

Multiple choice test questions 1, Winter Semester 2015 (Based on Lectures 1-12 and approx. Ch. 1-5,11, 12.1). You may use a calculator and the “useful formulae and numbers” from the corresponding document with test problems.

1) Earth is made mostly of metals and rocks. Where did this material come from?

- A) It was produced in the Big Bang.
- B) It was created by chemical reactions in interstellar space.
- C) It was produced by nuclear fusion in stars.
- D) It was made by our Sun.
- E) It was made by nuclear fission of uranium and other radioactive materials.

2) Which of the following is largest?

- A) size of a typical galaxy
- B) size of Pluto's orbit
- C) distance to the nearest star (other than our Sun)
- D) 1 light-year

3) How many seconds are in one year?

- A) about 380 million (380,000,000, or 3.8×10^8)
- B) about 30 million (30,000,000, or 3×10^7)
- C) about 86 thousand (86,000, or 8.6×10^5)
- D) about 3,600 (3.6×10^3)

4) Doppler shifted hydrogen absorption lines are seen in the spectrum of a star. The hydrogen line at 656.28 nm is seen to be shifted to 656.08 nm. How fast is the star moving (Note: The speed of light is approximately 300,000 km/s, or 3×10^5 km/s.)?

- A) about 100 km/s
- B) about 1,000 km/s
- C) about 10,000 km/s
- D) about 1,000,000 km/s

5) One of the most fundamental discoveries about the universe has been that it is expanding. "The universe is expanding" means

- A) our estimate for the size of the universe has increased over the last century.
- B) galaxies are growing with time.
- C) the cosmological horizon is growing with time.
- D) distances between most galaxies are getting larger.

6) Which is closest to the temperature of the Sun's *core*?

- A) 10,000 K
- B) 100,000 K
- C) 1 million K
- D) 10 million K
- E) 100 million K

7) Suppose you use the Southern Cross to determine that the south celestial pole appears 40 degrees above your horizon. Then you must be located at _____.

- A) latitude 40 degrees north
- B) latitude 50 degrees south
- C) latitude 40 degrees south
- D) longitude 40 degrees

8) During the period each year when we see Mars undergoing apparent retrograde motion in our sky, what is really going on in space?

- A) Mars is moving around the Sun in the opposite direction from which Earth is moving around the Sun.
- B) Earth and Mars are getting closer together.
- C) Earth is catching up with and passing by Mars in their respective orbits.
- D) Earth and Mars are on opposite sides of the Sun.

9) What makes the North Star, Polaris, special?

- A) It is the brightest star in the sky.
- B) It is the star straight overhead.
- C) It appears very near the north celestial pole.
- D) It is the star directly on your northern horizon.
- E) It can be used to determine your longitude on Earth.

10) Which of the following never goes in retrograde motion?

- A) the Sun
- B) Venus
- C) Mars
- D) Jupiter
- E) Saturn

11) Which planet is moving most slowly around the Sun?

- A) Earth
- B) Jupiter
- C) Venus
- D) They are all moving with the same speed around the Sun.

12) Which of the following scenarios involves energy that we would typically calculate with Einstein's formula $E = mc^2$?

- A) A small amount of the hydrogen in a nuclear bomb becomes energy as fusion converts the hydrogen to helium.
- B) An object accelerated to a great speed has a lot of kinetic energy.
- C) A mass raised to a great height has a lot of gravitational potential energy.
- D) A burning piece of wood produces light and heat, therefore giving off radiative and thermal energy.

13) Which of the following is *not* an advantage of the Hubble Space Telescope over ground-based telescopes?

- A) It is closer to the stars.
- B) Stars do not twinkle when observed from space.
- C) It can observe infrared and ultraviolet light, as well as visible light.
- D) It never has to close because of cloudy skies.

14) The point directly over your head is called _____.

- A) the meridian
- B) the zenith
- C) the north celestial pole
- D) the North Star

15) Which of the following statements about scientific models is *true*?

- A) A model tries to represent all aspects of nature.
- B) A model tries to represent only one aspect of nature.
- C) A model can be used to explain and predict real phenomena.
- D) All models that explain nature well are correct.
- E) All current models are correct.

16) From Kepler's third law, an asteroid with an orbital period of 8 years lies at an average distance from the Sun equal to

- A) 2 astronomical units.
- B) 4 astronomical units.
- C) 8 astronomical units.
- D) 16 astronomical units.
- E) It depends on the asteroid's mass.

17) What do we mean by a *geocentric* model of the universe?

- A) a model designed to explain what we see in the sky while having the Earth located in the center of the universe
- B) a model designed to explain what we see in the sky while having the Earth orbit the Sun
- C) the name given to sphere-shaped models that show all the constellations as they appear in our sky on the celestial sphere
- D) a model of the Milky Way Galaxy that has our solar system located at its center

18) If an object's velocity is doubled, its momentum is

- A) halved.
- B) unchanged.
- C) doubled.
- D) quadrupled.
- E) dependent on its acceleration.

19) You are standing on a scale in an elevator. Suddenly you notice your weight *decreases*. What do you conclude?

- A) The elevator is accelerating upwards.
- B) The elevator is moving at a constant velocity upwards.
- C) The elevator is accelerating downwards.
- D) The elevator is moving at a constant velocity downwards.
- E) Your diet is working.

20) What quantities does *angular momentum* depend upon?

- A) mass and velocity
- B) mass, velocity, and radius
- C) force and radius
- D) force, velocity, and radius
- E) momentum and angular velocity

21) The force of gravity is an inverse square law. This means that, if you double the distance between two large masses, the gravitational force between them

- A) also doubles.
- B) strengthens by a factor of 4.
- C) weakens by a factor of 4.
- D) weakens by a factor of 2.
- E) is unaffected.

22) 0 degrees Kelvin is

- A) the temperature at which all particles move at the speed of light.
- B) the temperature at which all particles transform into light.
- C) the temperature at which all random particle motion stops.
- D) meaningless, a temperature outside the range defined for the Kelvin scale.

23) The acceleration of gravity on Earth is approximately 10 m/s^2 (more precisely, 9.8 m/s^2). If you drop a rock from a tall building, about how fast will it be falling after 3 seconds?

- A) 30 m/s
- B) 10 m/s
- C) 30 m/s^2
- D) 10 m/s^2
- E) 20 m/s

24) The *wavelength* of a wave is

- A) how strong the wave is.
- B) the distance between a peak of the wave and the next trough.
- C) the distance between two adjacent peaks of the wave.
- D) the distance between where the wave is emitted and where it is absorbed.
- E) equal to the speed of the wave times the wave's frequency.

25) Sunspots are cooler than the surrounding gas in the photosphere because
A) they are regions where convection carries cooler material downward.
B) strong magnetic fields slow convection and prevent hot plasma from entering the region.
C) magnetic fields trap ionized gases that absorb light.
D) there is less fusion occurring there.
E) magnetic fields lift material from the sunspot and quickly cool the material.

26) We can see each other in the classroom during class because we
A) emit thermal radiation.
B) emit visible light.
C) emit infrared light.
D) reflect visible light.
E) reflect infrared light.

27) A gas heated to millions of degrees would emit
A) mostly radio waves.
B) mostly X-rays.
C) mostly ultraviolet light.
D) an equal amount of all wavelengths of light.
E) no light, because it is too hot.

28) What is the *solar wind*?
A) a stream of charged particles flowing outward from the surface of the Sun
B) the uppermost layer of the Sun, lying just above the corona
C) the strong wind that blows sunspots around on the surface of the Sun
D) the wind that causes huge arcs of gas to rise above the Sun's surface

29) On the scale of the cosmic calendar, in which the history of the universe is compressed to 1 year, how long has human civilization (*i.e.*, since ancient Egypt) existed?
A) about half the year
B) about a month
C) a few hours
D) a few seconds
E) a few days

30) The overall result of the proton-proton chain is _____.
A) 4 H becomes 1 He + energy
B) 6 H becomes 1 He + energy
C) p + p becomes ^2H + energy
D) individual protons are joined into long chains of protons

31) One *light-hour* is the distance that light travels in an hour. How far is this, in kilometers? (Recall that the speed of light is 300,000 km/s.)

- A) 300,000 km
- B) 18 million km
- C) 100 million km
- D) 1.08 billion km
- E) 9.46 trillion km

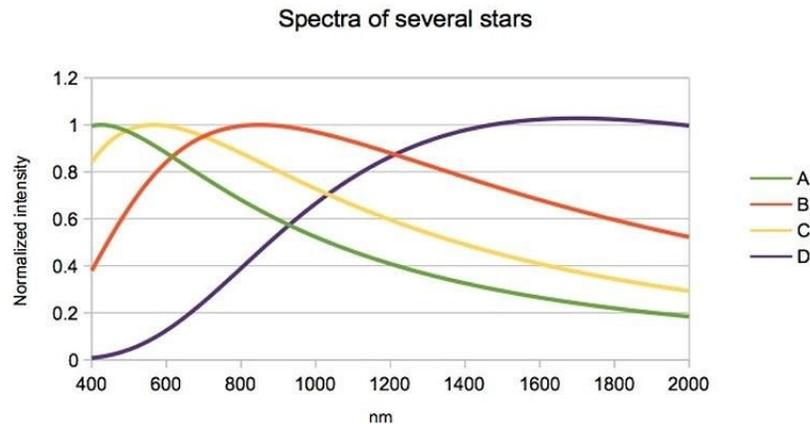
32) In order for an atom to absorb a photon (a particle of light),

- A) the photon must have energy matching the difference in energy between energy levels in the atom.
- B) the atom must have lost all of its electrons.
- C) the photon must have enough energy to remove an electron from the atom.
- D) A or C
- E) B or C

33) What is *nuclear fusion*?

- A) an explosion caused by putting together two volatile chemicals
- B) the process of splitting nuclei to produce energy
- C) the process of turning matter into pure energy
- D) the process of combining lightweight nuclei to make heavier nuclei
- E) a process that only occurs in bombs

34) The simplified spectra for four stars is shown here. Which star has the lowest temperature?



- A) star A (green line)
- B) star B (orange line)
- C) star C (yellow line)
- D) star D (purple line)

35) He discovered that the orbits of planets are ellipses.

- A) Tycho Brahe
- B) Copernicus
- C) Kepler

- D) Galileo
- E) Ptolemy

36) What is the only force that can overcome the repulsion between two positively charged nuclei to bind them into an atomic nucleus?

- A) the strong force
- B) the weak force
- C) the electromagnetic force
- D) the gravitational force
- E) the Coriolis force

37) If the sun's surface cooled, how would its appearance change?

- A) It would appear more red.
- B) It would appear more blue.
- C) It would become bright white.
- D) It would stay the same.

38) Approximately how fast is a person located at the Earth's equator traveling due to the rotation of the Earth?

- A) 17,000 km/hr
- B) 1,700 km/hr
- C) 170 km/hr
- D) 17 km/hr
- E) not moving at all

39) Why are astronauts weightless in the Space Station?

- A) because the Space Station is constantly in free-fall around the Earth
- B) because the Space Station is traveling so fast
- C) because there is no gravity in space
- D) because the Space Station is moving at constant velocity

40) Why were ancient peoples unable to detect stellar parallax?

- A) They did not look for it.
- B) They could not see distant stars.
- C) They did not have the ability to measure very small angles.
- D) They did not observe for long enough periods of time.
- E) They did detect it, but they rejected the observations.

41) A star's *luminosity* is the

- A) apparent brightness of the star in our sky.
- B) surface temperature of the star.
- C) lifetime of the star.
- D) total amount of energy that the star will radiate over its entire lifetime.
- E) total amount of energy that the star radiates each second.

42) You measure the parallax angle for a star to be 0.1 arcseconds. The distance to this star is

- A) 10 light-years.
- B) 10 parsecs.
- C) 0.1 light-year.
- D) 0.1 parsec.
- E) impossible to determine.

43) Which of the following stars are brightest at ultraviolet wavelengths?

- A) O and B stars
- B) A and F stars
- C) G and K stars
- D) M stars

44) If the Sun-Earth separation were 10 AU instead of 1 AU, what would the flux of sunlight (energy per second per square meter) be at the Earth, compared to what it is today?

- A) 10 times less
- B) about 3.16 (or the square root of 10) times less
- C) 10 times more
- D) 100 times less
- E) 100 times more

Answers:

- 1) C
- 2) A
- 3) B
- 4) A
- 5) D
- 6) D
- 7) C
- 8) C
- 9) C
- 10) A
- 11) B
- 12) A
- 13) A
- 14) B
- 15) C
- 16) B
- 17) A
- 18) C
- 19) C
- 20) B
- 21) C
- 22) C
- 23) A
- 24) C
- 25) B
- 26) D
- 27) B
- 28) A
- 29) D
- 30) A
- 31) D
- 32) D
- 33) D
- 34) D
- 35) C
- 36) A
- 37) A
- 38) B
- 39) A
- 40) C
- 41) E
- 42) B
- 43) A
- 44) D