

- 1 In addition to being accurate, Tycho Brahe's observations focused on measuring the positions of the planets
  - a. when they were in retrograde motion.
  - b. all the time.
  - c. near the horizon.
  - d. during conjunctions.
  - e. during the solstices.
  
- 2 The wavelength of the sound waves that correspond to middle-C is about 4 feet. If you are standing 8 feet away from a piano that is playing that note, then between you and the piano there will usually be
  - a. three regions of maximum pressure.
  - b. maximum pressure every two seconds.
  - c. one region of maximum pressure.
  - d. maximum pressure every four seconds.
  - e. two regions of maximum pressure.
  
- 3 The Moon turns red during a lunar eclipse because
  - a. our eyes see an after-image when the light dies.
  - b. it is completely covered with red dust.
  - c. it is lit by a sunset all round the Earth.
  - d. it is very hot and its glow is revealed.
  - e. faint light is reddened more than bright light.
  
- 4 Electrons that are bound to the nucleus of an atom (so that energy is needed to remove them) can have
  - a. only certain isolated positive energies.
  - b. any negative energy at all.
  - c. only certain isolated negative energies.
  - d. any positive energy at all.
  
- 5 The ecliptic is
  - a. the path of the Sun on the Celestial Sphere.
  - b. the path of the Moon on the Celestial Sphere.
  - c. halfway between the North and South Celestial Poles.
  - d. the set of points with zero right ascension.
  - e. an image of the Earth's equator.
  
- 6 Mercury is closer to the Sun than Earth. Which of the following statements is true?
  - a. Mercury takes less time to go around the Sun and moves faster than the Earth.
  - b. Mercury takes more time to go around the Sun and moves slower than the Earth.
  - c. Mercury takes less time to go around the Sun but moves slower than the Earth because it does not have as far to go.
  - d. Mercury takes more time to go around the Sun but moves faster than the Earth because it keeps getting confused.
  
- 7 Who discovered Newton's First Law of Motion?
  - a. Aristotle.
  - b. Galileo
  - c. Tycho Brahe
  - d. Kepler
  - e. Newton

- 8 X-Ray telescopes need to use mirrors that
- are kept extremely cold.
  - are kept extremely hot.
  - are extremely large.
  - use grazing angles of incidence.
  - are made of wire mesh.
- 9 The sun sets in the
- Ocean.
  - North.
  - East.
  - South.
  - West.
- 10 Tycho Brahe's careful observations of the planets agreed, to within observational error, with
- the Ptolemaic System.
  - the Tychonic System.
  - None of these systems.
  - the Copernican System
- 11 A unit of force is the
- meter.
  - kilogram.
  - meter per second per second.
  - meter per second.
  - Newton.
- 12 The Copernican System was first advocated in print by
- Tycho Brahe.
  - Galileo Galilei.
  - Michael Maestlin.
  - Ptolemy.
  - Johannes Kepler.
- 13 The force of gravity explains
- how things fall and how lightning works.
  - how the tides and lightning work.
  - how things fall and how the Sun shines.
  - how planets move and how the Sun shines.
  - how planets move and how the tides work.
- 14 Suppose that there is a cannon which can fire shells at any speed. If this cannon is located on the earth's surface, its shells
- could go into earth orbit if fired at a high enough speed.
  - could never go into earth orbit.
  - always return to the earth.

- 15 There are important lessons to be learned from the dispute between Galileo and the Roman Inquisition: Don't spit into the wind; Don't tug on superman's cape; and Don't
- arrest a famous scientist.
  - accept authority.
  - challenge authority.
  - present science as faith.
- 16 A solar sail is a large sheet of light-reflecting plastic spread on an extremely low-mass framework and attached to a spacecraft. Sunlight exerts a force on the sail and moves the spacecraft. Suppose the spacecraft has a total mass of 1000kg (including the sail) and sunlight exerts a total force of 5N on the sail. What will be the acceleration of the spacecraft?
- $0.02\text{m/s}^2$
  - $2\text{m/s}^2$
  - $0.005\text{m/s}^2$
  - $5\text{m/s}^2$
  - $1000\text{m/s}^2$
- 17 Copernicus said that the retrograde motion of the planets was caused by the
- planets moving on epicycles.
  - earth and the planets orbiting the Sun.
  - planets speeding up and slowing down.
  - earth turning on its axis.
  - planets turning on their axes.
- 18 A mirror that is supposed to bring light from a star directly overhead to a focus must be shaped like
- a shallow bowl with the open part facing up.
  - a flat surface.
  - an upside-down trough with the open part facing down.
  - a shallow trough with the open part facing up.
  - an upside-down bowl with the open part facing down.
- 19 When viewed looking down from above the Earth's North Pole, the Earth
- always rotates counterclockwise.
  - always rotates clockwise.
  - rotates clockwise in the spring and counterclockwise in the fall.
  - rotates clockwise in the fall and counterclockwise in the spring.
  - does not rotate.
- 20 The most severe problem facing a radio telescope is
- spherical aberration.
  - atmospheric turbulence.
  - the diffraction limit.
  - atmospheric absorption.
  - chromatic aberration.

- 21 Retrograde Motion refers to the
- westward motion of the planets relative to the horizon.
  - eastward motion of the planets relative to the stars.
  - eastward motion of the Sun relative to the stars.
  - westward motion of the planets relative to the stars.
  - westward motion of the Moon relative to the horizon.
- 22 One reason that the Copernican System failed to fit Tycho's observations was
- it placed the Earth at the center of the universe.
  - it used circular orbits instead of ellipses.
  - it used elliptical orbits instead of circles.
  - it placed the Sun at the center of the system.
- 23 The first major failure of the Ptolemaic Theory to predict the results of observations was
- the precise observations of Tycho Brahe.
  - the mountains of the Moon.
  - the phases of Venus.
  - the Moons of Jupiter.
  - the retrograde motion of the planets.
- 24 At 8pm, you see that the pointer stars of the Big dipper and the star Polaris are arranged in a vertical line. at what time would you see them arranged in a horizontal line?
- 2:00 am.
  - 11:00 pm.
  - 8:00 pm the next day.
  - 10:00 pm.
  - It will never happen.
- 25 Compared to the frequency of photons emitted during a transition from a  $-4\text{eV}$  state to a  $-5\text{eV}$  state, transitions from a  $-3\text{eV}$  state to the  $-5\text{eV}$  state would emit photons whose frequency is
- 3 times as high.
  - 4 times as high.
  - 2 times as high.
  - 5 times as high.
  - the same.
- 26 Light with an emission spectrum is usually generated by
- hot, dense material.
  - light from hot dense material passing through a rarefied gas.
  - a hot, rarefied gas.
  - a cold, rarefied gas.
- 27 Compared to a proton, an electron has
- much more mass.
  - about the same mass.
  - much less mass.

- 28 Orbiting ultraviolet observatories are most likely to end their useful life when
- funds to operate them run out.
  - their orbits decay.
  - they run out of electric power.
  - they run out of coolant.
- 29 The frequency of a wave is defined to be
- The time for a set of crests to pass divided by the number of crests.
  - The number of seconds that it takes for a crest to pass.
  - The distance from a maximum to a minimum.
  - The number of crests that pass in one second.
  - The distance from one crest to the next.
- 30 A total eclipse of the Sun can be seen
- Only in the Northern Hemisphere.
  - Only along a narrow path.
  - Everywhere on the night side of the Earth.
  - Everywhere on the day side of Earth.
  - Only near the Earth's equator.
- 31 The one-wave turning angle of a telescope mirror determines its
- atmospheric limit on its resolution.
  - chromatic aberration.
  - spherical aberration.
  - diffraction limit on its resolution.
  - light collection ability.
- 32 You see a telescope with a long tube and the eyepiece sticking out the side near the top. This telescope uses the
- Prime Focus.
  - Newtonian Focus.
  - Coudé Focus
  - Cassegrain Focus.
- 33 Which of the following is a scientific statement (as defined by Popper)?
- There is intelligent life on other stars.
  - Isaac Newton was the greatest scientist.
  - There is cheese on the Moon.
  - The Moon is made entirely of cheese.
  - There is beauty in a sunset.
- 34 Just after sunset, you might find
- A waxing crescent Moon rising in the east.
  - A waxing crescent Moon rising in the west.
  - A waxing crescent Moon setting in the east.
  - A waxing crescent Moon setting in the west.
  - A waning crescent Moon setting in the north.

- 35 Which one of the following statements about the Theory of Evolution is definitely wrong?
- The Theory has not yet been disproved.
  - The Theory is wrong.
  - The Theory might be right.
  - The Theory is well-established.
  - The Theory is a proven fact.
- 36 The velocity of sound waves is roughly the same for all wavelengths. Suppose that a sound wave has a wavelength of one meter and a frequency of 1000Hz. The wavelength of a 500Hz sound wave would then be
- 500 m.
  - 1000 m.
  - 2 m.
  - 1/2 m.
  - 1 m.
- 37 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?
- Red.
  - Yellow.
  - Blue.
  - Green.
  - Peach.
- 38 Eclipses happen when the Full or New Moon occurs on the
- Celestial Equator.
  - Horizon.
  - Winter Solstice.
  - Ecliptic.
  - Vernal Equinox.
- 39 Aristotle said that a moving object with nothing pushing or pulling on it will always
- keep moving at the same speed.
  - follow a circular path.
  - slow down and stop.
  - speed up.
- 40 In comparison to the Copernican Theory, the Ptolemaic Theory made predictions that were of
- much higher accuracy.
  - much less accuracy.
  - about the same accuracy.
- 41 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.

- 42 Newton's explanation of Kepler's Laws relied upon a force that
- acts only on inorganic matter.
  - acts on planets but not on comets.
  - acts only on planets.
  - acts on all objects.
  - acts only on heavenly bodies.
- 43 We can use the pointer stars in Orion to locate a point in the sky near the
- North Celestial Pole.
  - South Celestial Pole.
  - Celestial Equator.
  - Star Sirius.
  - East Celestial Pole.
- 44 A problem that is peculiar to infrared telescopes is a need for
- large reflector sizes.
  - very long exposure times.
  - grazing incidence mirrors.
  - cooling to low temperature.
- 45 Polarized light consists of electromagnetic waves that all
- move in the same direction.
  - have the same wavefronts.
  - have electric fields in the same direction.
  - have passed through the same narrow slit.
  - have the same frequency.
- 46 If the frequency of electromagnetic radiation goes from  $2 \times 10^{14} \text{ Hz}$  to  $6 \times 10^{14} \text{ Hz}$ , the energy of each individual photon in the radiation
- does not change.
  - is multiplied by 2.
  - is divided by 2.
  - is multiplied by 3.
  - is divided by 3.
- 47 Suppose that only the force of gravity and the force that you, personally, exert are acting on an object with a mass of one kilogram. How much upward force must *you* exert on the object to cause it to accelerate upward at 3 meters per second per second?
- 1 Newton.
  - 3 Newtons.
  - 12.8 Newtons.
  - 6.8 Newtons.
  - 9.8 Newtons.

- 48 In Newton's Theory,
- the Moon moves around the Earth which, in turn goes around the Sun.
  - the Earth and Sun move around a common point, which, in turn, goes around the Moon.
  - the Earth and Moon move around a common point which, in turn, goes around the Sun.
  - the Earth moves around the Moon which, in turn, goes around the Sun.
- 49 According to Kepler's Laws of Planetary Motion, as planets orbit the sun, they
- speed up when farthest from the Sun.
  - speed up when in retrograde motion.
  - speed up when closest to the Sun.
  - move at constant speed.
- 50 A non-science (in Popper's sense) is a discipline whose statements are
- not supported by evidence.
  - imprecise or fuzzy.
  - tentative.
  - not tentative.
  - obviously incorrect.
- 51 The focal point of a lens is
- the place where it sends rays that are off-axis.
  - the center of the lens.
  - the place where it sends all light rays.
  - the place where it sends rays that are parallel to the axis.
  - the center of curvature of the lens.
- 52 Which of the following types of radiation has the lowest frequency on this list.
- ultraviolet light.
  - green light.
  - infrared light.
  - red light.
  - X-Rays.



## Answer Key: Fall 2007 AHX1M

- 1 Choice b. (all the time.)
- 2 Choice e. (two regions of maximum pressure.)
- 3 Choice c. (it is lit by a sunset all round the Earth.)
- 4 Choice c. (only certain isolated negative energies.)
- 5 Choice a. (the path of the Sun on the Celestial Sphere.)
- 6 Choice a. (Mercury takes less time to go around the Sun and moves faster than the Earth.)
- 7 Choice b. (Galileo)
- 8 Choice d. (use grazing angles of incidence.)
- 9 Choice e. (West.)
- 10 Choice c. (None of these systems.)
- 11 Choice e. (Newton.)
- 12 Choice e. (Johannes Kepler.)
- 13 Choice e. (how planets move and how the tides work.)
- 14 Choice b. (could never go into earth orbit.)
- 15 Choice d. (present science as faith.)
- 16 Choice c. ( $0.005\text{m/s}^2$ )
- 17 Choice b. (earth and the planets orbiting the Sun.)
- 18 Choice a. (a shallow bowl with the open part facing up.)
- 19 Choice a. (always rotates counterclockwise.)
- 20 Choice c. (the diffraction limit.)
- 21 Choice d. (westward motion of the planets relative to the stars.)
- 22 Choice b. (it used circular orbits instead of ellipses.)
- 23 Choice c. (the phases of Venus.)
- 24 Choice a. (2:00 am.)
- 25 Choice c. (2 times as high.)
- 26 Choice c. (a hot, rarefied gas.)
- 27 Choice c. (much less mass.)
- 28 Choice a. (funds to operate them run out.)
- 29 Choice d. (The number of crests that pass in one second.)
- 30 Choice b. (Only along a narrow path.)
- 31 Choice d. (diffraction limit on its resolution.)
- 32 Choice b. (Newtonian Focus.)
- 33 Choice d. (The Moon is made entirely of cheese.)
- 34 Choice d. (A waxing crescent Moon setting in the west.)
- 35 Choice e. (The Theory is a proven fact.)
- 36 Choice c. (2 m.)

- 37 Choice c. (Blue.)
- 38 Choice d. (Ecliptic.)
- 39 Choice c. (slow down and stop.)
- 40 Choice c. (about the same accuracy.)
- 41 Choice b. (660nm.)
- 42 Choice d. (acts on all objects.)
- 43 Choice d. (Star Sirius.)
- 44 Choice d. (cooling to low temperature.)
- 45 Choice c. (have electric fields in the same direction.)
- 46 Choice d. (is multiplied by 3.)
- 47 Choice c. (12.8 Newtons.)
- 48 Choice c. (the Earth and Moon move around a common point which, in turn, goes around the Sun.)
- 49 Choice c. (speed up when closest to the Sun.)
- 50 Choice d. (not tentative.)
- 51 Choice d. (the place where it sends rays that are parallel to the axis.)
- 52 Choice c. (infrared light.)

## Solutions

- 1 Module 004 Tycho Brahe's Role: Question 004.43
- 2 Module 009 Wavelength: Question 009.12
- 3 Module 002 Lunar Eclipses: Question 002.33
- 4 Module 011 Atomic Energy Levels: Question 011.31
- 5 Module 001 The Path of the Sun: Question 001.51
- 6 Module 006 The Period-Radius Relation: Question 006.42
- 7 Module 007 The Law of Inertia: Question 007.11
- 8 Module 013 X-Rays: Question 013.41
- 9 Module 001 Apparent Motion of the Sun: Question 001.42
- 10 Module 006 Death of a Theory: Question 006.12
- 11 Module 007 Definitions of Force and Mass: Question 007.24
- 12 Module 005 Advocate for Copernicus: Question 005.32
- 13 Module 008 Unifying Physical Law: Question 008.22
- 14 Module 008 Artificial Satellites: Question 008.41
- 15 Module 005 The Science Writer: Question 005.44
- 16 Module 007 The Law of Force and Mass: Question 007.46
- 17 Module 004 The Copernican System: Question 004.21
- 18 Module 012 Focal Point of a Mirror: Question 012.21
- 19 Module 001 Celestial Coordinates: Question 001.25
- 20 Module 013 Radio Telescopes: Question 013.11
- 21 Module 004 Wandering Planets: Question 004.12
- 22 Module 006 Orbits are Ellipses: Question 006.22
- 23 Module 005 The First Astrophysicist: Question 005.24
- 24 Module 001 Star Motions: Question 001.35
- 25 Module 011 The Reason for Spectra: Question 011.43
- 26 Module 010 Spectra: Question 010.32
- 27 Module 011 The Building Blocks: Question 011.12
- 28 Module 013 Ultraviolet: Question 013.31
- 29 Module 009 Frequency: Question 009.21
- 30 Module 002 Solar Eclipses: Question 002.21
- 31 Module 012 Telescope Limitations: Question 012.42
- 32 Module 012 Telescope Designs: Question 012.31
- 33 Module 003 How to test a statement : Question 003.21
- 34 Module 002 Phases of the Moon: Question 002.14
- 35 Module 003 Scientific Proof: Question 003.11
- 36 Module 009 Speed of a Wave: Question 009.36

- 37 Module 010 Temperature and Color: Question 010.21
- 38 Module 002 Predicting Eclipses: Question 002.43
- 39 Module 005 The First Physicist: Question 005.11
- 40 Module 004 Why Copernicus Lost: Question 004.32
- 41 Module 010 The Doppler Effect: Question 010.43
- 42 Module 008 Explaining Kepler's Laws: Question 008.12
- 43 Module 001 The Celestial Sphere: Question 001.13
- 44 Module 013 Infrared: Question 013.21
- 45 Module 009 Polarization: Question 009.42
- 46 Module 011 Photons: Question 011.23
- 47 Module 007 Definitions of Force and Mass: Question 007.35
- 48 Module 008 Making New Predictions: Question 008.32
- 49 Module 006 Equal Area Rule: Question 006.31
- 50 Module 003 Non-science: Question 003.31
- 51 Module 012 Focal Point of a Lens: Question 012.12
- 52 Module 010 The Electromagnetic Spectrum: Question 010.18