain more answer choices for this question

44. At 3pm a 1st quarter moon would be[128]
    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[129]
    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[130]
    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[131]
    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[132]
    A. below the eastern horizon
    B. western horizon
    C. high in western sky
    D. below the western horizon
    E. high in eastern sky

8 AstroLunarphasesSimple

1. At midnight a new moon would be [133]
    A. western horizon
    B. eastern horizon
    C. overhead
    D. below the horizon

The next page might contain more answer choices for this question

2. At midnight a full moon would be [134]
    A. below the horizon
    B. overhead
    C. eastern horizon
    D. western horizon
3. At 6pm a third quarter moon would be [135]
    A. overhead
    B. eastern horizon
    C. western horizon
    D. below the horizon
4. At 6am a 1st quarter moon would be [136]
    A. eastern horizon
    B. western horizon
    C. overhead
    D. below the horizon
5. At noon a full moon would be [137]
    A. western horizon
    B. below the horizon
    C. eastern horizon
    D. overhead
6. At 6pm a full moon would be [138]
    A. western horizon
    B. overhead
    C. below the horizon
    D. eastern horizon
7. At 6pm a 1st quarter moon would be [139]
    A. below the horizon
    B. overhead
    C. western horizon
    D. eastern horizon
8. At 6am a full moon would be [140]
    A. overhead
    B. western horizon
    C. below the horizon
    D. eastern horizon
9. At noon a third quarter moon would be [141]
    A. overhead

The next page might contain more answer choices for this question

B. western horizon

C. below the horizon

D. eastern horizon

10. At noon a 1st quarter moon would be [142]

A. western horizon

B. eastern horizon

C. overhead

D. below the horizon

11. At noon a new moon would be [143]

A. below the horizon

B. overhead

C. western horizon

D. eastern horizon

12. At 6pm a new moon would be [144]

A. eastern horizon

B. western horizon

C. overhead

D. below the horizon

13. At 6am a third quarter moon would be[145]

A. overhead

B. eastern horizon

C. western horizon

D. below the horizon

14. At midnight a third quarter moon would be [146]

A. below the horizon

B. eastern horizon

C. western horizon

D. overhead

15. At midnight a 1st quarter moon would be [147]

A. below the horizon

B. overhead

C. eastern horizon

D. western horizon

16. At 6am a new moon would be [148]

A. overhead

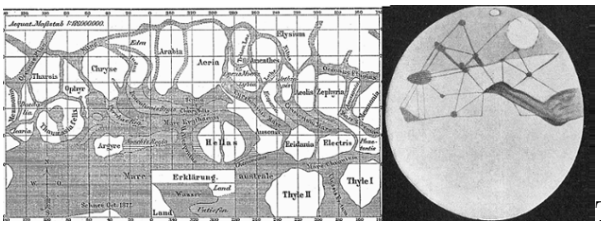
B. western horizon

C. eastern horizon

D. below the horizon

The next page might contain more answer choices for this question

9 AstroMars

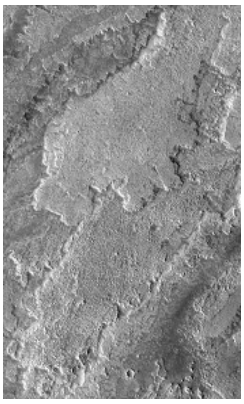
1. 

These drawings by Schiaparelli and Lowell were ultimately shown to be:[149]

   A. slip faults
   B. subduction zones
   C. rilles
   D. optical illusions
   E. rift valleys

2. Antipodal to the Tharsis bulge is[150]

   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 [151]

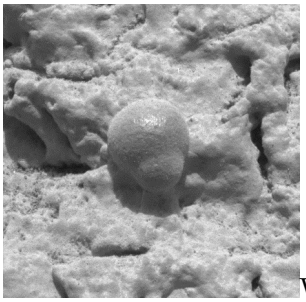
   A. dust storms
   B. plate tectonics
   C. water flow
   D. lava flow
   E. wind erosion

4. The Martian dichotomy separates[152]

   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

The next page might contain more answer choices for this question

5. According to Wikipedia, _____ was formed due to swelling of the Tharsis bulge which caused the crust to collapse[153]
   - **A. Valles Marineris**
   - B. Elysium
   - C. the southern lowlands
   - D. Hellas basin
   - E. the northern lowlands

6.  What is this hematite?[154]
   - **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

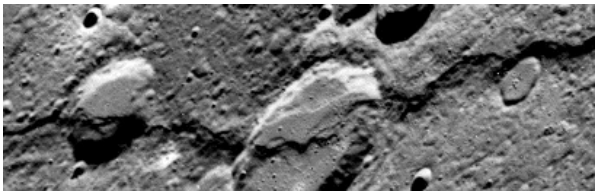
7. The polar ice caps on Mars are ___[155]
   - A. caused by geysers
   - B. actually clouds above the surface of Mars
   - C. a nearly equal mix of water and carbon dioxide
   - **D. mostly water**
   - E. mostly carbon dioxide

8. Liquid water cannot exist on Mars due to ___[156]
   - 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?[157]
   - 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

The next page might contain more answer choices for this question

10 AstroMercury

1.  The horizontal crack along the center of figure is a[158]

   A. antipodal
   B. propodal
   C. meander
   D. scarp
   E. rille

2. Antipodal to Caloris Basin is[159]

   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 [160]

   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 ___. [161]

   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?[162]

   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[163]

   A. hydrogen

The next page might contain more answer choices for this question

B. helium
C. oxygen
D. nitrogen
E. carbon dioxide

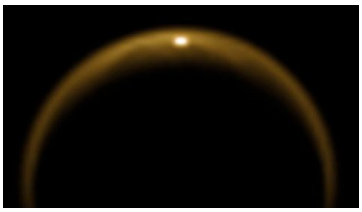
7. In what sequence did Mercury's weird terrain and Caloris basin form?[164]
   A. The were formed at exactly the same time
   B. The weird terrain was formed almost immediately after the Caloris basin
   C. The weird terrain was formed a few millions years after the Caloris basin
   D. The weird terrain was formed approximately 2 billion years after the Caloris basin
   E. The weird terrain was formed approximately 2 billion years before the Caloris basin

11 AstroMirandaTitan

1. The 1982 Voyager flyby of Miranda (a moon of Uranus) established that _____ [165]
   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" [166]
   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 [167]
   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 [168]
   A. a volcano
   B. lightening
   C. aurora borealis (northern lights)

The next page might contain more answer choices for this question

D. a lake

E. solar wind particles striking the atmosphere

5. One "year" on Saturn's largest moon Titan lasts [169]

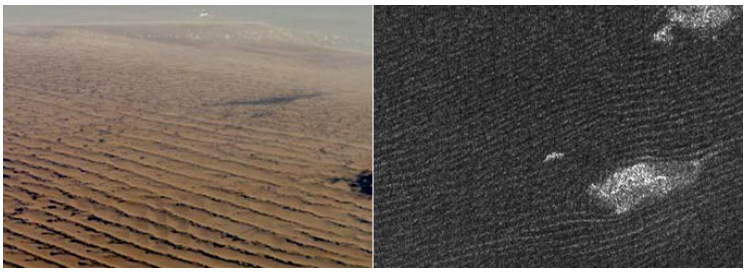
A. 3 hours

B. 3 years

C. 30 hours

D. 30 years

E. 300 days

6.  The photographs compare [170]

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, [171]

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

12 AstroPlanetaryScience

1.  The incomplete rims seen in the figure are caused by:[172]

A. meteorite erosion

B. micrometeorite erosion

C. rilles

The next page might contain more answer choices for this question

D. vulcanism

E. low surface gravity

2. Rilles are caused by[173]

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) [174]

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

13 AstroPluto and planetary mass

1. Which of the following is NOT used to measure the mass of a planet[175]

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?[176]

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?[177]

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[178]

A. the motion of an artificial satellite

The next page might contain more answer choices for this question

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[179]

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

14 AstroPtolCopTycho

1. The Ptolemaic system was geocentric.[180]

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.[181]

A. TRUE

B. FALSE

3. Tycho tended to favor religious arguments over scientific arguments when justifying his opinions about the geocentric/heliocentric controversy.[182]

A. TRUE

B. FALSE

4. Tycho was the first to propose an earth-orbiting sun had planets in orbit around the Sun.[183]

A. TRUE

B. FALSE

5. The Ptolemaic system was heliocentric.[184]

A. TRUE

B. FALSE

6. Most ancient Roman and most medieval scholars thought the Earth was flat.[185]

A. TRUE

B. FALSE

7. Evidence for the Copernican system is that the Earth does not seem to move.[186]

A. TRUE

B. FALSE

8. The ancient Greeks believed in circular orbits, causing them to devise the epicycle and the deferent.[187]

A. TRUE

B. FALSE

The next page might contain more answer choices for this question

9. Copernicus was a university-trained Catholic priest dedicated to astronomy.[188]

   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.[189]

    A. TRUE

    B. FALSE

11. Copernicus shared his heliocentric theory with colleagues decades before he died.[190]

    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.[191]

    A. TRUE

    B. FALSE

15 AstroSizeWhitdwrfNeutstarQSO

1. At the center of the Crab nebula is [192]

   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? [193]

   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?[194]

   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

The next page might contain more answer choices for this question

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?[195]

   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[196]

   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[197]

   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[198]

   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[199]

   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?[200]

The next page might contain more answer choices for this question

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?[201]

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?[202]

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[203]

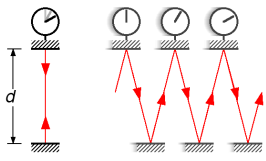
A. the expansion of the universe

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 [204]

A. all of these are true

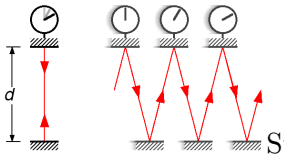
B. gravitational shift

C. doppler shift

D. special relativity

E. general relativity

The next page might contain more answer choices for this question

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?[205]

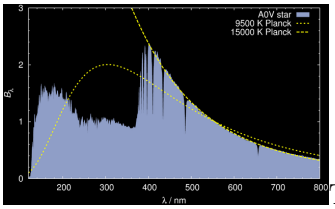
A. The observer on the ground would perceive the width the train to be greater.

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[206]

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. [207]

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?[208]

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, [209]

A. 0.1

B. 1

C. 10

The next page might contain more answer choices for this question

D. 25

E. 100

19. What was Messier doing when he independently rediscovered the Crab in 1758? [210]

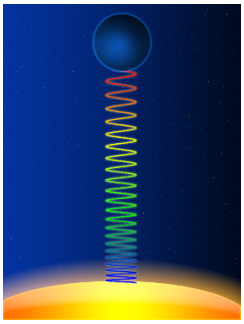
A. Trying to measure the orbital radius of a planet

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?[211]

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?[212]

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

16 AstroStarCluster

1. A grouping with 100 thousand stars would probably be a[213]

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[214]

The next page might contain more answer choices for this question

A. True

B. False

3. Many stars in a typical globular cluster are nearly as old as the universe[215]

A. True

B. False

4. The number of globular clusters in the Milky way galaxy is about[216]

A. 1,500

B. 150

C. 15 thousand

D. 15 million

5. The location of open clusters can be described as[217]

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?[218]

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[219]

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?[220]

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[221]

A. True

B. False

10. Members of an open cluster feel significant forces from nearby giant molecular clouds[222]

The next page might contain more answer choices for this question

A. True

B. False

11. Members of a globular cluster tend to be[223]

A. young

B. old

C. of all ages

12. Members of a globular cluster tend to have[224]

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[225]

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[226]

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

17 AstroStellarMeasurements

1. Stellar parallax is [227]

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[228]

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[229]

A. 400 and 700 nanometers

B. 1 and 10 nanometers

C. 600 and 1200 nanometers

The next page might contain more answer choices for this question

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.[230]

A. $3x10^3$

B. $3x10^9$

C. $3x10^{11}$

D. $3x10^7$

E. $3x10^5$

5. Luminosity is [231]

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[232]

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 [233]

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[234]

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.[235]

A. .015

B. 0.15

The next page might contain more answer choices for this question

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? [236]

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?)[237]

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? [238]

A. 10 parsecs

B. 25 parsecs

C. 5 parsecs

D. 1 parsec

E. 50 parsecs

18 AstroVenus

1. When imaged in visible light Venus appears like _____ rather than _____.[239]

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[240]

A. water

B. steam

C. carbon dioxide

D. nitrogen

E. sulfuric acid

The next page might contain more answer choices for this question

3. The geology of Venus is predominantly[241]
   A. Basalt
   B. Andesite
   C. Picrite
4. Basalt is what type of rock?[242]
   A. Igneous
   B. Sedimentary
   C. Metamorphic
5. The rocks on Venus are mostly[243]
   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.[244]
   A. TRUE
   B. FALSE
7. When Venus is viewed in the ultraviolet, its color appears brownish.[245]
   A. TRUE
   B. FALSE
8. Moldavite is a mineral that may be associated with what radiation astronomy phenomenon?[246]
   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[247]
   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?[248]
    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[249]
    A. the mass of Venus is slightly higher

The next page might contain more answer choices for this question

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[250]

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[251]

A. oxygen

B. helium

C. hydrogen

D. nitrogen

E. sulfuric acid

19 AstroWikipSidereNunc

1. The Wikipedia article 'Sidereus Nuncius' suggests that the inventor of the telescope was likely to be[252]

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[253]

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 [254]

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 [255]

A. a mistake

B. a double magnifying glass

The next page might contain more answer choices for this question

C. the magic eye

D. the liberator

E. an optical cannon

5. The "terminator" for Galileo was [256]

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[257]

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 [258]

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 [259]

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 _____ [260]

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 [261]

A. a planetary nebula

B. a supernovae remnant

The next page might contain more answer choices for this question

C. the rings of Saturn

D. a comet

E. many faint stars

11. Galileo's naming of the "Medicean Stars"[262]

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

20 AstroWikipSolSys1

1. Very far from the sun, the heliosphere[263]

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.[264]

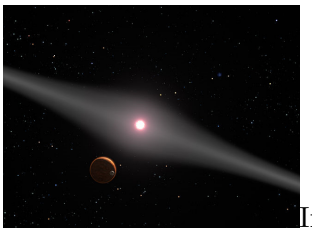
A. 1

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[265]

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 [266]

A. the star in the middle

B. the north pole of a planet

The next page might contain more answer choices for this question

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 [267]
   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. [268]
   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?[269]
   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, [270]
   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[271]
   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[272]
    A. interstellar
    B. retrograde
    C. ecliptic

The next page might contain more answer choices for this question

D. angular

E. fissile

11. The AU is[273]

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[274]

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[275]

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?[276]

A. 3

B. 10

C. 30

D. 100

E. 300

15. Roughly how much bigger is a the Sun than a gas planet?[277]

A. 3

B. 10

C. 30

D. 100

E. 300

The next page might contain more answer choices for this question

21 AstroWikipSolSys2

1. In astrophysics, what is accretion? [278]

   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? [279]

   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, [280]

   A. true
   B. false

4. Pluto is classified as [281]

   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? [282]

   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. [283]

   A. 20
   B. 2
   C. 200
   D. 2000

7. The revolution of Haley's comet around the Sun is nearly circular. [284]

   A. true
   B. false

8. The revolution of Haley's comet around the Sun is opposite that of the 8 planets.[285]

The next page might contain more answer choices for this question

A. true

B. false

9. The frost line is situated approximately [286]

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

22 AstroWikipStar

1. Why is a star made of plasma? [287]

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 [288]

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. [289]

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 [290]

A. through an HR diagram as they die

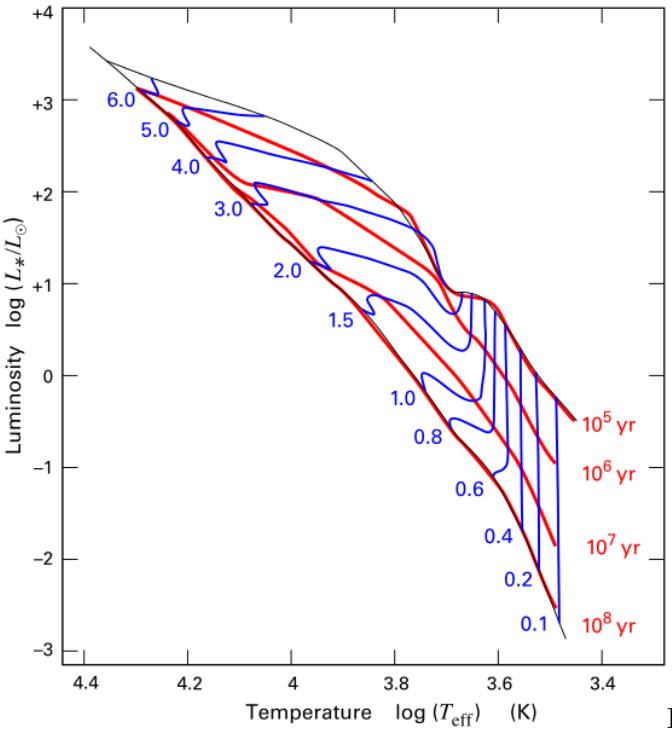
B. through a cluster as they die

C. through a cluster as they are born

D. Two of these are true

E. through an HR diagram as they are born

The next page might contain more answer choices for this question



5. How do low-mass stars change as they are born?[291]

   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 [292]

   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 [293]

   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 _____ [294]

   A. neutron star....black hole
   B. white dwarf....black hole

The next page might contain more answer choices for this question

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 _____ [295]

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? [296]

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 [297]

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. [298]

A. None of these is correct.

B. collisions

C. photon exchange

D. ion exchange

E. Two of these are correct

13. A starburst galaxy. [299]

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) [300]

A. $P > \beta MT$

The next page might contain more answer choices for this question

B. $M > \beta RT$

C. $R > \beta MT$

D. $P > \beta MR$

E. $T > \beta RM$

15. Which of the following changes in the properties of a giant molecular cloud might cause it to collapse? [301]

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? [302]

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? [303]

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

23 AstroWikipediaAstronomy

1. When did astronomy split between theoretical and observational branches?[304]

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[305]

A. among the Babylonians

B. among the Chinese

C. in south America

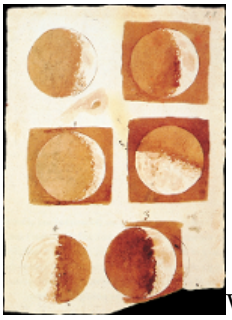
D. in ancient Greece

E. in central America

The next page might contain more answer choices for this question

3. How many years did it take before Europe made a device as sophisticated as Antikythera?[306]
   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[307]
   A. planets
   B. eclipses
   C. seasons

5.  Who drew these sketches?[308]
   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)?[309]
   A. 17th century
   B. 19th century
   C. 18th century
   D. 20th century
   E. 16th century

7. The largest galaxy in the local group is[310]
   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)[311]
   A. Neptune and the Alabama Streaker
   B. Mercury and Friendship

The next page might contain more answer choices for this question

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 _____[312]

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? [313]

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[314]

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[315]

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[316]

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 [317]

A. the Moon and Sun

B. the Sun

The next page might contain more answer choices for this question

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[318]
    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[319]
    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?[320]
    A. 14th century
    B. 18th century
    C. 20th century
    D. 16th century

24 AstroWikipediaAstronomy2

1.  What is this? [321]
    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 _____[322]
    A. magnetism
    B. gravity
    C. nuclear fusion

The next page might contain more answer choices for this question

D. nuclear fission

E. exploding stars

3. Wihlem Conrad Rontgen, a pioneer in X-rays is famous for his photo of [323]

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[324]

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[325]

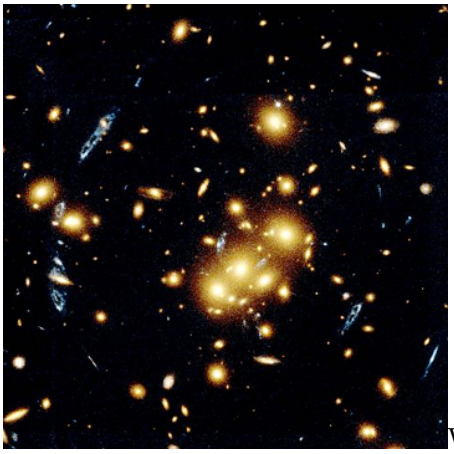
A. X-rays

B. blue light

C. infrared

D. gamma rays

E. ultra violet

6.  What are the blue things in this figure?[326]

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.[327]

A. meteors

The next page might contain more answer choices for this question

B. photons

C. radio waves

D. energy

E. meteorites

8. Most gamma rays are[328]

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[329]

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 [330]

A. underground

B. near the north and south poles

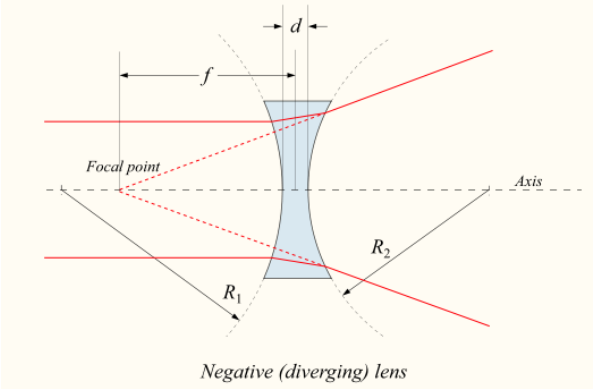
C. near the equator

D. where the air is dry

E. where the air is cold

25 a25GeometricOptics_image

1. figure:



Shown is a corrective lens by a person who needs glasses. This ray diagram illustrates[331]

A. how a nearsighted person might see a distant object

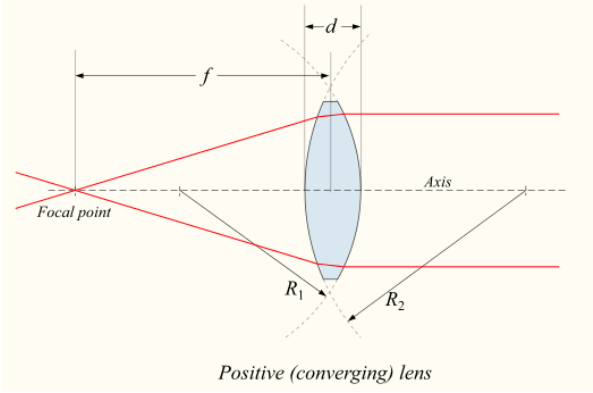
B. how a nearsighted person might see an object that is too close for comfort

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

The next page might contain more answer choices for this question

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[332]

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[333]

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[334]

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[335]

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[336]

A. it does not bend

B. the frequency decreases

C. the frequency increases

D. it bends towards the normal

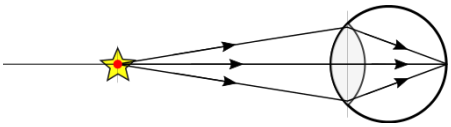
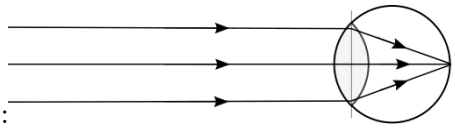
The next page might contain more answer choices for this question

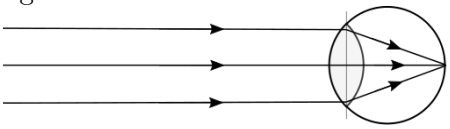
E. it bends away from the normal

7. An important principle that allows fiber optics to work is[337]
   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[338]
   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

26 a25GeometricOptics_vision

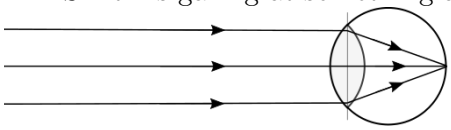
1. Which lens has the shorter focal length?[339]
   A. This lens:
   
   B. This lens:
   
   C. Both lenses have the same the same focal length

2. figure:
   
   If this represents the eye looking at an object, where is this object?[340]
   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.[341]
   A. False
   B. True

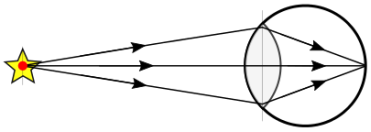
The next page might contain more answer choices for this question

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

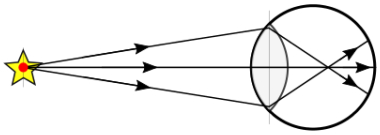


Suppose the object is suddenly moved closer, but for some reason Mr. Smith does not refocus his eyes. which drawing below best depicts the rays' paths.[342]

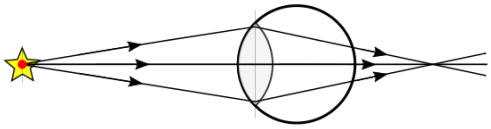
A. This drawing:



B. This drawing:



C. This drawing:



27 b_WhyIsSkyDarkAtNight

1. Approximately how often does a supernovae occur in a typical galaxy?[343]
   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[344]
   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[345]
   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?[346]
   A. 350km/s
   B. 700km/s
   C. 1400km/s

5. The "apparent" magnitude of a star is[347]
   A. How bright it would be if you were exactly one light year away

The next page might contain more answer choices for this question

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)?[348]

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?[349]

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?[350]

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

28 b_ecliptic_quiz1

1. The ecliptic is the set of all points on the celestial sphere[351]

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 _____ [352]

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)[353]

A. 0

B. 1

C. 2

D. 3

E. 4

The next page might contain more answer choices for this question

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.[354]

    A. true

    B. false

5. Four minutes times 365 is approximately one[355]

    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[356]

    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.[357]

    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.[358]

    A. true

    B. false

9. In the course of a year, the Sun is always in or near one of the 12 zodiacal constellations[359]

    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[360]

    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

29 b_motionSimpleArithmetic

1. Mr. Smith starts from rest and accelerates to 4 m/s in 3 seconds. How far did he travel?[361]

    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?[362]

The next page might contain more answer choices for this question

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? [363]

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?[364]

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? [365]

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?[366]

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?[367]

A. 3.0 meters

B. 4.0 meters

C. 5.0 meters

D. 6.0 meters

The next page might contain more answer choices for this question

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? [368]

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?[369]

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?[370]

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? [371]

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?[372]

A. 13.0 meters

B. 14.0 meters

C. 15.0 meters

D. 16.0 meters

E. 17.0 meters

The next page might contain more answer choices for this question

30 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 _____[373]

   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 _____[374]

   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?[375]

   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

31 b_saros_quiz1

1. Saros (or Sar) was the Babylonian word for the Saros cycle.[376]

   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[377]

   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.[378]

   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.[379]

   A. true

The next page might contain more answer choices for this question

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.[380]

A. true

B. false

6. The name "saros" (Greek: σαρος) was first given to the eclipse cycle by[381]

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[382]

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.)[383]

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)?[384]

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?[385]

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[386]

A. 15

B. 5

C. 8

D. 30

The next page might contain more answer choices for this question

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