

- 1 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
 - a. the lighter object would hit the ground long before the heavier one.
 - b. both objects would hit the ground at the same time.
 - c. the heavier object would hit the ground long before the lighter one.

- 2 Kepler was an early advocate of the Copernican Theory. When he applied it to Tycho's observations, it
 - a. failed but led to a better theory.
 - b. failed and was completely discarded.
 - c. was as accurate as the observations.
 - d. worked perfectly.

- 3 The Lunar Regolith is
 - a. a rock layer just beneath the lunar surface.
 - b. the soft part of the lunar core.
 - c. a layer of dirt on the lunar surface.
 - d. the layer just above the core.
 - e. another name for the lunar crust.

- 4 You see a reflecting telescope with a short, stubby tube and the eyepiece at the back. This telescope uses the
 - a. Newtonian Focus.
 - b. Prime Focus.
 - c. Coudé Focus
 - d. Cassegrain Focus.

- 5 Kepler found that planetary orbits are
 - a. ellipses with the Sun at the center.
 - b. circles with the Sun at the center.
 - c. circles with the Sun off-center.
 - d. ellipses with the Sun at one focus.

- 6 How long will it take for a star that is near the Celestial Equator to move by one degree relative to the earth?
 - a. 30 minutes.
 - b. 15 minutes.
 - c. 5 minutes.
 - d. $6 \frac{2}{3}$ minutes.
 - e. 4 minutes.

- 7 Rising pressure at the center of a collapsing cloud usually
 - a. prevents the cloud from fragmenting.
 - b. causes the cloud to fragment.
 - c. blows the cloud apart.
 - d. stops the collapse.
 - e. makes the collapse go faster.

- 8 Galaxies are organized into clusters and other large non-uniform structures that
- stop with voids and filaments (made of superclusters), which are themselves uniformly distributed.
 - stop with superclusters (of clusters), which are themselves uniformly distributed.
 - stop with tapestries (made of voids and filaments), which are themselves uniformly distributed.
 - apparently continue to larger and larger structures without end.
- 9 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
- intense magnetic fields confine the stars.
 - stars crowd closer together than usual and then move on.
 - the orbital motion of the stars has wound a bar shape into a spiral.
- 10 One conclusion that was drawn from the gradual slowing of the radio signals from the Crab Nebula was that they were probably
- an obvious hoax.
 - from a source moving away from us.
 - of natural origin.
 - from a source moving toward us.
 - of artificial origin.
- 11 The Law of Inertia states that a moving object will
- always stop.
 - stop if no force acts on it.
 - never stop.
 - keep moving if no force acts on it.
 - keep moving if a force pushes it.
- 12 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.
- 2m/s
 - 5000m/s
 - 1000m/s
 - 2500m/s
 - 1250m/s
- 13 On a HR diagram, a visible white dwarf star is in the
- upper right corner.
 - lower left corner.
 - main sequence.
 - lower right corner.
 - upper left corner.
- 14 Which of the following spectral classes corresponds to the highest surface temperature (on this list)?
- F
 - G
 - B
 - K
 - A

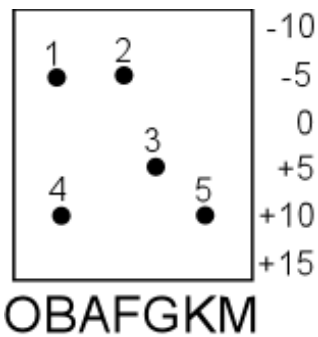
- 15 Which of the following levels of the Sun's atmosphere has the highest temperature?
- corona.
 - chromosphere.
 - transition zone.
 - photosphere.
- 16 The steam catapult on an aircraft carrier must accelerate an airplane from zero to 100m/s in just ten seconds. If the airplane has a mass of 10,000kg, how much force must the catapult exert on the plane?
- 100,000N
 - 1,000,000N
 - 100N.
 - 10,000N
 - 5,000,000N
- 17 Planetesimals of rock and iron, prevented from forming a planet by Jupiter's gravity, became
- the Moons of the Jovian planets.
 - the interstellar dust.
 - the asteroid belt.
 - the Oort Cloud.
 - the Kuiper belt.
- 18 The Kuiper Belt is mostly located
- between the orbits of Jupiter and Uranus.
 - between the orbits of Uranus and Neptune.
 - beyond the orbit of Neptune.
 - between the orbits of Mars and Jupiter.
- 19 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 downward
 - 10 Newtons upward
 - 20 Newtons upward
 - 200 Newtons downward
 - 20 Newtons downward
- 20 The Lunar Maria are actually
- ancient dust storms.
 - oceans of water.
 - oceans of carbon disulfide.
 - ancient lava flows.
 - the original lunar surface.
- 21 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.

- 22 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
- does not change.
 - is multiplied by 3.
 - is multiplied by 2.
 - is divided by 3.
 - is divided by 2.
- 23 A star that forms an iron core most likely has a mass of
- less than one solar mass.
 - between 1 and 4 solar masses.
 - more than 20 solar masses.
 - between 15 and 20 solar masses.
- 24 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
- 38.53"/yr.
 - 3853"/yr.
 - 3.853"/yr.
 - 1.9265"/yr.
 - 0.26"/yr.
- 25 At the center of our Milky Way galaxy, neighboring stars are typically
- much closer together than neighbors of our sun.
 - much farther apart than neighbors of our sun.
 - about the same distance apart as neighbors of our sun.
- 26 The iron core of an evolved massive star collapses because
- 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.
 - its temperature rise stops when iron nuclei come apart.
 - its temperature suddenly goes to zero.
- 27 The origin of the energy that is released in a supernova explosion is
- matter-antimatter annihilation.
 - rotational energy in the core.
 - nuclear energy stored in the star.
 - gravitational energy from the core collapse.
- 28 Jupiter failed to become a star because
- It was made from the wrong material.
 - The Sun's gravity prevented it from growing.
 - When Jupiter ignited, the Sun blew it out.
 - It was too far from the Sun.
 - The Sun's ignition blew all the gas away.

- 29 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?
- 260Mpc.
 - 4Mpc.
 - 0.25Mpc.
 - 0.1Mpc.
 - 10Mpc.
- 30 In a region of the atmosphere in which the temperature rises with increasing altitude
- you expect no changes.
 - you expect rapid changes.
- 31 In our Sun, the convection zone is located
- near the surface.
 - above the central region but well below the surface.
 - at the very center.
- 32 Relative to the Milky Way family of stars, our sun is
- neither at the center nor at the edge.
 - at the center.
 - at the extreme edge.
- 33 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?
- Peach.
 - Red.
 - Yellow.
 - Blue.
 - Green.
- 34 Detecting too few neutrinos from the Sun was a problem because it meant that
- the detectors were not working.
 - government grant money would be lost.
 - some part of the theory was wrong.
- 35 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
 - 0.002amu
 - 0.012amu
 - 0.006amu
 - 0.004amu
- 36 The frequency of a wave is defined to be
- 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.
 - The number of seconds that it takes for a crest to pass.

- 37 Which of the following statements is scientific (as defined by Popper)?
- Passenger pigeons taste good.
 - Passenger pigeons taste terrible.
 - Passenger pigeons were pests.
 - Passenger pigeons are extinct.
 - Passenger pigeons are not extinct.
- 38 The formation of a new white dwarf is usually accompanied by a
- nova.
 - dust cloud.
 - supernova explosion.
 - planetary nebula.
 - helium flash.
- 39 In the reaction chain that powers our Sun, the first nucleus to form is
- He-3 (two protons and one neutron).
 - He-4 (two protons and two neutrons).
 - C-12 (six protons and six neutrons).
 - ${}^2_1\text{H}$ (two neutrons stuck together).
 - D (one proton, one neutron).
- 40 Which of the following types of radiation has the lowest frequency on this list.
- microwaves.
 - X-Rays.
 - infrared light.
 - red light.
 - ultraviolet light.
- 41 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?
- 5 parsecs.
 - 1000 parsecs.
 - 100 parsecs.
 - 10 parsecs.
 - 50 parsecs.
- 42 Icy objects condensed from the outskirts of the Solar Nebula to form
- the Kuiper belt.
 - the interstellar dust.
 - The moons of the Jovian Planets.
 - the asteroid belt.
 - The Oort Cloud.

- 43 Convection currents in the Earth's Mantle
- happen but do not affect the crust.
 - are responsible for land tides.
 - cause mass extinctions.
 - are responsible for moving the tectonic plates.
 - do not happen because solid rock does not move.
- 44 The Large Magellanic Cloud is an example of a galaxy of type
- Peculiar
 - Irr II
 - Sc
 - Irr I
 - SBC
- 45 In the Hertzsprung-Russell diagram shown, point number 3 could be a



- B0 star of absolute magnitude 10.
 - F9 star of absolute magnitude 5.
 - F0 star of absolute magnitude -5.
 - K2 star of absolute magnitude 10.
 - B0 star of absolute magnitude -5.
- 46 The mass of Sgr A* has been determined by observing
- the intensity of X-ray emissions from it.
 - fluctuations in radio emissions from it.
 - the motions of stars near it.
 - interstellar space probes in orbit around it.
- 47 Copernicus said that the Earth and planets orbiting the Sun caused
- The rising and setting of the Moon.
 - The daily motions in the heavens.
 - The rising and setting of the Sun.
 - The phases of the Moon.
 - The retrograde motion of the planets.
- 48 The dark matter in our own galaxy is currently thought to be mostly
- something else.
 - brown dwarfs.
 - cold gas and dust.

- 49 Our Sun's location in the Milky Way is closest to the
- Norma Arm.
 - Scutum-Crux Arm.
 - Orion Arm.
 - Cygnus Arm.
 - Sagittarius Arm.
- 50 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 horizontal and then goes almost vertical.
 - starts out vertical and then goes almost horizontal.
- 51 The motion of the Moon around the Earth causes
- Meteor Showers.
 - Daily motions in the Heavens.
 - The seasons.
 - The phases of the Moon.
 - Dandruff.
- 52 Which layer of the Earth has a thickness of only about ten miles?
- The liquid part of the iron core.
 - The mantle.
 - The crust.
- 53 The stars of the Milky Way are found
- only near the ecliptic.
 - in a band of stars stretching across the sky.
 - only near the celestial equator.
 - only near the celestial poles.
 - in all parts of the celestial sphere.
- 54 The first telescope was built by
- Galileo
 - A Dutchman
 - Tycho Brahe
 - Newton
- 55 A large asteroid impact causes the extinction of whole species mainly by the effects of the
- light and heat: It incinerates them.
 - noise: It scares them to death.
 - blast and shock wave: It blows them away.
 - smoke and dust: It blocks the sunlight.

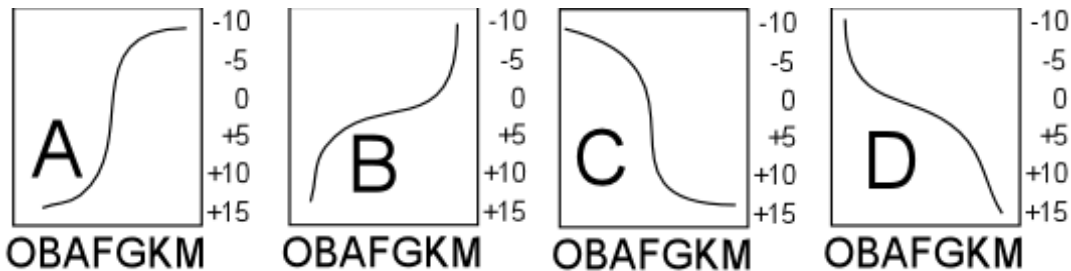
56 A steady X-ray signal with sudden bursts lasting a few seconds each is probably caused by

- a main sequence star.
- a neutron star in a binary system.
- a supermassive star.
- a white dwarf in a binary system.
- an isolated neutron star.

57 A nova occurs when

- a white dwarf steals fuel from a neighbor.
- a star blows off its outer envelope.
- a star runs out of fuel.
- the core of a star suddenly collapses.
- a red giant begins to burn helium.

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



59 The red supergiant phase of a star is caused by

- the ignition of hydrogen at its core.
- the exhaustion of helium at its core.
- the ignition of helium at its core.
- the exhaustion of hydrogen at its core.
- the collapse of its core.

60 The idea that a supernova is preceded by a huge burst of neutrinos is

- a prediction that has not yet been observed.
- a purely theoretical idea that cannot be tested.
- no longer believed to be correct.
- a prediction that has now been observed.

61 The HR diagram of a young, open cluster typically shows

- only the lower part of the main sequence still present.
- 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.

62 An eclipse of the Sun is caused by

- the Earth's shadow falling on the Moon.
- the Moon's shadow falling on the Sun.
- the Sun's shadow falling on the Earth.
- the Moon's shadow falling on the Earth.
- the Earth's shadow falling on the Sun.

- 63 When a large interstellar cloud collapses, it usually
- remains together and collapses to a single large star.
 - remains together and spits out several stars.
 - forms a large ring that fragments to form a ring of stars.
 - fragments into several smaller clouds which then form stars.
- 64 Electrons that are bound to the nucleus of an atom (so that energy is needed to remove them) can have
- only certain isolated positive energies.
 - any negative energy at all.
 - only certain isolated negative energies.
 - any positive energy at all.
- 65 By making extensive observations of planetary motion, Tycho Brahe
- proved that Copernicus was right.
 - discovered new planets.
 - explained how planets move.
 - provided only a lot of accurate data.
 - disproved Ptolemy's theory of planetary motion.
- 66 Light with an emission spectrum is usually generated by
- light from hot dense material passing through a rarefied gas.
 - hot, dense material.
 - a hot, rarefied gas.
 - a cold, rarefied gas.
- 67 The average energy of motion of an atom or molecule in a gas is called its
- speed.
 - frequency.
 - entropy.
 - temperature.
 - density.
- 68 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
- $1/9$ parsecs.
 - 18 parsecs.
 - 9 parsecs.
 - 4.5 parsecs.
 - 4 parsecs.
- 69 We can use the pointer stars in Orion to locate a point in the sky near the
- North Celestial Pole.
 - Star Sirius.
 - South Celestial Pole.
 - East Celestial Pole.
 - Celestial Equator.

- 70 The dust tail of a comet
- consists of straight streamers.
 - is curved and fuzzy-looking.
 - is a ball around the nucleus.
 - shoots out in random directions..
- 71 In a Hertzsprung-Russell diagram, white dwarf stars such as Sirius B are
- at the upper left.
 - at the upper right.
 - at the lower right.
 - at the lower left.
- 72 Which of the following colors indicates the hottest star?
- red.
 - yellow.
 - peach.
 - blue.
 - orange.
- 73 The most convincing argument in favor of a large black hole at the center of the Milky Way Galaxy is
- the fact that it is at the center.
 - its large mass.
 - its large mass in a small region.
 - its power or luminosity.
- 74 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 yellow dwarf.
 - a white dwarf.
 - a class M object.
 - a brown dwarf.
- 75 As seen from far above the Earth's North Pole, the Earth orbits the Sun counter clockwise and
- Mercury orbits the Sun clockwise.
 - the Jovian planets orbit the Sun clockwise.
 - No planet orbits the Sun clockwise.
 - Pluto orbits the Sun clockwise.
- 76 The layer of the atmosphere that absorbs most of the ultraviolet radiation from the Sun is the
- ionosphere.
 - mesosphere.
 - ozone layer.
 - troposphere.
 - stratosphere.

- 77 Within our own Milky Way Galaxy, our sun is a typical member of
- either Population I or II.
 - Population I.
 - Population II.
- 78 Because mirrors only use one surface, they have a big advantage over lenses: They can be
- thinner and larger in diameter.
 - made out of metal.
 - filled with more holes.
 - thicker and stronger.
 - made more accurately.
- 79 Assume that the Hubble constant is 65 km/s/Mpc. If a galaxy is 100Mpc away, how fast is it moving away from us?
- 100km/s
 - 65km/s
 - 6500km/s
 - 650km/s
 - 0.65km/s
- 80 The total luminosity, at all wavelengths, of the source Sgr A* is approximately
- a thousand 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.
 - a million times the luminosity of our sun.
- 81 High tide should occur
- only when the Moon is over the opposite side of the Earth.
 - when the Moon is setting.
 - 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.
- 82 A nearby cluster of several thousand galaxies is called
- The Local Group.
 - The Virgo Cluster.
 - The Andromeda cluster.
 - The Milky Way.
- 83 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
- 650nm.
 - 660nm.
 - 656nm.

- 84 The Doppler shift of familiar spectral lines from gas clouds and stars in our galaxy measures their
- orbital velocities within the galaxy.
 - directions of motion in the galaxy.
 - relative ages.
 - masses.
 - distances from the Sun.
- 85 The distances to the farthest galaxies can be measured using
- the Tulley-Fisher relation.
 - heliocentric parallax.
 - Hertzsprung-Russel diagrams.
 - radar ranging.
 - cepheid variable stars.
- 86 Newton's explanation of Kepler's Laws relied upon a force that
- acts on all objects.
 - acts on planets but not on comets.
 - acts only on planets.
 - acts only on heavenly bodies.
 - acts only on inorganic matter.
- 87 A type I supernova occurs when
- the core of a star collapses.
 - material falls onto a neutron star.
 - two neutron stars merge.
 - a white-dwarf collapses.
 - a white-dwarf flares briefly.
- 88 Pressure waves are transmitted through
- solids but not liquids.
 - liquids but not solids.
 - both solids and liquids.
- 89 The Moon's orbit
- is perpendicular to the plane of the Earth's equator.
 - is in the plane of the Earth's equator.
 - is somewhat tilted relative to the plane of the Earth's equator.
 - is in the plane of the ecliptic.
- 90 A galaxy that is a featureless flattened ball of stars would be called a type
- Sa.
 - E0.
 - E7.
 - S0.
 - Sb.

- 91 Stellar Parallax is caused by
- the finite speed of light.
 - turbulence in the Earth's atmosphere.
 - the actual motion of stars relative to their neighbors.
 - the motion of the Earth around the Sun.
 - the motion of our Sun relative to its neighbors.
- 92 Which of the following spectral types corresponds to the star with the lowest surface temperature?
- K5
 - G5
 - G0
 - K0
- 93 Orbiting Infrared Observatories usually have limited life primarily because
- their orbits decay.
 - they run out of electric power.
 - funds to operate them run out.
 - they run out of coolant.
 - they run out of maneuvering fuel.
- 94 The X-rays that reveal the possible presence of a black hole are the result of
- vibrations of the hole's event horizon.
 - starlight accelerated in the hole's gravity.
 - matter heating up as it falls toward the hole.
 - gravitons converted to photons by the hole.
- 95 A globular cluster usually consists of
- Billions of stars together.
 - A single dead star surrounded by glowing gas.
 - Millions of stars together.
 - Glowing gas and newborn stars.
- 96 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.
- 97 Once a star has evolved onto the Main Sequence in the HR Diagram, it
- drifts slowly toward lower mass and brightness.
 - moves both up and down the sequence.
 - stays at the same point until it runs out of fuel.
 - evolves up the sequence toward higher brightness.

- 98 Which of Kepler's Laws governs how a particular planet speeds up and slows down?
- The Law of Inertia.
 - The Equal Area Law.
 - The Law of Averages.
 - The Period-Radius Relation.
 - Orbits are Ellipses.
- 99 The twisting of magnetic field lines by the Sun's differential rotation causes
- solar gravity.
 - sunspots.
 - sun dogs.
 - solar granules.
 - solar eclipses.
- 100 Which of the following three systems is regarded as the most normal for a terrestrial planet?
- Venus, with no moons at all.
 - Mars, with two moons each the size of an asteroid.
 - Earth, with a moon larger than the dwarf planet Pluto.
- 101 The number of near-Earth asteroids is large because they
- are in stable orbits and have nowhere else to go.
 - are kicked out of the asteroid belt by Jupiter's gravity.
 - are the remains of a destroyed planet near the Earth.
 - are left over from the formation of our Moon.
- 102 The mass that is distributed in different parts of our Milky Way Galaxy is estimated by
- measuring how much hydrogen there is from its emissions.
 - measuring the temperature of the interstellar gas.
 - measuring the bending of starlight by unseen objects.
 - measuring how stars orbit the center of the galaxy.
 - counting visible stars and adding up their masses.
- 103 The epicenters of earthquakes are located
- mostly along the edges of moving plates.
 - at random places on the Earth's surface.
 - mostly along continental boundaries.
 - mostly in the centers of oceans.
 - mostly near the Earth's equator.
- 104 Which of the following objects is closest in size to a black hole formed from the collapse of a star?
- a neutron star.
 - a white dwarf star.
 - a red giant star.
 - a yellow dwarf star.

- 105 The problem of stars "twinkling" due to atmospheric turbulence
- can be corrected by using a more powerful eyepiece.
 - can be corrected by going to larger telescope mirrors.
 - can only be corrected by putting telescopes in space.
 - can be corrected by using a guide star.
 - cannot be corrected.
- 106 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.
 - more because gravity pulls on it more strongly and it has less inertia.
 - less because it has more inertia.
 - the same because gravity pulls on it more strongly and it has more inertia.
 - less because gravity pulls on it less strongly and it has more inertia.
- 107 The high tides drawn up by the Moon's gravity run ahead of the Moon's motion because of
- friction with the rotating Earth.
 - the finite speed of gravity.
 - the effect of the Sun's gravity.
 - dragging by the Earth's magnetic field.
 - the delayed response of the ocean.
- 108 Cepheid variable stars with the same luminosity usually
- are at the same distance from us.
 - have the same apparent magnitude.
 - belong to the same star cluster.
 - have similar periods.
- 109 Comets are made of
- rock and iron.
 - concrete and marble.
 - ice and frozen gas.
 - gold and silver.
 - styrofoam and poster paint.
- 110 When the number of sunspots is greatest, the energy output of the Sun is
- decreased because the spots radiate less.
 - unaffected because the spots are small.
 - increased because solar activity is greater.
- 111 A star whose apparent brightness is 10^{-6} times that of a first magnitude star would have magnitude
- 11.
 - 1.
 - 16.
 - 21.
 - 6.

- 112 The Greenhouse Effect is important because it suggests an effect on
- the Earth's rotation.
 - shielding UV light from the Sun.
 - the Earth's climate.
 - the availability of greenhouses.
 - near-Earth asteroids.
- 113 The winter solstice occurs when the Sun is
- farthest from the Earth.
 - farthest South of the Celestial Equator.
 - closest to the Earth.
 - on the Celestial Equator.
 - farthest North of the Celestial Equator.
- 114 Neutron stars are often observed as
- asteroids.
 - novas.
 - pulsars.
 - Tau Tauri stars.
 - quasars.
- 115 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.
 - still be 13 billion years.
 - be less than 13 billion years.
- 116 During a meteor shower, shooting stars seem to be coming from
- the celestial north pole.
 - the equant.
 - the celestial equator.
 - the radiant.
 - all parts of the sky.
- 117 A star with a distance modulus of zero is at a distance of
- 100 parsecs.
 - 1000 parsecs.
 - 10 parsecs.
 - 1 parsec.
 - 10,000 parsecs.
- 118 Galaxies A and B are 100Mpc from us while galaxy C is 200Mpc from us. From the viewpoint of galaxy A, we are moving away while
- C moves away and B moves closer.
 - B and C both move closer.
 - B moves away and C moves closer.
 - B and C both move away.

Answer Key: Fall 2007 AFXC

- 1 Choice c. (the heavier object would hit the ground long before the lighter one.)
- 2 Choice a. (failed but led to a better theory.)
- 3 Choice c. (a layer of dirt on the lunar surface.)
- 4 Choice d. (Cassegrain Focus.)
- 5 Choice d. (ellipses with the Sun at one focus.)
- 6 Choice e. (4 minutes.)
- 7 Choice a. (prevents the cloud from fragmenting.)
- 8 Choice a. (stop with voids and filaments (made of superclusters), which are themselves uniformly distributed.)
- 9 Choice b. (stars crowd closer together than usual and then move on.)
- 10 Choice c. (of natural origin.)
- 11 Choice d. (keep moving if no force acts on it.)
- 12 Choice d. (2500m/s)
- 13 Choice b. (lower left corner.)
- 14 Choice c. (B)
- 15 Choice a. (corona.)
- 16 Choice a. (100,000N)
- 17 Choice c. (the asteroid belt.)
- 18 Choice c. (beyond the orbit of Neptune.)
- 19 Choice b. (10 Newtons upward)
- 20 Choice d. (ancient lava flows.)
- 21 Choice c. (other galaxies much like our own.)
- 22 Choice b. (is multiplied by 3.)
- 23 Choice d. (between 15 and 20 solar masses.)
- 24 Choice c. ($3.853''/\text{yr.}$)
- 25 Choice a. (much closer together than neighbors of our sun.)
- 26 Choice d. (its temperature rise stops when iron nuclei come apart.)
- 27 Choice d. (gravitational energy from the core collapse.)
- 28 Choice e. (The Sun's ignition blew all the gas away.)
- 29 Choice b. (4Mpc.)
- 30 Choice a. (you expect no changes.)
- 31 Choice a. (near the surface.)
- 32 Choice a. (neither at the center nor at the edge.)
- 33 Choice d. (Blue.)
- 34 Choice c. (some part of the theory was wrong.)
- 35 Choice a. (0.009amu)
- 36 Choice d. (The number of crests that pass in one second.)

- 37 Choice d. (Passenger pigeons are extinct.)
- 38 Choice d. (planetary nebula.)
- 39 Choice e. (D (one proton, one neutron).)
- 40 Choice a. (microwaves.)
- 41 Choice c. (100 parsecs.)
- 42 Choice a. (the Kuiper belt.)
- 43 Choice d. (are responsible for moving the tectonic plates.)
- 44 Choice d. (Irr I)
- 45 Choice b. (F9 star of absolute magnitude 5.)
- 46 Choice c. (the motions of stars near it.)
- 47 Choice e. (The retrograde motion of the planets.)
- 48 Choice a. (something else.)
- 49 Choice c. (Orion Arm.)
- 50 Choice a. (is mostly horizontal.)
- 51 Choice d. (The phases of the Moon.)
- 52 Choice c. (The crust.)
- 53 Choice b. (in a band of stars stretching across the sky.)
- 54 Choice b. (A Dutchman)
- 55 Choice d. (smoke and dust: It blocks the sunlight.)
- 56 Choice b. (a neutron star in a binary system.)
- 57 Choice a. (a white dwarf steals fuel from a neighbor.)
- 58 Choice d. (D)
- 59 Choice b. (the exhaustion of helium at its core.)
- 60 Choice d. (a prediction that has now been observed.)
- 61 Choice b. (the entire main sequence still present.)
- 62 Choice d. (the Moon's shadow falling on the Earth.)
- 63 Choice d. (fragments into several smaller clouds which then form stars.)
- 64 Choice c. (only certain isolated negative energies.)
- 65 Choice d. (provided only a lot of accurate data.)
- 66 Choice c. (a hot, rarefied gas.)
- 67 Choice d. (temperature.)
- 68 Choice c. (9 parsecs.)
- 69 Choice b. (Star Sirius.)
- 70 Choice b. (is curved and fuzzy-looking.)
- 71 Choice d. (at the lower left.)
- 72 Choice d. (blue.)
- 73 Choice c. (its large mass in a small region.)

- 74 Choice e. (a brown dwarf.)
- 75 Choice c. (No planet orbits the Sun clockwise.)
- 76 Choice c. (ozone layer.)
- 77 Choice b. (Population I.)
- 78 Choice a. (thinner and larger in diameter.)
- 79 Choice c. (6500km/s)
- 80 Choice e. (a million times the luminosity of our sun.)
- 81 Choice d. (when the Moon is overhead and when the Moon is over the opposite side of the Earth.)
- 82 Choice b. (The Virgo Cluster.)
- 83 Choice b. (660nm.)
- 84 Choice a. (orbital velocities within the galaxy.)
- 85 Choice a. (the Tulley-Fisher relation.)
- 86 Choice a. (acts on all objects.)
- 87 Choice d. (a white-dwarf collapses.)
- 88 Choice c. (both solids and liquids.)
- 89 Choice c. (is somewhat tilted relative to the plane of the Earth's equator.)
- 90 Choice c. (E7.)
- 91 Choice d. (the motion of the Earth around the Sun.)
- 92 Choice a. (K5)
- 93 Choice d. (they run out of coolant.)
- 94 Choice c. (matter heating up as it falls toward the hole.)
- 95 Choice c. (Millions of stars together.)
- 96 Choice d. (a method for finding distances to stars.)
- 97 Choice c. (stays at the same point until it runs out of fuel.)
- 98 Choice b. (The Equal Area Law.)
- 99 Choice b. (sunspots.)
- 100 Choice a. (Venus, with no moons at all.)
- 101 Choice b. (are kicked out of the asteroid belt by Jupiter's gravity.)
- 102 Choice d. (measuring how stars orbit the center of the galaxy.)
- 103 Choice a. (mostly along the edges of moving plates.)
- 104 Choice a. (a neutron star.)
- 105 Choice d. (can be corrected by using a guide star.)
- 106 Choice d. (the same because gravity pulls on it more strongly and it has more inertia.)
- 107 Choice a. (friction with the rotating Earth.)
- 108 Choice d. (have similar periods.)
- 109 Choice c. (ice and frozen gas.)
- 110 Choice c. (increased because solar activity is greater.)

- 111 Choice c. (16.)
- 112 Choice c. (the Earth's climate.)
- 113 Choice b. (farthest South of the Celestial Equator.)
- 114 Choice c. (pulsars.)
- 115 Choice c. (be less than 13 billion years.)
- 116 Choice d. (the radiant.)
- 117 Choice c. (10 parsecs.)
- 118 Choice d. (B and C both move away.)

Solutions

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