Astronomy 101.002

Hour Exam 1

February 18, 2009

Answers given in Bold Face

QUESTION 1: Which of the following is true for the speed of light in vacuum:

a) Its value is always 300,000 cm/hr.
b) Its measured value depends on the velocity of the observer.
c) It is larger for red light than for blue light in vacuum.
d) It is the same for all electromagnetic waves traveling in vacuum.
e) It is larger for gamma rays than for microwaves in vacuum.

QUESTION 2: Which of the following is most representative of the scientific method?

a) It is aesthetically pleasing by current standards.
b) Is uses physical ideas to explain phenomena.
c) It contains a geometrical picture.
d) Agrees with prevailing beliefs.
e) It is testable by observations.

QUESTION 3: If the earth rotated on its axis twice as fast as it currently does, but its motion around the Sun stayed the same, then:

a) The night would be twice as long.
b) The night would be one half as long.
c) The year would be one half as long.
d) The year would be twice as long.
e) The length of the day would be unchanged.

QUESTION 4: Which of the numbers below is the largest?

a) 2.4×10^{10}
b) 5×10^{11}
c) 24,000,000,001
d) 2.4×10^{-11}
e) 8.9999×10^{9}

QUESTION 5: Which of the following did Aristotle believe to be true?

a) The planets have circular orbits around the sun.
b) In the absence of air resistance, all objects fall to earth at the same rate.
c) The planets have elliptical orbits around the sun.
d) The stars on the celestial sphere revolve around the earth once a day.
e) The earth rotates on its axis once a day.

QUESTION 6: Kepler's Laws do NOT include the following:

a) The planetary orbits around the sun are ellipses.
b) A planet's orbital speed increases as it gets closer to the sun.
c) Planets close to the sun have shorter periods than planets further from the sun.
d) The earth's speed in orbit around the sun is the same throughout the year.
e) The sun is at a focus of Jupiter's elliptical orbit.

QUESTION 7: At approximately what time of night would you expect to see a full moon highest in the sky?

a) 6 pm.
b) 9 pm.
c) Midnight.
d) 3 am.
e) 6 am.

QUESTION 8: Paris is about ¼ of the way around the earth from Albuquerque. On a night that people in Albuquerque see a first-quarter moon, people in Paris see:

a) A new moon.
b) **A first-quarter moon.**
c) A half moon.
d) A third-quarter moon.
e) It depends on the time of night.

QUESTION 9: The seasons on Earth occur primarily because

a) The Earth rotates on its axis.
b) The Earth's axis is tilted with respect to the ecliptic.
c) The Earth's distance from the sun changes throughout the year.
d) The Earth's orbit is an ellipse.
e) Kepler's Third Law.

QUESTION 10: If the earth rotated east-to-west instead of west-to-east:

a) Our seasons would occur in reverse order.
b) We would not have seasons.
c) Daylight periods would be longer in winter and shorter in summer.
d) Winter in the Northern Hemisphere would occur in July.
e) None of the above.

QUESTION 11: Stars rise in the east and set in the west because of:

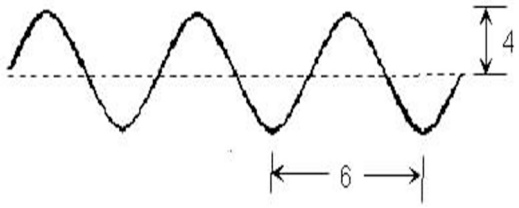
a) The Earth's motion around the sun.
b) The Earth's rotation about its axis.
c) The moon's motion about the earth.
d) The turning of the stars on the celestial sphere.
e) None of the above.

QUESTION 12: If the distance between two asteroids were doubled, the gravitational force they exert on each other would be:

a) Doubled.
b) One half as great.
c) Unchanged.
d) One fourth as great.
e) One sixteenth as great.

QUESTION 13: In the diagram below, which statement about the wave is true?

a) The amplitude is 4 and the period is 6.
b) The amplitude is 6 and the wavelength is 4.
c) The amplitude is 4 and the wavelength is 6.
d) The amplitude is 8 and the wavelength is 6.
e) The amplitude is 8 and the wavelength is 12.



QUESTION 14: The speed of light in vacuum is:

a) 93,000,000 miles.
b) 186,000 miles/hour
c) One light-year
d) 300,000 km/s
e) It depends on the wavelength (color) of the light.

QUESTION 15: The difference between red and blue light is:

a) Red light has a longer wavelength than blue light
b) Red light has a larger frequency than blue light
c) Red light travels faster than blue light in vacuum.
d) Red light has a larger amplitude than blue light in vacuum.
e) Red light travels slower than blue light in vacuum.

QUESTION 16: If the frequency of electromagnetic radiation doubles:

a) The velocity of the radiation increases.
b) The wavelength of the light doubles.
c) The wavelength of the light decreases by one-half.
d) The wavelength of the light decreases by one-quarter.
e) The brightness doubles.

QUESTION 17: Two identical stars are the same distance away from us. If Star A is moving rapidly towards us and Star B is moving rapidly away from us:

a) Star A will appear brighter than Star B
b) The light from Star A will reach us sooner than the light from Star B.
c) The two observed spectra will be the same.
d) The spectrum from Star A will be red-shifted compared with the spectrum from Star B.
e) The spectrum from Star A will be blue-shifted compared with the spectrum from Star B.

QUESTION 18: Each element has its own characteristic spectrum because:

a) The speed of light differs for each element.
b) Some elements are at higher temperatures than other elements.
c) Atoms combine to form molecules, releasing different wavelengths depending on the elements involved.
d) Electron energy levels are different for different elements.
e) The Doppler effect is different for different elements.

QUESTION 19: Which of these is NOT a form of electromagnetic radiation:

a) Light from a campfire.
b) X-Rays in a dentist's office used to take a picture of your teeth.
c) Ultrasound waves used in a doctor's office to observe a fetus.
d) Ultraviolet rays from the sun that cause a suntan.
e) Microwaves used to communicate with your cell phone.

QUESTION 20: Zero degrees on the Kelvin scale corresponds to:

a) The temperature at which molecular motion ceases.
b) Room temperature.
c) The boiling point of water.
d) The freezing point of water.
e) The temperature in outer space.

QUESTION 21: As the temperature of a blackbody increases:

a) The wavelength of the peak of the emission spectrum increases.
b) The frequency of the peak of the emission spectrum increases.
c) The body continues to appear black.
d) The amount of radiated energy decreases.
e) The total amount of thermal energy decreases.

QUESTION 22: Astronomers can measure the temperature of the surface of Mars by:

a) Studying the color of the Martian surface.
b) Studying the orbital parameters of Mars.
c) Studying the blackbody spectrum emitted by Mars.
d) Studying the spectral lines emitted by Mars.
e) Measuring the brightness of Mars.

QUESTION 23: A photon is emitted from an atom when:

a) The atom vibrates.
b) The atom is approaching us.
c) An atomic electron absorbs light.
d) An atomic electron falls from an excited state to a lower state.
e) The atom spins.

QUESTION 24: The angle from the horizon to an observer's zenith is:

a) 30° for an observer located at 30°north latitude.
b) 90° for everyone on earth.
c) 23.5 ° for observers on the Tropic of Cancer.
d) 0° for observers at the North Pole.
e) It depends on the observer's longitude.

QUESTION 25: A constellation is:

a) A group of galaxies that are gravitationally bound and close together.
b) A group of stars making an apparent pattern in the sky.
c) A group of stars that are located close to each other.
d) Apparent groupings of stars and planets observed on a given evening.
e) The celestial sphere.

QUESTION 26: If the sun and all of its mass were to suddenly disappear, the Earth would:

a) Fly off into space on a straight line.
b) Continue unchanged in its orbit.
c) Continue in its orbit but with a shorter period.
d) Stop spinning.
e) Spiral out of the ecliptic.

QUESTION 27: How do the spectral lines from a galaxy that is receding from us appear compared with a galaxy that is approaching us?

a) Dimmer.
b) Brighter.
c) Broadened.
d) Red-shifted.
e) Blue-shifted.

QUESTION 28: An astronomer observes a continuous hot source that is located behind a cool dilute gas. How will this affect the observed spectrum?

a) Dark absorption lines would appear in the spectrum.
b) The peak of the continuous spectrum would be blue-shifted.
c) The peak of the continuous spectrum would be red-shifted.
d) Bright emission lines would appear in the spectrum.
e) The spectral lines would be broadened by the gas.

QUESTION 29: Electromagnetic radiation consists of the following:

a) Vibrating molecules.
b) Longitudinal waves.
c) Oscillating electrons.
d) Electric and magnetic fields that oscillate in the direction of wave propagation.
e) Oscillating electric and magnetic fields that are perpendicular to each other and to the direction of wave propagation.

QUESTION 30: The sun's observed spectrum is:

a) A bright continuum with no lines, as shown by the rainbow.
b) A bright continuum with emission lines.
c) Absorption lines on a black background.
d) A bright continuum with absorption lines.
e) Emission lines on a black background.

QUESTION 31: Star α Orionis appears brighter than the star β Orionis. The difference in the light waves from these two stars is:

a) The amplitude of the light from α Orionis is larger.
b) The amplitude of the light from α Orionis is smaller.
c) The frequency of the light from α Orionis is larger.
d) The frequency of the light from α Orionis is smaller.
e) The light from α Orionis has a longer wavelength.

QUESTION 32: Stars twinkle because of:

a) Motions of gas in their atmospheres.
b) Motions of gas in interstellar space.
c) Interstellar dust.
d) Motion of gas in the solar system.
e) Motion of gas in the Earth's atmosphere.

QUESTION 33: Where would be the best place to locate a telescope to observe celestial X-rays?

a) Near a hospital.
b) Antarctica.
c) On a mountaintop.
d) In a desert.
e) Aboard a satellite.

QUESTION 34: Spectroscopy CANNOT be used to determine which of these properties of a star?

a) Surface temperature.
b) Mass.
c) Kinds of atoms in the star's atmosphere.
d) Speed the star is moving towards or away from earth.
e) Rotation rate.

QUESTION 35: Helium was first discovered by:

a) Chemical analysis of our atmosphere.
b) Spectroscopic observations of the sun.
c) Underground explorations near Amarillo, Texas.
d) A space probe sent to the sun.
e) Chemical analysis of ocean water.

QUESTION 36: Adaptive optics was developed to overcome which problem?

a) Turbulence in the Earth's atmosphere causing blurring.
b) Defects in the optics of the telescope.
c) Chromatic aberration.
d) Light pollution in urban areas.
e) Cloudy weather.

QUESTION 37: The resolving power of a telescope is:

a) Its ability to see faint objects.
b) Its ability to separate light by wavelength for further analysis.
c) Its ability to make distant objects appear closer to us.
d) Its ability to distinguish two objects that appear close together in the sky.
e) Its ability to focus different colors of light.

QUESTION 38: Why do most astronomical observatories primarily use reflecting telescopes?

a) Large mirrors are easier to build than large lenses.
b) Mirrors produce better images than lenses.
c) Lenses tend to produce inverted images.
d) Mirrors do not suffer from the effects of seeing.
e) Lenses are harder to steer.

QUESTION 39: The primary advantage of placing the Hubble space telescope in orbit is:

a) To avoid the earth's rotational motion.
b) To avoid light pollution.
c) To get closer to the stars.
d) To avoid atmospheric turbulence.
e) To be able to use CCD's.

QUESTION 40: Radio telescopes have poorer angular resolution compared with optical telescopes of the same diameter because of:

a) Its poorer diffraction limit.
b) Radio waves have lower energy than light waves.
c) Radio waves scatter in the Earth's atmosphere.
d) Chromatic aberration.
e) Interferometry.

QUESTION 41: The primary purpose of using telescopes for astronomical observations is:

a) To collect a large amount of light and bring it to a focus.
b) To magnify distant stars.
c) To separate light into its component wavelengths.
d) To measure the brightness of stars very accurately.
e) To look at just one portion of the sky at a time.

QUESTION 42: A 20-cm diameter telescope collects how much more light than a 5-cm diameter telescope in a given amount of time?

a) 4
b) 16
c) 25
d) 400
e) equal amounts.

QUESTION 43: Which of the following was a contribution to astronomy by Isaac Newton?

a) He proved that the earth was not at the center of the solar system.
b) He showed that planes move in elliptical orbits around the sun.
c) He observed moons orbiting Jupiter.
d) He developed the theory of gravity that could be used to explain orbital motion.
e) He perfected the reflecting telescope.

QUESTION 44: Hot hydrogen gas emits light at discrete frequencies because:

a) Each atom only has one electron.
b) The other frequencies are reserved for other elements.
c) Light is only produced by accelerated electrons.
d) The electron in a hydrogen atom can only be in specific discrete states.
e) Light at other frequencies is absorbed.

QUESTION 45: A light-year is:

a) 93,000,000 miles.
b) Approximately 3.15×10^7 seconds
c) Different for different planets.
d) The distance light travels in one year.
e) 300,000,000 km.

QUESTION 46: The observed changing positions of the stars during a night is caused by:

a) The tilt of the Earth's axis.
b) The rotation of the earth on its axis.
c) The rotation of the stars on their axes.
d) The revolution of the earth around the sun.
e) The premise is false – stars are fixed on the celestial sphere so they show no motion.

QUESTION 47: The ecliptic is:

a) A plane defined by the Earth's orbit around the Sun.
b) A plane perpendicular to the Earth's rotation on its axis.
c) A plane located about the Tropic of Cancer.
d) Caused by the moon passing through the shadow of the Earth.
e) Can only occur during a full moon.

QUESTION 48: The appearance of the planets in the spring sky is:

a) Different year to year.
b) The same every year.
c) Repeats every four years.
d) Is completely unpredictable.
e) Is determined by Kepler's Laws.

QUESTION 49: The sixth planet from the sun is:

a) The Earth.
b) Mars.
c) Jupiter.
d) Saturn.
e) Uranus.

QUESTION 50: The phases of the moon are caused by:

a) The moon moving in and out of the Earth's shadow.
b) Different fractions of the lunar surface being illuminated by the Sun.
c) Different degrees of surface darkness on the moon.
d) Different amounts of the illuminated half of the moon being visible from the Earth.
e) The tilt of the Earth's rotation axis.

QUESTION 51: The spectrum emitted from a hot low-density gas is:

a) A continuous spectrum.
b) A continuous spectrum with dark absorption lines.
c) A black-body spectrum.
d) A series of bright emission lines.
e) A continuous spectrum with bright emission lines.

QUESTION 52: You can hear sound waves around a corner due to:

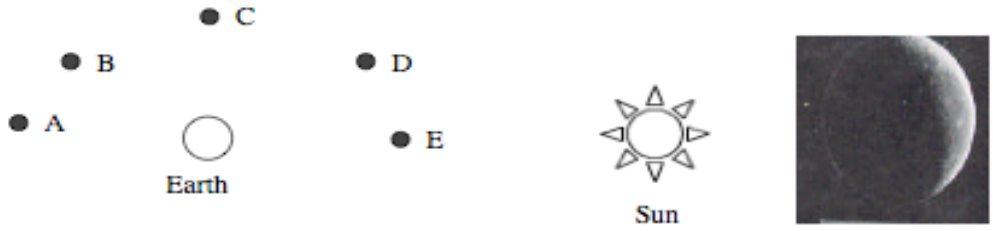
a) Aberration.
b) Refraction.
c) Reflection.
d) Diffraction.
e) Frequency doubling.

QUESTION 53: The astronomical unit is defined to be:

a) The mass of the Earth.
b) The mass of the sun.
c) One light-year.
d) The average distance between the earth and the moon.
e) The average distance between the Earth and the sun.

QUESTION 54: The diagram below shows the position of the Sun and the Earth as well as five possible positions for the Moon. For which position of the Moon, would the Moon appear to an observer on Earth as shown in the figure to the right?

a) A.
b) B.
c) C.
d) D.
e) E.



QUESTION 55: When observed six months apart, the star Wolf 1061 has a parallax of 2.34 arcseconds, while the star Ross 652 has a parallax of 1.70 arcseconds. What can you conclude?

a) Both stars are outside the Milky Way galaxy.
b) Wolf 1061 must have a larger proper motion than Ross 652.
c) Ross 652 must have a larger proper motion than Wolf 1061.
d) Ross 652 is closer to earth than Wolf 1061.
e) Wolf 1061 is closer to earth than Ross 652.

QUESTION 56: The (orbital) period of Neptune is:

a) The time it takes Neptune to complete one revolution on its axis.
b) 365 days.
c) Longer than 365 days.
d) Shorter than 365 days.
e) 1 day.

QUESTION 57: You can see the blackboard right now because the blackboard:

a) is emitting a black-body spectrum.
b) is emitting visible light.
c) is emitting infrared light.
d) is reflecting visible light.
e) is absorbing visible light.

QUESTION 58: If a scientist performs an experiment whose result contradicts one aspect of Einstein's Theory of Relativity and this result is confirmed by other experiments:

a) **The theory of relativity must be discarded or modified.**
b) The theory of relativity should still be considered valid because it explained so many other phenomena.
c) The theory of relativity should still be considered valid as Einstein postulated it.
d) One shouldn't be surprised, as it was only a theory.
e) The theory of relativity should still be considered valid as it agrees with our beliefs.

QUESTION 59: A person is reading a newspaper while standing 5 feet away from a table that has on it an unshaded 100-watt light bulb. Imagine that the table were moved to a distance of 10 feet. How many light bulbs in total would have to be placed on the table to light up the newspaper to the same amount of brightness as before?

a) One bulb.
b) Two bulbs.
c) Three bulbs.
d) Four bulbs.
e) More than four bulbs.

QUESTION 60: Two kinds of electromagnetic radiation that experience the LEAST atmospheric absorption are:

a) X-rays and gamma rays.
b) Ultraviolet and infrared radiation.
c) Microwaves and ultraviolet rays.
d) Visible light and radio waves.
e) Visible light and X-rays.