

- 1 The Doppler shift of familiar spectral lines from gas clouds and stars in our galaxy measures their
 - a. relative ages.
 - b. directions of motion in the galaxy.
 - c. masses.
 - d. distances from the Sun.
 - e. orbital velocities within the galaxy.
- 2 Relative to the Milky Way family of stars, our sun is
 - a. neither at the center nor at the edge.
 - b. at the center.
 - c. at the extreme edge.
- 3 Once you know to look for it, you will see that different stars have different colors. Which of the following star colors indicates the highest surface temperature?
 - a. Yellow.
 - b. Red.
 - c. Peach.
 - d. Green.
 - e. Blue.
- 4 The epicenters of earthquakes are located
 - a. mostly near the Earth's equator.
 - b. mostly along continental boundaries.
 - c. at random places on the Earth's surface.
 - d. mostly in the centers of oceans.
 - e. mostly along the edges of moving plates.
- 5 Suppose that a flash of lightning from a cloud 5000 meters away is followed by a clap of thunder two seconds later. Assume that the light arrived in a negligible time and calculate the speed of the sound waves.
 - a. 2m/s
 - b. 5000m/s
 - c. 1250m/s
 - d. 2500m/s
 - e. 1000m/s
- 6 In the reaction chain that powers our Sun, the first nucleus to form is
 - a. C-12 (six protons and six neutrons).
 - b. He-4 (two protons and two neutrons).
 - c. D (one proton, one neutron).
 - d. ${}^2_1\text{H}$ (two neutrons stuck together).
 - e. He-3 (two protons and one neutron).
- 7 The star delta-Eridani shows a heliocentric stellar parallax of almost exactly $1/9$ seconds of arc. The distance from our Sun to delta-Eridani is
 - a. 9 parsecs.
 - b. 18 parsecs.
 - c. 4.5 parsecs.
 - d. $1/9$ parsecs.
 - e. 4 parsecs.

- 8 In our Sun, the convection zone is located
- above the central region but well below the surface.
 - near the surface.
 - at the very center.
- 9 Kepler was an early advocate of the Copernican Theory. When he applied it to Tycho's observations, it
- failed and was completely discarded.
 - failed but led to a better theory.
 - was as accurate as the observations.
 - worked perfectly.
- 10 Comets are made of
- rock and iron.
 - ice and frozen gas.
 - gold and silver.
 - concrete and marble.
 - styrofoam and poster paint.
- 11 Suppose that you lift an object by exerting an upward force of 20 Newtons on it. If gravity exerts a force of 10 Newtons downward on the object, what is the total force on the object?
- 10 Newtons upward
 - 10 Newtons downward
 - 20 Newtons upward
 - 200 Newtons downward
 - 20 Newtons downward
- 12 The red line of a spectrum is normally at a wavelength of 656 nm. In the light of a star that is moving away from us, we might expect to see that red line at a wavelength of
- 656nm.
 - 660nm.
 - 650nm.
- 13 Take Hubble's constant to be 65km/s/Mpc. If the red-shift of an object indicates that it is moving away from us at 260km/s, how far away is it?
- 0.25Mpc.
 - 10Mpc.
 - 260Mpc.
 - 4Mpc.
 - 0.1Mpc.
- 14 You see a reflecting telescope with a short, stubby tube and the eyepiece at the back. This telescope uses the
- Newtonian Focus.
 - Cassegrain Focus.
 - Coudé Focus
 - Prime Focus.

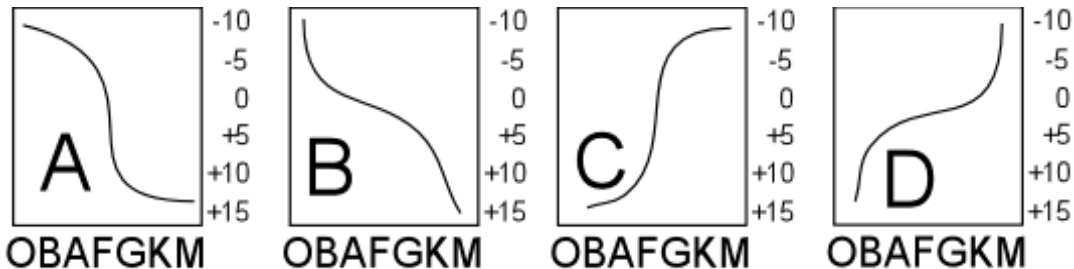
- 15 When an interstellar cloud fragment does not have enough mass to form a star powered by nuclear fusion, but gets hot enough to glow for a while, it is called
- a planet.
 - a brown dwarf.
 - a white dwarf.
 - a yellow dwarf.
 - a class M object.
- 16 The Lunar Regolith is
- a layer of dirt on the lunar surface.
 - another name for the lunar crust.
 - the layer just above the core.
 - a rock layer just beneath the lunar surface.
 - the soft part of the lunar core.
- 17 The Kuiper Belt is mostly located
- beyond the orbit of Neptune.
 - between the orbits of Uranus and Neptune.
 - between the orbits of Mars and Jupiter.
 - between the orbits of Jupiter and Uranus.
- 18 Detecting too few neutrinos from the Sun was a problem because it meant that
- some part of the theory was wrong.
 - the detectors were not working.
 - government grant money would be lost.
- 19 At the center of our Milky Way galaxy, neighboring stars are typically
- about the same distance apart as neighbors of our sun.
 - much farther apart than neighbors of our sun.
 - much closer together than neighbors of our sun.
- 20 Stellar Parallax is caused by
- the motion of our Sun relative to its neighbors.
 - turbulence in the Earth's atmosphere.
 - the finite speed of light.
 - the motion of the Earth around the Sun.
 - the actual motion of stars relative to their neighbors.
- 21 Icy objects condensed from the outskirts of the Solar Nebula to form
- the asteroid belt.
 - the Kuiper belt.
 - The moons of the Jovian Planets.
 - the interstellar dust.
 - The Oort Cloud.

- 22 Orbiting Infrared Observatories usually have limited life primarily because
- funds to operate them run out.
 - their orbits decay.
 - they run out of maneuvering fuel.
 - they run out of coolant.
 - they run out of electric power.
- 23 The idea that a supernova is preceded by a huge burst of neutrinos is
- a prediction that has now been observed.
 - no longer believed to be correct.
 - a purely theoretical idea that cannot be tested.
 - a prediction that has not yet been observed.
- 24 A nearby cluster of several thousand galaxies is called
- The Virgo Cluster.
 - The Local Group.
 - The Milky Way.
 - The Andromeda cluster.
- 25 The HR diagram of a young, open cluster typically shows
- the entire main sequence still present.
 - only the middle part of the main sequence still present.
 - only the upper part of the main sequence still present.
 - only the lower part of the main sequence still present.
- 26 In a Hertzsprung-Russell diagram, white dwarf stars such as Sirius B are
- at the upper right.
 - at the lower right.
 - at the upper left.
 - at the lower left.
- 27 Newton's explanation of Kepler's Laws relied upon a force that
- acts on all objects.
 - acts only on heavenly bodies.
 - acts only on planets.
 - acts only on inorganic matter.
 - acts on planets but not on comets.
- 28 The X-rays that reveal the possible presence of a black hole are the result of
- starlight accelerated in the hole's gravity.
 - vibrations of the hole's event horizon.
 - gravitons converted to photons by the hole.
 - matter heating up as it falls toward the hole.

- 29 Rising pressure at the center of a collapsing cloud usually
- causes the cloud to fragment.
 - blows the cloud apart.
 - prevents the cloud from fragmenting.
 - makes the collapse go faster.
 - stops the collapse.
- 30 Which of the following spectral classes corresponds to the highest surface temperature (on this list)?
- B
 - F
 - G
 - A
 - K
- 31 Assume that the Hubble constant is 65 km/s/Mpc . If a galaxy is 100 Mpc away, how fast is it moving away from us?
- 65 km/s
 - 0.65 km/s
 - 100 km/s
 - 6500 km/s
 - 650 km/s
- 32 We can use the pointer stars in Orion to locate a point in the sky near the
- Celestial Equator.
 - North Celestial Pole.
 - Star Sirius.
 - South Celestial Pole.
 - East Celestial Pole.
- 33 Galaxies A and B are 100 Mpc from us while galaxy C is 200 Mpc from us. From the viewpoint of galaxy A, we are moving away while
- B moves away and C moves closer.
 - B and C both move away.
 - C moves away and B moves closer.
 - B and C both move closer.
- 34 In a region of the atmosphere in which the temperature rises with increasing altitude
- you expect no changes.
 - you expect rapid changes.
- 35 The average energy of motion of an atom or molecule in a gas is called its
- entropy.
 - frequency.
 - density.
 - temperature.
 - speed.

- 36 During a meteor shower, shooting stars seem to be coming from
- the celestial north pole.
 - the radiant.
 - the equant.
 - the celestial equator.
 - all parts of the sky.
- 37 Suppose that an object with a mass of one kilogram and an object with a mass of two kilograms are both in free fall near the Earth's surface. As compared to the one kilogram object, the two kilogram object accelerates
- more because gravity pulls on it more strongly.
 - the same because gravity pulls on it more strongly and it has more inertia.
 - more because gravity pulls on it more strongly and it has less inertia.
 - less because gravity pulls on it less strongly and it has more inertia.
 - less because it has more inertia.
- 38 Which of the following colors indicates the hottest star?
- red.
 - peach.
 - yellow.
 - blue.
 - orange.

- 39 Which of the following pictures is the most like the main sequence on a Hertzsprung-Russell Diagram?



- 40 The total luminosity, at all wavelengths, of the source Sgr A* is approximately
- a thousand million times the luminosity of our sun.
 - a million times the luminosity of our sun.
 - a thousand times the luminosity of our sun.
 - the same as the luminosity of our sun.
 - one tenth the luminosity of our sun.
- 41 The formation of a new white dwarf is usually accompanied by a
- supernova explosion.
 - planetary nebula.
 - dust cloud.
 - nova.
 - helium flash.

- 42 When the number of sunspots is greatest, the energy output of the Sun is
- increased because solar activity is greater.
 - decreased because the spots radiate less.
 - unaffected because the spots are small.
- 43 The distances to the farthest galaxies can be measured using
- heliocentric parallax.
 - radar ranging.
 - the Tulley-Fisher relation.
 - Hertzsprung-Russel diagrams.
 - cepheid variable stars.
- 44 Light with an emission spectrum is usually generated by
- a hot, rarefied gas.
 - light from hot dense material passing through a rarefied gas.
 - hot, dense material.
 - a cold, rarefied gas.
- 45 Neutron stars are often observed as
- quasars.
 - novas.
 - asteroids.
 - Tau Tauri stars.
 - pulsars.
- 46 The frequency of a wave is defined to be
- The number of seconds that it takes for a crest to pass.
 - The distance from one crest to the next.
 - The distance from a maximum to a minimum.
 - The time for a set of crests to pass divided by the number of crests.
 - The number of crests that pass in one second.
- 47 One conclusion that was drawn from the gradual slowing of the radio signals from the Crab Nebula was that they were probably
- of natural origin.
 - from a source moving toward us.
 - of artificial origin.
 - from a source moving away from us.
 - an obvious hoax.
- 48 The twisting of magnetic field lines by the Sun's differential rotation causes
- sunspots.
 - solar granules.
 - solar gravity.
 - solar eclipses.
 - sun dogs.

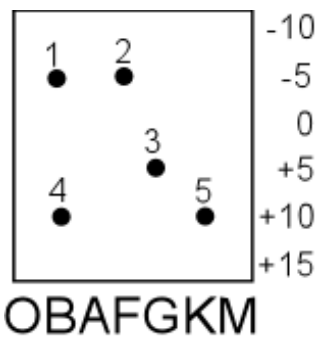
- 49 Which of the following three systems is regarded as the most normal for a terrestrial planet?
- Venus, with no moons at all.
 - Earth, with a moon larger than the dwarf planet Pluto.
 - Mars, with two moons each the size of an asteroid.
- 50 The word 'Parallax' in the term 'Spectroscopic Parallax' is used because that term refers to
- the use of stellar parallax.
 - a method for finding the masses of stars.
 - the use of parallel lines on the HR diagram.
 - a method for finding distances to stars.
- 51 Because mirrors only use one surface, they have a big advantage over lenses: They can be
- made out of metal.
 - made more accurately.
 - thinner and larger in diameter.
 - filled with more holes.
 - thicker and stronger.
- 52 Our Sun's location in the Milky Way is closest to the
- Sagittarius Arm.
 - Cygnus Arm.
 - Orion Arm.
 - Norma Arm.
 - Scutum-Crux Arm.
- 53 The star alpha-Centauri C has moved across the sky by 3853 seconds of arc during the last thousand years - slightly more than one full degree of arc. Its proper motion is
- $3.853''/\text{yr}$.
 - $1.9265''/\text{yr}$.
 - $0.26''/\text{yr}$.
 - $3853''/\text{yr}$.
 - $38.53''/\text{yr}$.
- 54 When a large interstellar cloud collapses, it usually
- forms a large ring that fragments to form a ring of stars.
 - fragments into several smaller clouds which then form stars.
 - remains together and collapses to a single large star.
 - remains together and spits out several stars.
- 55 The first telescope was built by
- A Dutchman
 - Tycho Brahe
 - Newton
 - Galileo

- 56 Which of the following spectral types corresponds to the star with the lowest surface temperature?
- K0
 - K5
 - G5
 - G0
- 57 The mass of Sgr A* has been determined by observing
- fluctuations in radio emissions from it.
 - the motions of stars near it.
 - interstellar space probes in orbit around it.
 - the intensity of X-ray emissions from it.
- 58 A type I supernova occurs when
- the core of a star collapses.
 - material falls onto a neutron star.
 - a white-dwarf collapses.
 - two neutron stars merge.
 - a white-dwarf flares briefly.
- 59 The iron core of an evolved massive star collapses because
- its temperature suddenly goes to zero.
 - its temperature rise stops when iron nuclei come apart.
 - the weight of the rest of the star goes away.
 - its temperature rises faster when iron nuclei come apart.
 - the weight of the rest of the star increases.
- 60 The stars of the Milky Way are found
- in a band of stars stretching across the sky.
 - only near the ecliptic.
 - only near the celestial equator.
 - only near the celestial poles.
 - in all parts of the celestial sphere.
- 61 The most convincing argument in favor of a large black hole at the center of the Milky Way Galaxy is
- its large mass.
 - the fact that it is at the center.
 - its large mass in a small region.
 - its power or luminosity.
- 62 Which of the following levels of the Sun's atmosphere has the highest temperature?
- photosphere.
 - transition zone.
 - corona.
 - chromosphere.
- 63 Within our own Milky Way Galaxy, our sun is a typical member of
- either Population I or II.
 - Population II.
 - Population I.

- 64 By making extensive observations of planetary motion, Tycho Brahe
- explained how planets move.
 - disproved Ptolemy's theory of planetary motion.
 - provided only a lot of accurate data.
 - discovered new planets.
 - proved that Copernicus was right.
- 65 Which of the following statements is scientific (as defined by Popper)?
- Passenger pigeons are extinct.
 - Passenger pigeons were pests.
 - Passenger pigeons taste terrible.
 - Passenger pigeons taste good.
 - Passenger pigeons are not extinct.
- 66 The Greenhouse Effect is important because it suggests an effect on
- shielding UV light from the Sun.
 - the Earth's climate.
 - the Earth's rotation.
 - the availability of greenhouses.
 - near-Earth asteroids.
- 67 The winter solstice occurs when the Sun is
- on the Celestial Equator.
 - closest to the Earth.
 - farthest from the Earth.
 - farthest South of the Celestial Equator.
 - farthest North of the Celestial Equator.
- 68 Jupiter failed to become a star because
- It was made from the wrong material.
 - The Sun's ignition blew all the gas away.
 - It was too far from the Sun.
 - The Sun's gravity prevented it from growing.
 - When Jupiter ignited, the Sun blew it out.
- 69 The dust tail of a comet
- consists of straight streamers.
 - is curved and fuzzy-looking.
 - shoots out in random directions..
 - is a ball around the nucleus.
- 70 An eclipse of the Sun is caused by
- the Sun's shadow falling on the Earth.
 - the Earth's shadow falling on the Sun.
 - the Earth's shadow falling on the Moon.
 - the Moon's shadow falling on the Sun.
 - the Moon's shadow falling on the Earth.

- 71 A globular cluster usually consists of
- A single dead star surrounded by glowing gas.
 - Billions of stars together.
 - Glowing gas and newborn stars.
 - Millions of stars together.
- 72 The motion of the Moon around the Earth causes
- The phases of the Moon.
 - Dandruff.
 - Daily motions in the Heavens.
 - The seasons.
 - Meteor Showers.
- 73 The steam catapult on an aircraft carrier must accelerate an airplane from zero to 100m/s in just ten seconds. If the airplane has a mass of 10,000kg, how much force must the catapult exert on the plane?
- 1,000,000N
 - 10,000N
 - 100,000N
 - 100N.
 - 5,000,000N
- 74 Which of the following types of radiation has the lowest frequency on this list.
- microwaves.
 - infrared light.
 - ultraviolet light.
 - red light.
 - X-Rays.
- 75 The spiral arms of a galaxy such as our Milky Way contain stars that are orbiting around the galactic center. One current theory is that these spiral arms are places where
- stars crowd closer together than usual and then move on.
 - intense magnetic fields confine the stars.
 - the orbital motion of the stars has wound a bar shape into a spiral.
- 76 Objects such as the Great Nebula in Andromeda were once called "extragalactic nebulae". It is now realized that they are actually
- small objects just outside our own galaxy.
 - inside our own galaxy.
 - other galaxies much like our own.
- 77 If the frequency of electromagnetic radiation goes from 2×10^{14} Hz to 6×10^{14} Hz, the energy of each individual photon in the radiation
- is divided by 2.
 - is multiplied by 3.
 - is divided by 3.
 - does not change.
 - is multiplied by 2.

- 78 Planetesimals of rock and iron, prevented from forming a planet by Jupiter's gravity, became
- the asteroid belt.
 - the interstellar dust.
 - the Moons of the Jovian planets.
 - the Oort Cloud.
 - the Kuiper belt.
- 79 The problem of stars "twinkling" due to atmospheric turbulence
- can be corrected by going to larger telescope mirrors.
 - can be corrected by using a more powerful eyepiece.
 - can be corrected by using a guide star.
 - cannot be corrected.
 - can only be corrected by putting telescopes in space.
- 80 On a HR diagram, a visible white dwarf star is in the
- lower left corner.
 - upper left corner.
 - main sequence.
 - lower right corner.
 - upper right corner.
- 81 Which of the following objects is closest in size to a black hole formed from the collapse of a star?
- a neutron star.
 - a red giant star.
 - a yellow dwarf star.
 - a white dwarf star.
- 82 In the Hertzsprung-Russell diagram shown, point number 4 could be a



- K2 star of absolute magnitude 10.
 - F9 star of absolute magnitude 5.
 - B0 star of absolute magnitude 10.
 - B0 star of absolute magnitude -5.
 - F0 star of absolute magnitude -5.
- 83 The origin of the energy that is released in a supernova explosion is
- matter-antimatter annihilation.
 - gravitational energy from the core collapse.
 - rotational energy in the core.
 - nuclear energy stored in the star.

- 84 The mass of a carbon atom is 12.00amu while the mass of a helium-4 atom is 4.003amu. If three atoms of helium fuse to form carbon, how much mass is converted into energy?
- 0.009amu
 - 0.012amu
 - 0.002amu
 - 0.004amu
 - 0.006amu
- 85 A star with a distance modulus of zero is at a distance of
- 100 parsecs.
 - 10 parsecs.
 - 10,000 parsecs.
 - 1 parsec.
 - 1000 parsecs.
- 86 High tide should occur
- only when the Moon is overhead.
 - when the Moon is overhead and when the Moon is over the opposite side of the Earth.
 - when the Moon is rising.
 - only when the Moon is over the opposite side of the Earth.
 - when the Moon is setting.
- 87 Suppose that the color and behavior of a star identify it as a type that we know has absolute magnitude -3 . If the star's apparent magnitude is found to be 2, how far away is it?
- 1000 parsecs.
 - 10 parsecs.
 - 5 parsecs.
 - 50 parsecs.
 - 100 parsecs.
- 88 A star that forms an iron core most likely has a mass of
- between 15 and 20 solar masses.
 - less than one solar mass.
 - more than 20 solar masses.
 - between 1 and 4 solar masses.
- 89 The Law of Inertia states that a moving object will
- keep moving if a force pushes it.
 - stop if no force acts on it.
 - keep moving if no force acts on it.
 - never stop.
 - always stop.
- 90 Kepler found that planetary orbits are
- circles with the Sun at the center.
 - ellipses with the Sun at the center.
 - ellipses with the Sun at one focus.
 - circles with the Sun off-center.

- 91 Galaxies are organized into clusters and other large non-uniform structures that
- stop with tapestries (made of voids and filaments), which are themselves uniformly distributed.
 - apparently continue to larger and larger structures without end.
 - stop with superclusters (of clusters), which are themselves uniformly distributed.
 - stop with voids and filaments (made of superclusters), which are themselves uniformly distributed.
- 92 The Large Magellanic Cloud is an example of a galaxy of type
- Irr I
 - SBc
 - Irr II
 - Peculiar
 - Sc
- 93 The number of near-Earth asteroids is large because they
- are kicked out of the asteroid belt by Jupiter's gravity.
 - are left over from the formation of our Moon.
 - are the remains of a destroyed planet near the Earth.
 - are in stable orbits and have nowhere else to go.
- 94 The high tides drawn up by the Moon's gravity run ahead of the Moon's motion because of
- the delayed response of the ocean.
 - dragging by the Earth's magnetic field.
 - the effect of the Sun's gravity.
 - the finite speed of gravity.
 - friction with the rotating Earth.
- 95 Suppose that you drop two objects from the same height at the same time. Both objects are heavy enough to be unaffected by air resistance. If one object is twice as heavy as the other, Aristotle predicted that
- both objects would hit the ground at the same time.
 - the lighter object would hit the ground long before the heavier one.
 - the heavier object would hit the ground long before the lighter one.
- 96 A nova occurs when
- the core of a star suddenly collapses.
 - a star blows off its outer envelope.
 - a star runs out of fuel.
 - a white dwarf steals fuel from a neighbor.
 - a red giant begins to burn helium.
- 97 The mass that is distributed in different parts of our Milky Way Galaxy is estimated by
- measuring the bending of starlight by unseen objects.
 - measuring how stars orbit the center of the galaxy.
 - measuring the temperature of the interstellar gas.
 - counting visible stars and adding up their masses.
 - measuring how much hydrogen there is from its emissions.

- 98 How long will it take for a star that is near the Celestial Equator to move by one degree relative to the earth?
- 6 2/3 minutes.
 - 4 minutes.
 - 30 minutes.
 - 5 minutes.
 - 15 minutes.
- 99 As seen from far above the Earth's North Pole, the Earth orbits the Sun counter clockwise and
- Pluto orbits the Sun clockwise.
 - Mercury orbits the Sun clockwise.
 - the Jovian planets orbit the Sun clockwise.
 - No planet orbits the Sun clockwise.
- 100 Which of Kepler's Laws governs how a particular planet speeds up and slows down?
- The Equal Area Law.
 - The Period-Radius Relation.
 - Orbits are Ellipses.
 - The Law of Inertia.
 - The Law of Averages.
- 101 A star whose apparent brightness is 10^{-6} times that of a first magnitude star would have magnitude
- 1.
 - 6.
 - 21.
 - 16.
 - 11.
- 102 A large asteroid impact causes the extinction of whole species mainly by the effects of the
- smoke and dust: It blocks the sunlight.
 - light and heat: It incinerates them.
 - noise: It scares them to death.
 - blast and shock wave: It blows them away.
- 103 The Moon's orbit
- is in the plane of the Earth's equator.
 - is in the plane of the ecliptic.
 - is somewhat tilted relative to the plane of the Earth's equator.
 - is perpendicular to the plane of the Earth's equator.
- 104 A steady X-ray signal with sudden bursts lasting a few seconds each is probably caused by
- a main sequence star.
 - a white dwarf in a binary system.
 - a neutron star in a binary system.
 - an isolated neutron star.
 - a supermassive star.

- 105 The layer of the atmosphere that absorbs most of the ultraviolet radiation from the Sun is the
- troposphere.
 - ozone layer.
 - stratosphere.
 - mesosphere.
 - ionosphere.
- 106 Which layer of the Earth has a thickness of only about ten miles?
- The crust.
 - The liquid part of the iron core.
 - The mantle.
- 107 Convection currents in the Earth's Mantle
- cause mass extinctions.
 - happen but do not affect the crust.
 - are responsible for moving the tectonic plates.
 - do not happen because solid rock does not move.
 - are responsible for land tides.
- 108 Copernicus said that the Earth and planets orbiting the Sun caused
- The phases of the Moon.
 - The rising and setting of the Moon.
 - The daily motions in the heavens.
 - The rising and setting of the Sun.
 - The retrograde motion of the planets.
- 109 Hubble's constant is not very accurately determined. For the most accepted value of 65km/s/Mpc the Hubble expansion time is about 13 billion years. If the correct value of Hubble's constant is actually 100km/s/Mpc , the Hubble expansion time would
- be greater than 13 billion years.
 - be less than 13 billion years.
 - still be 13 billion years.
- 110 Once a star has evolved onto the Main Sequence in the HR Diagram, it
- drifts slowly toward lower mass and brightness.
 - evolves up the sequence toward higher brightness.
 - moves both up and down the sequence.
 - stays at the same point until it runs out of fuel.
- 111 Stars with more than 15 times the mass of our Sun usually evolve off the main sequence along a path in the HR diagram that
- is mostly horizontal.
 - is mostly vertical.
 - starts out vertical and then goes almost horizontal.
 - starts out horizontal and then goes almost vertical.

- 112 The dark matter in our own galaxy is currently thought to be mostly
- something else.
 - brown dwarfs.
 - cold gas and dust.
- 113 Electrons that are bound to the nucleus of an atom (so that energy is needed to remove them) can have
- any positive energy at all.
 - any negative energy at all.
 - only certain isolated negative energies.
 - only certain isolated positive energies.
- 114 A galaxy that is a featureless flattened ball of stars would be called a type
- Sa.
 - E7.
 - Sb.
 - E0.
 - S0.
- 115 Pressure waves are transmitted through
- solids but not liquids.
 - liquids but not solids.
 - both solids and liquids.
- 116 The red supergiant phase of a star is caused by
- the exhaustion of helium at its core.
 - the ignition of hydrogen at its core.
 - the collapse of its core.
 - the ignition of helium at its core.
 - the exhaustion of hydrogen at its core.
- 117 Cepheid variable stars with the same luminosity usually
- are at the same distance from us.
 - have the same apparent magnitude.
 - have similar periods.
 - belong to the same star cluster.
- 118 The Lunar Maria are actually
- ancient lava flows.
 - the original lunar surface.
 - oceans of carbon disulfide.
 - oceans of water.
 - ancient dust storms.

Answer Key: Fall 2007 AFXB

- 1 Choice e. (orbital velocities within the galaxy.)
- 2 Choice a. (neither at the center nor at the edge.)
- 3 Choice e. (Blue.)
- 4 Choice e. (mostly along the edges of moving plates.)
- 5 Choice d. (2500m/s)
- 6 Choice c. (D (one proton, one neutron).)
- 7 Choice a. (9 parsecs.)
- 8 Choice b. (near the surface.)
- 9 Choice b. (failed but led to a better theory.)
- 10 Choice b. (ice and frozen gas.)
- 11 Choice a. (10 Newtons upward)
- 12 Choice b. (660nm.)
- 13 Choice d. (4Mpc.)
- 14 Choice b. (Cassegrain Focus.)
- 15 Choice b. (a brown dwarf.)
- 16 Choice a. (a layer of dirt on the lunar surface.)
- 17 Choice a. (beyond the orbit of Neptune.)
- 18 Choice a. (some part of the theory was wrong.)
- 19 Choice c. (much closer together than neighbors of our sun.)
- 20 Choice d. (the motion of the Earth around the Sun.)
- 21 Choice b. (the Kuiper belt.)
- 22 Choice d. (they run out of coolant.)
- 23 Choice a. (a prediction that has now been observed.)
- 24 Choice a. (The Virgo Cluster.)
- 25 Choice a. (the entire main sequence still present.)
- 26 Choice d. (at the lower left.)
- 27 Choice a. (acts on all objects.)
- 28 Choice d. (matter heating up as it falls toward the hole.)
- 29 Choice c. (prevents the cloud from fragmenting.)
- 30 Choice a. (B)
- 31 Choice d. (6500km/s)
- 32 Choice c. (Star Sirius.)
- 33 Choice b. (B and C both move away.)
- 34 Choice a. (you expect no changes.)
- 35 Choice d. (temperature.)
- 36 Choice b. (the radiant.)

- 37 Choice b. (the same because gravity pulls on it more strongly and it has more inertia.)
- 38 Choice d. (blue.)
- 39 Choice b. (B)
- 40 Choice b. (a million times the luminosity of our sun.)
- 41 Choice b. (planetary nebula.)
- 42 Choice a. (increased because solar activity is greater.)
- 43 Choice c. (the Tully-Fisher relation.)
- 44 Choice a. (a hot, rarefied gas.)
- 45 Choice e. (pulsars.)
- 46 Choice e. (The number of crests that pass in one second.)
- 47 Choice a. (of natural origin.)
- 48 Choice a. (sunspots.)
- 49 Choice a. (Venus, with no moons at all.)
- 50 Choice d. (a method for finding distances to stars.)
- 51 Choice c. (thinner and larger in diameter.)
- 52 Choice c. (Orion Arm.)
- 53 Choice a. ($3.853''/\text{yr.}$)
- 54 Choice b. (fragments into several smaller clouds which then form stars.)
- 55 Choice a. (A Dutchman)
- 56 Choice b. (K5)
- 57 Choice b. (the motions of stars near it.)
- 58 Choice c. (a white-dwarf collapses.)
- 59 Choice b. (its temperature rise stops when iron nuclei come apart.)
- 60 Choice a. (in a band of stars stretching across the sky.)
- 61 Choice c. (its large mass in a small region.)
- 62 Choice c. (corona.)
- 63 Choice c. (Population I.)
- 64 Choice c. (provided only a lot of accurate data.)
- 65 Choice a. (Passenger pigeons are extinct.)
- 66 Choice b. (the Earth's climate.)
- 67 Choice d. (farthest South of the Celestial Equator.)
- 68 Choice b. (The Sun's ignition blew all the gas away.)
- 69 Choice b. (is curved and fuzzy-looking.)
- 70 Choice e. (the Moon's shadow falling on the Earth.)
- 71 Choice d. (Millions of stars together.)
- 72 Choice a. (The phases of the Moon.)
- 73 Choice c. (100,000N)

- 74 Choice a. (microwaves.)
- 75 Choice a. (stars crowd closer together than usual and then move on.)
- 76 Choice c. (other galaxies much like our own.)
- 77 Choice b. (is multiplied by 3.)
- 78 Choice a. (the asteroid belt.)
- 79 Choice c. (can be corrected by using a guide star.)
- 80 Choice a. (lower left corner.)
- 81 Choice a. (a neutron star.)
- 82 Choice c. (B0 star of absolute magnitude 10.)
- 83 Choice b. (gravitational energy from the core collapse.)
- 84 Choice a. (0.009amu)
- 85 Choice b. (10 parsecs.)
- 86 Choice b. (when the Moon is overhead and when the Moon is over the opposite side of the Earth.)
- 87 Choice e. (100 parsecs.)
- 88 Choice a. (between 15 and 20 solar masses.)
- 89 Choice c. (keep moving if no force acts on it.)
- 90 Choice c. (ellipses with the Sun at one focus.)
- 91 Choice d. (stop with voids and filaments (made of superclusters), which are themselves uniformly distributed.)
- 92 Choice a. (Irr I)
- 93 Choice a. (are kicked out of the asteroid belt by Jupiter's gravity.)
- 94 Choice e. (friction with the rotating Earth.)
- 95 Choice c. (the heavier object would hit the ground long before the lighter one.)
- 96 Choice d. (a white dwarf steals fuel from a neighbor.)
- 97 Choice b. (measuring how stars orbit the center of the galaxy.)
- 98 Choice b. (4 minutes.)
- 99 Choice d. (No planet orbits the Sun clockwise.)
- 100 Choice a. (The Equal Area Law.)
- 101 Choice d. (16.)
- 102 Choice a. (smoke and dust: It blocks the sunlight.)
- 103 Choice c. (is somewhat tilted relative to the plane of the Earth's equator.)
- 104 Choice c. (a neutron star in a binary system.)
- 105 Choice b. (ozone layer.)
- 106 Choice a. (The crust.)
- 107 Choice c. (are responsible for moving the tectonic plates.)
- 108 Choice e. (The retrograde motion of the planets.)
- 109 Choice b. (be less than 13 billion years.)
- 110 Choice d. (stays at the same point until it runs out of fuel.)

- 111 Choice a. (is mostly horizontal.)
- 112 Choice a. (something else.)
- 113 Choice c. (only certain isolated negative energies.)
- 114 Choice b. (E7.)
- 115 Choice c. (both solids and liquids.)
- 116 Choice a. (the exhaustion of helium at its core.)
- 117 Choice c. (have similar periods.)
- 118 Choice a. (ancient lava flows.)

Solutions

- 1 Module 054: Dark Matter in the Milky Way Question 054.12
- 2 Module 052: The Milky Way Question 052.41
- 3 Module 010 Temperature and Color: Question 010.21
- 4 Module 021: Continental Drift Question 021.12
- 5 Module 009 Speed of a Wave: Question 009.35
- 6 Module 042: Nuclear Fire Question 042.42
- 7 Module 043: Stellar Parallax Question 043.32
- 8 Module 040: Survey of the Sun Question 040.11
- 9 Module 006 Death of a Theory: Question 006.11
- 10 Module 014: Solar System Survey: Question 014.42
- 11 Module 007 Definitions of Force and Mass: Question 007.34
- 12 Module 010 The Doppler Effect: Question 010.43
- 13 Module 057: The Expanding Universe Question 057.32
- 14 Module 012 Telescope Designs: Question 012.32
- 15 Module 047: Star Formation Question 047.44
- 16 Module 022: The Earth's Moon Question 022.32
- 17 Module 015: Comets in Detail: Question 015.21
- 18 Module 042: Nuclear Fire Question 042.52
- 19 Module 055: The Monster in the Milky Way Question 055.11
- 20 Module 043: Stellar Parallax Question 043.11
- 21 Module 017: Formation of the Solar System: Question 017.43
- 22 Module 013 Infrared: Question 013.22
- 23 Module 049: Supernova Explosions Question 049.43
- 24 Module 056: The Family of Galaxies Question 056.44
- 25 Module 047: Star Formation Question 047.53
- 26 Module 046: The Hertzsprung-Russell Diagram Question 046.22
- 27 Module 008 Explaining Kepler's Laws: Question 008.12
- 28 Module 051: Black Holes Question 051.22
- 29 Module 047: Star Formation Question 047.22
- 30 Module 045: Star Colors and Classes 045.21
- 31 Module 057: The Expanding Universe Question 057.11
- 32 Module 001 The Celestial Sphere: Question 001.13
- 33 Module 057: The Expanding Universe Question 057.21
- 34 Module 019: The Earth's Atmosphere Question 019.13
- 35 Module 042: Nuclear Fire Question 042.32
- 36 Module 015: Comets in Detail: Question 015.45

- 37 Module 008 Unifying Physical Law: Question 008.24
- 38 Module 045: Star Colors and Classes 045.11
- 39 Module 046: The Hertzsprung-Russell Diagram Question 046.32
- 40 Module 055: The Monster in the Milky Way Question 055.23
- 41 Module 048: The Quiet Deaths of Ordinary Stars Question 048.44
- 42 Module 040: Survey of the Sun Question 040.35
- 43 Module 056: The Family of Galaxies Question 056.35
- 44 Module 010 Spectra: Question 010.32
- 45 Module 050: Neutron Stars Question 050.22
- 46 Module 009 Frequency: Question 009.21
- 47 Module 050: Neutron Stars Question 050.12
- 48 Module 041: Solar Magnetism and Activity Question 041.22
- 49 Module 014: Solar System Survey: Question 014.24
- 50 Module 046: The Hertzsprung-Russell Diagram Question 046.52
- 51 Module 012 Focal Point of a Mirror: Question 012.24
- 52 Module 053: Shape of the Milky Way Question 053.23
- 53 Module 043: Stellar Parallax Question 043.42
- 54 Module 047: Star Formation Question 047.13
- 55 Module 005 The First Astrophysicist: Question 005.22
- 56 Module 045: Star Colors and Classes Question 045.32
- 57 Module 055: The Monster in the Milky Way Question 055.31
- 58 Module 049: Supernova Explosions Question 049.62
- 59 Module 049: Supernova Explosions Question 049.31
- 60 Module 052: The Milky Way Question 052.12
- 61 Module 055: The Monster in the Milky Way Question 055.41
- 62 Module 040: Survey of the Sun Question 040.23
- 63 Module 053: Shape of the Milky Way Question 053.31
- 64 Module 004 Tycho Brahe's Role: Question 004.42
- 65 Module 003 How to test a statement : Question 003.23
- 66 Module 019: The Earth's Atmosphere Question 019.33
- 67 Module 001 The Path of the Sun: Question 001.56
- 68 Module 017: Formation of the Solar System: Question 017.31
- 69 Module 015: Comets in Detail: Question 015.14
- 70 Module 002 Solar Eclipses: Question 002.23
- 71 Module 052: The Milky Way Question 052.22
- 72 Module 002 Phases of the Moon: Question 002.12
- 73 Module 007 The Law of Force and Mass: Question 007.44

- 74 Module 010 The Electromagnetic Spectrum: Question 010.14
- 75 Module 053: Shape of the Milky Way Question 053.43
- 76 Module 053: Shape of the Milky Way Question 053.11
- 77 Module 011 Photons: Question 011.23
- 78 Module 017: Formation of the Solar System: Question 017.51
- 79 Module 012 Telescope Limitations: Question 012.43
- 80 Module 048: The Quiet Deaths of Ordinary Stars Question 048.54
- 81 Module 051: Black Holes Question 051.14
- 82 Module 046: The Hertzsprung-Russell Diagram Question 046.13
- 83 Module 049: Supernova Explosions Question 049.53
- 84 Module 042: Nuclear Fire Question 042.21
- 85 Module 044: Stellar Magnitudes 044.31
- 86 Module 018: The Moon and the Tides: Question 018.11
- 87 Module 044: Stellar Magnitudes Question 044.42
- 88 Module 049: Supernova Explosions Question 049.12
- 89 Module 007 The Law of Inertia: Question 007.12
- 90 Module 006 Orbits are Ellipses: Question 006.21
- 91 Module 056: The Family of Galaxies Question 056.51
- 92 Module 056: The Family of Galaxies Question 056.21
- 93 Module 016: Earth Impacts: Question 016.11
- 94 Module 018: The Moon and the Tides: Question 018.42
- 95 Module 005 The First Physicist: Question 005.14
- 96 Module 048: The Quiet Deaths of Ordinary Stars Question 048.61
- 97 Module 054: Dark Matter in the Milky Way Question 054.22
- 98 Module 001 Star Motions: Question 001.34
- 99 Module 017: Formation of the Solar System: Question 017.11
- 100 Module 006 Equal Area Rule: Question 006.32
- 101 Module 044: Stellar Magnitudes 044.23
- 102 Module 016: Earth Impacts: Question 016.33
- 103 Module 022: The Earth's Moon Question 022.43
- 104 Module 050: Neutron Stars Question 050.32
- 105 Module 019: The Earth's Atmosphere Question 019.25
- 106 Module 020: Earth and Moon Interiors Question 020.22
- 107 Module 021: Continental Drift Question 021.32
- 108 Module 004 The Copernican System: Question 004.22
- 109 Module 057: The Expanding Universe Question 057.41
- 110 Module 047: Star Formation Question 047.33

- 111 Module 049: Supernova Explosions Question 049.22
- 112 Module 054: Dark Matter in the Milky Way Question 054.33
- 113 Module 011 Atomic Energy Levels: Question 011.31
- 114 Module 056: The Family of Galaxies Question 056.16
- 115 Module020:Earth and Moon Interiors Question 020.13
- 116 Module 048: The Quiet Deaths of Ordinary Stars Question 048.31
- 117 Module 052: The Milky Way Question 052.32
- 118 Module 022: The Earth's Moon Question 022.11