pg 3/19 The spectrum of a star is a(n) absorption spectrum.

pg 3/26 The proton-proton chain A series of three nuclear reactions that builds a helium atom by adding together protons. The main energy source in the sun.

pg 4/52 Sun spots are dark because they are slightly cooler than ~~these~~ the rest of the photosphere. The average sunspot is about twice the size of earth and contains magnetic forces a few thousand times stronger than Earth's.

pg 4/63 A star's luminosity depends only on the star's... It depends on 2 things - it's size and its temperature

pg 4/62-63 The location of a star in the HR diagram indicates its temperature and intrinsic brightness. (Luminosity)

pg 4/65 The absolute magnitude of a star is the apparent magnitude it would have if it were here.

pg 4/67 The luminosity of a star is a measure of the total energy radiated by the star in one

pg 4/69 In the HR diagram 90 percent of all stars are in the main sequence.

Question 9:

Score: 1.00

Why are Europa, Ganymede, and Callisto necessary for the continued heating of Io?

- a. The tidal forces that these moons exert on Io are greater than the tidal force on Io due to Jupiter.
- ✓ b. These moons periodically tug on Io and keep its orbit elliptical.
- c. These moons send incoming comet bodies toward Io.
- d. These outer moons disrupt Jupiter's magnetic field lines causing them to twist back and forth across Io.
- e. Io is the smallest of these moons and subject to their influence.

Question 4:

Score: 0.00

What is the Roche limit?

- ✓ a. The maximum distance from a planet at which planetary rings can exist.
- b. The maximum distance that a moon can travel from its planet.
- ✗ c. The maximum mass of a blattella germanica.
- d. The maximum mass of a terrestrial planet.
- e. The minimum mass of a Jovian planet.

Correct Answer:
a

Question 6:

Score: 0.00

The density of Callisto is 1.8 grams per cubic centimeter and that of Ganymede is 1.9 grams per cubic centimeter. What does this suggest about these outer two of Jupiter's four big moons?

- a. These two moons must be made of roughly equal volumes of rock and iron.
- ✓ b. These two moons must be made of roughly equal volumes of ice and rock.
- ✗ c. Both moons must be larger than Earth's moon.
- d. Both moons must be smaller than Earth's moon.
- e. both b and c above

Correct Answer:
b

Status: Incorrect

Question 7:

Score: 0.00

What evidence do we have that the surface of Europa is young and active?

- a. The density of Europa is 3.0 grams per cubic centimeter.
- ✗ b. Europa is the smallest of Jupiter's four large moons.
- ✓ c. Europa has very few impact craters.
- d. both a and b above
- e. all of the above

Correct Answer:
c

Question 15:

Score: 0.00

Both Uranus and Neptune have a blue-green tint when observed through a telescope. What does this tell you about their composition?

- a. Their atmospheres are composed of mostly hydrogen and helium.
- b. Their atmospheres are composed of mostly carbon dioxide.
- ✗ c. Their atmospheres are composed of mostly nitrogen.
- d. Their atmospheres contain traces of ammonia.
- ✓ e. Their atmospheres contain traces of methane.

Correct Answer:
e

Question 3:

Score: 0.00

The two requirements for a strong planetary magnetic field are rapid rotation and a fluid interior zone composed of an electrically conductive material. Jupiter's rotational period is slightly less than 10 hours. What type of matter fulfills the second requirement?

- ✗ a. liquid molecular hydrogen
- b. molten copper-aluminum
- ✓ c. liquid metallic hydrogen
- d. a salty subsurface ocean
- e. molten iron-nickel

Correct Answer:
c

Incorrect

Question 20:

Score: 0.00

What evidence indicates that the rings of Uranus have little dust and the rings of Neptune contain a lot of dust?

- a. The camera lens of Voyager 2 was dust free until it passed through the rings of Neptune.
- ✗ b. The rings of Uranus appear bright in forward-scattered light and the rings of Neptune appear dark in forward-scattered light.
- ✓ c. The rings of Uranus appear dark in forward-scattered light and the rings of Neptune appear bright in forward-scattered light.
- d. The rings of Uranus appear bright in back-scattered light and the rings of Neptune appear dark in back-scattered light.
- e. The rings of Uranus appear dark in back-scattered light and the rings of Neptune appear bright in back-scattered light.

Correct Answer:
c

Question 1:

Score: 0.00

What evidence do we have that Jupiter has a very hot interior?

- a. It reflects most of the sunlight that it receives.
- ✗ b. It absorbs most of the sunlight that it receives.
- ✓ c. It emits more energy than it receives from the sun.
- d. both a and b above
- e. all of the above

Correct Answer:
c

Question 12:

Score: 0.00

What creates the gaps in Saturn's rings?

- a. the gravitational interaction between ring particles
- ✓ b. the gravitational influence of Saturn's moons on the ring particles
- ✗ c. the gravitational interactions between Saturn and the ring particles
- d. both and b above
- e. all of the above

Correct Answer:
b

Status: Incorrect

Question 19:

Score: 1.00

Why is the surface temperature of Venus higher than that of any other planet?

- a. Its period of rotation is longer than that of any other planet.
- b. Its orbit is more nearly circular than that of any other planet.
- ✓ c. It has an extreme greenhouse effect.
- d. It is the closest planet to the sun.
- e. It has a retrograde rotation.

Question 7:

Score: 0.00

What happened to the majority of the carbon dioxide that was formerly in Earth's atmosphere?

- a. Most of it remains in the atmosphere today.
- b. Most of it resides in living plants and animals.
- ✗ c. Most was ionized and eroded away by the intense solar wind of the youthful sun.
- d. Most was dissociated by ultraviolet photons and the carbon and oxygen escaped into space.
- ✓ e. Most of it dissolved into the oceans and now is in the form of limestone rocks of Earth's crust.

Correct Answer:
e

Question 21:

Score: 1.00

All of the dormant volcanoes on Venus and Mars are the shield type, and many are much larger than any shield volcano on Earth. What does this tell us about Venus and Mars?

- a. Venus and Mars both have plate tectonics
- ✓ b. Neither Venus nor Mars has plate tectonics.
- c. Their interiors are at a higher temperature than Earth's interior.
- d. Their interiors are at a lower temperature than Earth's interior.
- e. Venus and Mars both have carbon dioxide atmospheres.

Question 24:

Score: 0.00

What evidence do we have that Mars had much more liquid water at its surface in the past than it has today?

- a. We see large dry outflow channels and valley networks on the surface of Mars.
- b. The deuterium hydrogen ratio is 5.5 times as high as on Earth.
- ✗ c. Robotic rovers have found small spherical concretions.
- d. Robotic rovers have found ripple marks.
- ✓ e. all of the above

Question 14:

Score: 0.00

Where are most of the asteroids?

- a. inside the orbit of Mercury
- ✗ b. between the orbits of Earth and Venus
- c. between the orbits of Earth and Mars
- ✓ d. between the orbits of Mars and Jupiter
- e. between the orbits of Jupiter and Neptune

Correct Answer:
d

Question 1:

Score: 0.00

When Earth formed it melted and differentiated. What was the source of heat that melted Earth?

- a. the in-fall of matter that formed Earth
- ✗ b. the decay of radioactive elements
- c. sunlight striking Earth's surface
- ✓ d. both a and b above
- e. all of the above

Correct Answer:

Question 3:

Score: 0.00

Earth's interior can be divided up into four zones: the inner core, the outer core, the mantle, and the crust. Which of these zones has the lowest density?

- ✗ a. the inner core
- b. the outer core
- c. the mantle
- ✓ d. the crust
- e. All four zones have the same density.

Correct Answer:
d

Status: Incorrect

Question 25:

Score: 0.00

In the solar nebula at a distance of one AU from the protosun, the temperature is predicted to have been about 600 K. Which material could condense to form Earth in this environment?

- ✗ a. metals
- b. rocks
- c. ices
- ✓ d. both a and b above
- e. all of the above

Correct Answer:
d

Question 2:

Score: 0.00

What is the origin of the atoms of hydrogen, oxygen, and sodium in the perspiration that exits your body during an astronomy exam?

- ✗ a. All of these elements were synthesized inside stars more than 4.6 billion years ago.
- b. All of the elements were produced in the first few minutes after the big bang event.
- ✓ c. The hydrogen nuclei were produced a few minutes after the big bang event 13.7 billion years ago, and the oxygen and sodium nuclei were synthesized inside stars more than 4.6 billions years ago.
- d. They were all fused deep inside Earth.
- e. none of the above

Correct Answer:
c

Question 10:

Score: 0.00

How is the solar nebula theory supported by the motion of solar system bodies?

- a. All of the planets orbit the sun near the sun's equatorial plane.
- b. All of the planets orbit in the same direction that the sun rotates.
- ✗ c. Six out of nine planets rotate in the same direction as the sun.
- d. Most moons orbit their planets in the same direction that the sun rotates.
- ✓ e. all of the above

Correct Answer:
e

Status: Incorrect

Question 22:

Score: 0.00

How does the solar nebula theory explain the formation of an asteroid belt between Mars and Jupiter rather than a planet at this location?

a. A single planet formed here and was disrupted by an impact with a large comet from the outer solar system.

b. Jupiter swept up so much material that not enough was left to form a planet.

✗ c. Mars was once larger and collided with a large planetesimal from the inner solar system that sent debris outward.

✓ d. Jupiter formed early and its gravitational influence altered the orbits of nearby accreting planetesimals such that their collisions became destructive rather than constructive.

e. The asteroids were originally moons of the planets that were perturbed by Jupiter's gravity and now reside in the zone between Mars and Jupiter.

Correct Answer:
d

Question 1:

Score: 0.00

How do most astronomers believe that planets form?

a. from the material ejected when two stars collide

✓ b. in a spinning disk of gas and dust that naturally forms around protostars

✗ c. from material that is pulled from a star when another star passes nearby

d. in the collapse of planetary nebula shell of material around a white dwarf

e. in the collapse of planetary nebula shell of material around a neutron star

Correct Answer:
b

Question 24:

Score: 0.00

How did the solar nebula get cleared of material?

a. The radiation pressure of sunlight pushed gas particles outward.

b. The intense solar wind of the youthful sun pushed gas and dust outward.

✗ c. The planets swept up gas, dust, and small particles.

d. Close gravitational encounters with Jovian planets ejected material outward.

✓ e. all of the above

Correct Answer:
e

Status: Incorrect

Question 5:

Score: 1.00

What evidence do we have that the universe is expanding?

- a. Earth is gaining mass and volume as it collects about 40,000 tons of meteoric dust each year.
- b. As the sun ages its surface temperature decrease and its diameter increases.
- c. As stars age some become giants and supergiants.
- ✓ d. The amount of red shift in the spectra of distant galaxies is proportional to their distance.
- e. all of the above

Status: Correct

Question 4:

Score: 1.00

What is meant by the term "observable universe"?

- a. It is everything that exists.
- ✓ b. It is the part of everything that exists that we can see.
- c. It is the part of everything that exists that is above the horizon at one instant.
- d. It is the part of everything that exists that is within our galaxy.
- e. It is the part of everything that exists that is within the solar system.

Status: Correct

Question 19:

Score: 1.00

What alteration to the standard big bang model solves the flatness and horizon problems?

- a. The unification of the electromagnetic force and the weak force.
- b. The unification of the electroweak force and the strong force.
- ✓ c. Sudden rapid expansion early during the first second of the universe.
- d. both a and b above
- e. all of the above

Status: Correct

Question 8:

Score: 0.00

The early universe was

- a. hot.
- b. cool.
- ✗ c. at high density.
- d. both a and b above
- ✓ e. both a and c above

Correct Answer:
e

Question 20:

Score: 0.00

In 1998 two independent teams of astronomers observed supernova type Ia to determine galactic distances. They hoped to find out how much gravity had slowed the rate of expansion of the universe. What did they discover?

- a. The rate of expansion is slowing more than expected.
- ✗ b. The rate of expansion is slowing less than expected.
- c. The rate of expansion has not changed.
- ✓ d. The rate of expansion is increasing.
- e. The universe is contracting.

Correct Answer:
d

Question 3:

Score: 1.00

If the universe has no edge, then it must also have no

- a. age.
- b. mass.
- ✓ c. center.
- d. temperature.
- e. all of the above

Status: Correct

Question 13:

Score: 0.00

When viewing a distant galaxy the amount of look-back time in years is equal to the

- ✓ a. distance to the galaxy in light years.
- ✗ b. round-trip distance to the galaxy in light years.
- c. time that has passed since the galaxy was first discovered.
- d. exposure time of photograph that is taken of that galaxy.
- e. time since you last looked at the galaxy.

Correct Answer:
a

Question 25:

Score: 0.00

According to the WMAP (Wilkinson Microwave Anisotropy Probe) results, what is the nature of our universe?

- a. The universe is 4% baryonic matter, 23% dark matter, and 73% dark energy.
- b. The universe is 13.7 billion years old.
- ✗ c. Inflation occurred everywhere early in the first second of expansion.
- d. The universe is flat, accelerating, and will expand forever.
- ✓ e. all of the above

Correct Answer:
e

Status: Incorrect

Question 2:

Score: 0.00

What cosmological inference can you draw from the observed darkness of the night sky?

- a. The universe is infinite.
- b. The sun is below the horizon.
- ✗ c. Earth's atmosphere scatters light.
- ✓ d. The universe is not infinitely old.
- e. The apparent magnitude of bright galaxies is less than that of bright stars.

Correct Answer:
d

Status: Incorrect

Question 11:

Score: 0.00

Why is a supernova type Ia standard candle better to use in measuring very long distances than the Cepheid variable star standard candle?

✓ a. Supernovae type Ia are more luminous.

b. Cepheid variables exist only in the Milky Way Galaxy.

✗ c. Supernovae type Ia are very common.

d. The calibration of supernovae type Ia is more precise.

e. both c and d above

Correct Answer:

a

Question 1:

Score: 0.00

Galaxies with active star formation also have which of the following?

a. plenty of gas and dust

✗ b. O and B associations

c. emission nebulae

d. a bluish tint

✓ e. all of the above

Correct Answer:
e

Question 4:

Score: 0.00

Which type of galaxy are the two hazy patches visible to the unaided eye in southern skies that are known as the Large and Small Magellanic Clouds?

a. normal spiral

✗ b. barred spiral

c. elliptical

✓ d. irregular

e. peculiar

Correct Answer:
d

Status: Incorrect

Question 16:

Score: 0.00

Why do astronomers propose that the Milky Way Galaxy contains a lot of dark matter?

a. The light from stars in the disk is dimmed about 1 magnitude per kiloparsec.

b. The light from stars in the disk is redder than their spectral types indicate.

✗ c. Dark silhouettes of material are observed blocking the light from stars.

✓ d. The galaxy's rotation curve flattens out at great distances.

e. all of the above

Correct Answer:
d

Question 3:

Score: 1.00

The Milky Way is _____ galaxy.

a. a normal spiral

✓ b. a barred spiral

c. an elliptical

d. an irregular

e. a S0

Question 24:

Score: 0.00

You observe a spiral galaxy that rotates in one direction in its outer regions and rotates in the opposite direction in its inner regions. What does this opposing motion suggest?

a. This galaxy has a supermassive black hole at its center.

✗ b. This galaxy has a repulsive gravitational force at work.

c. This galaxy is about to divide into two galaxies.

✓ d. This galaxy is a merger of two galaxies.

e. This is an irregular galaxy.

Correct Answer:
d

Status: Incorrect

Question 3:

Score: 0.00

What main conclusion did the Herschels draw from their star counts?

✓ a. The Milky Way is a disk of stars with the sun near the center.

b. The center of the Milky Way is far away in the constellation Sagittarius.

c. All stars have about the same luminosity.

✗ d. The sun's luminosity is much higher than that of the average star.

e. The Milky Way extends out an infinite distance.

Correct Answer:
a

Question 13:

Score: 1.00

Where are the youngest stars in the Milky Way Galaxy located?

✓ a. in the flattened disk

b. in the spherical halo

c. in the nuclear bulge

d. in the globular clusters

e. all of the above

Status: Correct

Question 11:

Score: 0.00

What main conclusion did Shapley draw from his measurements of the distances to the globular clusters?

✓ a. The sun is far from the center of the Milky Way.

b. The sun is near the center of the Milky Way.

✗ c. A period-luminosity relationship also exists for RR Lyrae variable stars.

d. Globular clusters contain 10,000 to 1,000,000 stars.

e. Open clusters and globular clusters have about the same average diameter.

Correct Answer:
a

Status: Incorrect

Question 24:

Score: 1.00

At what wavelength band can we observe the center of our galaxy?

- a. radio
- b. infrared
- c. visible
- ✓ d. both a and b above
- e. all of the above

Status: Correct

Question 5:

Score: 0.00

Which type of pulsating variable star is the most luminous?

- ✓ a. long period Cepheid variables
- b. medium period Cepheid variables
- ✗ c. short period Cepheid variables
- d. RR Lyrae variables
- e. All pulsating variables have the same average luminosity.

Correct Answer:
a

Question 18:

Score: 0.00

What does the observed heavy element abundance tell us about a star?

- ✗ a. A high percentage of metals indicates that a star is about to leave the main sequence.
- b. A high percentage of metals indicates that a star will remain on the main sequence for a long time.
- ✓ c. A low percentage of metals indicates that a star formed long ago.
- d. A low percentage of metals indicates that a star formed recently.
- e. both a and d above

Correct Answer:
c

Status: Incorrect

Question 14:

Score: 0.00

Why have no black dwarfs yet been observed in our galaxy?

a. They can only be detected by their gravitational influence on a binary companion.

b. They are too dim for our present-day telescopes to detect.

✗ c. Astronomers are not motivated to search for such objects.

d. They are all too distant (in theory) to be detected.

✓ e. Our galaxy is too young for any to have formed.

Correct Answer:
e

Status: Incorrect

Question 22:

Score: 1.00

Why can't massive stars generate energy from iron fusion?

a. The temperature at their centers never gets high enough.

b. The density at their centers is too low.

✓ c. Iron fusion consumes energy.

d. Not enough iron is present.

e. both a and b above

Question 15:

Score: 1.00

What unusual property do all higher mass white dwarfs have?

a. They are cooler than lower mass white dwarfs.

✓ b. They are smaller than lower mass white dwarfs.

c. They are less dense than lower mass white dwarfs.

d. They are less luminous than lower mass white dwarfs.

e. all of the above

Status: Correct

Question 25:

Score: 0.00

How does the mass of a spectral type A5 main-sequence star compare to that of the sun?

a. The sun has greater mass.

✗ b. The mass of the two stars is the same.

✓ c. The A5 main-sequence star has greater mass.

d. The A5 main-sequence star must be a binary star to determine its mass.

e. The sun is not a binary star; thus, there is no way that we can compare their masses.

Correct Answer:
c

Question 18:

Score: 0.00

The mass-luminosity relationship applies to which luminosity class?

a. the supergiant

b. the giant

✗ c. the subgiant

✓ d. the main sequence

e. The mass luminosity relationship applies to all luminosity classes.

Correct Answer:
d

Question 5:

Score: 0.00

Why does helium fusion require a higher temperature than hydrogen fusion?

✓ a. Helium nuclei have two protons whereas hydrogen nuclei have only one proton.

✗ b. Helium nuclei have the greatest binding energy per nucleon.

c. Helium nuclei are less massive than hydrogen nuclei.

d. both a and b above

e. both a and c above

Correct Answer:
a

Status: Incorrect

Question 12:

Score: 0.00

What is a protostar's energy source?

a. nuclear fusion

✓ b. gravitational energy

✗ c. chemical energy

d. both a and b above

e. all of the above

Correct Answer:
b

Question 3:

Score: 0.00

Why can smaller parallax angles be measured by a telescope in Earth's orbit than by a telescope at Earth's surface?

a. Telescopes orbiting Earth are closer to the stars.

✓ b Earth's atmosphere severely limits a telescope's resolving power.

✗ c. Earth's atmosphere severely limits a telescope's light gathering power.

d. Earth's atmosphere severely limits a telescope's magnifying power.

e. They can be connected to Earth-based telescopes to do interferometry.

Correct Answer:
b

Question 10:

Score: 0.00

How can a cool star be more luminous than a hot star?

✓ a. It can be more luminous if it is larger.

✗ b. It can be more luminous if it is denser.

c. It can be more luminous if it is closer to Earth.

d. It can be more luminous if it is farther from Earth.

e. A cool star cannot be more luminous than a hot star.

Correct Answer:
a

Status: Incorrect

Question 4:

Score: 1.00

What type of spectra is obtained from a reflection nebulae?

a. continuous spectra

b. emission line spectra

✓ c. absorption line spectra

d. both b and c above

e. all of the above

Status: Correct

Question 22:

Score: 1.00

Why is there a lower mass limit of 0.08 solar mass for main-sequence stars?

a. This is an unsolved astronomical mystery.

b. Objects below this mass can only form in HI clouds.

✓ c. Objects below this mass are not hot enough to fuse normal hydrogen.

d. They form too slowly and hot stars nearby clear the gas and dust quickly.

e. Our telescopes do not have enough light gathering power to detect dim objects.

Question 25:

Score: 0.00

Of the following, which main-sequence star has a longer life expectancy than the sun?

a. spectral type B9

✓ b. spectral type K2

✗ c. spectral type A7

d. spectral type O5

e. spectral type F4

Correct Answer:
b

Status: Incorrect

Question 19:

Score: 0.00

What would happen in the interior of a normal star if gravity were to shrink the star's size a small amount?

a. The interior temperature would increase.

b. The rate of fusion would increase.

✗ c. The gas pressure would increase

d. both a and b above

✓ e. all of the above

Correct Answer:
e

Hot emission nebulae are somewhat red and cool reflection nebulae are blue. Why are these colors different from what Wien's law tells us about the radiation emitted by a black body?

a. The gases in an emission nebula do not emit light like a black body.

✗ b. We see reflection nebulae by reflected light, not emitted light.

c. The dust grains in reflection nebulae scatter shorter wavelengths of visible light better than longer wavelengths.

d. both a and b above

✓ e. all of the above

Correct Answer:
e

Question 9:

Score: 0.00

What triggers the gravitational collapse of material inside a molecular cloud?

a. collisional cooling

b. shielding of the interstellar magnetic field

c. tidal forces slow the rate of rotation

✗ d. a subsidence in turbulence due to internal friction

✓ e. a passing shock wave

Correct Answer:
e

Status: Incorrect