

Yellow Key

Ast 1040 Test #1

Write the color of your test booklet on the top of your bubble sheet!

Be sure to fill in your name and student ID#. That's how your grade gets back to you and not someone else.

If you can't do this correctly, it will cost you two points!!!

Be sure to follow the standard bubble-sheet drill:

- use a #2 pencil (some pens get ignored by the scanner)
- completely fill in the circles
- if you want to change an answer, be sure to completely erase the old one

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) What do we mean when we say that the universe is *expanding*?

- A) Everything in the universe is gradually growing in size.
- B) Average distances between galaxies are increasing with time.
- C) Within galaxies, average distances between star systems are increasing with time.
- D) The statement is not meant to be literal; rather, it means that our knowledge of the universe is growing.

1) B

2) What is *stellar parallax*?

- A) It is the change in the set of constellations that we see at different times of year in the evening sky.
- B) It describes the fact that stars are actually moving relative to one another, even though to our eyes the stars appear fixed in the constellations.
- C) It is the daily rise and set of the stars.
- D) It is the slight back-and-forth shifting of star positions that occurs as we view the stars from different positions in Earth's orbit of the Sun.

2) D

3) How does a rocket launch upwards? Choose the statement that best describes why a rocket goes up.

- A) By expelling gas downwards, the rocket is propelled upwards.
- B) By expelling gas downwards, which pushes against the ground, the rocket is propelled upwards.
- C) By expelling gas, the rocket loses mass; because it is lighter, it rises up.

3) A

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

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

4) D

5) Which of the following is largest?

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

5) B

6) Cell phone signals passing through walls is an example of

- A) reflection or scattering.
- B) emission.
- C) transmission.
- D) absorption.

6) C

- 7) According to the universal law of gravitation, if you triple the distance between two objects, then the gravitational force between them _____.
- A) decreases by a factor of 9
B) decreases by a factor of 3
C) increases by a factor of 3
D) increases by a factor of 9
- 8) We can see each other in the classroom right now because we
- A) emit thermal radiation.
B) emit visible light.
C) reflect visible light.
D) reflect infrared light.
E) emit infrared light.
- 9) Consider an atom of gold in which the nucleus contains 79 protons and 118 neutrons. What is its atomic number and atomic mass number?
- A) The atomic number is 118, and the atomic mass number is 197.
B) The atomic number is 118, and the atomic mass number is 79.
C) The atomic number is 79, and the atomic mass number is 197.
D) The atomic number is 79, and the atomic mass number is 118.
- 10) What is the Sun mainly made of?
- A) hydrogen and helium
B) oxygen and carbon
C) carbon and nitrogen
D) nearly equal portions of all the elements
E) hydrogen and oxygen
- 11) From Kepler's third law, a hypothetical planet that is twice as far from the Sun as Earth should have a period of
- A) 1 Earth year.
B) 1/2 Earth year.
C) 2 Earth years.
D) more than 2 Earth years.
E) It depends on the planet's mass.
- 12) At which lunar phase(s) are tides most pronounced (for example, the highest high tides)?
- A) both new and full moons
B) new moon only
C) full moon only
D) both first and third quarters
- 13) When we see Venus in its full phase, what phase would Earth be in as seen by a hypothetical Venetian?
- A) third quarter
B) first quarter
C) waning crescent
D) full
E) new

- 14) What makes the North Star, Polaris, special? 14) E
A) It can be used to determine your longitude on Earth.
B) It is the star straight overhead.
C) It is the star directly on your northern horizon.
D) It is the brightest star in the sky.
E) It appears very near the north celestial pole.
- 15) One star is emitting primarily visible light and another star is emitting primarily infrared light. Which star is hotter? 15) B
A) the star emitting infrared light
B) the star emitting visible light
C) Both stars are the same temperature.
D) The temperature also depends on the radius of the star, so one can't decide based on the information provided.
- 16) Scientific models are used to _____. 16) D
A) prove that past paradigms no longer hold true
B) make miniature representations of the universe
C) present the scale of the solar system to the general public
D) make specific predictions that can be tested through observations or experiments
- 17) According to Kepler's third law ($p^2 = a^3$), how does a planet's mass affect its orbit around the Sun? 17) D
A) A more massive planet must have a larger semimajor axis.
B) More massive planets must have more circular orbits.
C) More massive planets orbit the Sun at higher average speed.
D) A planet's mass has no effect on its orbit around the Sun.
- 18) Has Polaris always been the "North Star"? 18) D
A) Yes, because the stars are unchanging.
B) No, because it is a young star that only formed a few hundred years ago.
C) No, because the Milky Way blocked our line of sight to it for a long time.
D) No, because the Earth's axis slowly changes the direction it points.
- 19) During the period each year when we see Mars undergoing apparent retrograde motion in our sky, what is really going on in space? 19) B
A) Mars is moving around the Sun in the opposite direction from which Earth is moving around the Sun.
B) Earth is catching up with and passing by Mars in their respective orbits.
C) Earth and Mars are on opposite sides of the Sun.
D) Earth and Mars are getting closer together.
- 20) How did the Ptolemaic model explain the apparent retrograde motion of the planets? 20) A
A) The planets moved along small circles that moved on larger circles around the Earth.
B) The model showed that apparent retrograde motion occurs as Earth passes by another planet in its orbit of the Sun.
C) The planets resided on giant spheres that sometimes turned clockwise and sometimes turned counterclockwise.
D) The planets sometimes stopped moving and then reversed to move backward along their circular orbits.

- 21) The energies of two photons you might detect emitted by hydrogen atoms are 10.2 and 2.1 eV. Which photon has the longest wavelength?
A) the 2.1 eV photon
B) the 10 eV photon
C) They both have the same wavelength. 21) A
- 22) Which of the following is the reason for the solar day being longer than a sidereal day?
A) Earth year being a non-integer number of Earth days
B) precession of Earth's axis
C) the non-circular orbit of Earth around the Sun
D) the tilt of Earth's axis
E) the combined effect of the rotation of Earth and its orbit about the Sun 22) E
- 23) What led Kepler to abandon circular orbits and his discovery that planetary orbits are ellipses?
A) a deviation between observed and model values that was much larger than the observation uncertainties
B) the observation of a comet moving on a highly eccentric orbit
C) a desire to gain prestige by using a more complicated model 23) A
- 24) Which of the following statements about X-rays and radio waves is *not* true?
A) X-rays have shorter wavelengths than radio waves.
B) X-rays have higher energy than radio waves.
C) X-rays have higher frequency than radio waves.
D) Neither X-rays nor radio waves can penetrate Earth's atmosphere.
E) X-rays and radio waves are both forms of light, or electromagnetic radiation. 24) D
- 25) Kepler's second law, which states that as a planet moves around its orbit it sweeps out equal areas in equal times, means that
A) planets have circular orbits.
B) planets that are farther from the Sun move at slower average speeds than nearer planets.
C) a planet's period does not depend on the eccentricity of its orbit.
D) a planet travels faster when it is nearer to the Sun and slower when it is farther from the Sun.
E) the period of a planet does not depend on its mass. 25) D
- 26) The fact that Voyager 2 continues to speed out of the solar system, even though its rockets have no not fired for a long time, is an example of
A) Newton's first law of motion.
B) Newton's second law of motion.
C) Newton's third law of motion.
D) the universal law of gravitation.
E) none of the above 26) A
- 27) How are wavelength, frequency, and energy related for photons of light?
A) Longer wavelength means higher frequency and lower energy.
B) Longer wavelength means lower frequency and lower energy.
C) Longer wavelength means higher frequency and higher energy.
D) Longer wavelength means lower frequency and higher energy.
E) There is no simple relationship because different photons travel at different speeds. 27) B

- 28) Which of the following statements about the celestial equator is true at *all* latitudes? 28) B
A) It extends from your horizon due north, through your zenith, to your horizon due south.
B) It represents an extension of Earth's equator onto the celestial sphere.
C) It lies along the band of light we call the Milky Way.
D) It cuts the dome of your local sky exactly in half.
E) It extends from your horizon due east, through your zenith, to your horizon due west.
- 29) What practical value did astronomy offer to ancient civilizations? 29) C
A) It allowed them to predict eclipses with great accuracy.
B) It helped them understand our cosmic origins.
C) It helped them keep track of time and seasons, and it was used by some cultures for navigation.
D) It helped them find uses for ancient structures like Stonehenge.
- 30) Laboratory measurements show hydrogen produces a spectral line at a wavelength of 486.1 nanometers (nm). A particular star's spectrum shows the same hydrogen line at a wavelength of 486.0 nm. What can we conclude? 30) B
A) The star is moving away from us. B) The star is moving toward us.
C) The star is getting hotter. D) The star is getting colder.
- 31) Which of the following represents a case in which you are *not* accelerating? 31) C
A) driving 60 miles per hour around a curve
B) slamming on the brakes to come to a stop at a stop sign
C) driving in a straight line at 60 miles per hour
D) going from 0 to 60 miles per hour in 10 seconds
- 32) Suppose it is full moon. What phase of Earth would someone on the Moon see at this time? 32) A
A) new Earth
B) first quarter Earth
C) full Earth
D) Earth does not go through phases as seen from the Moon.
- 33) Which of the following statements does *not* use the term *light-year* in an appropriate way? 33) D
A) It will take the Voyager spacecraft about 20,000 years to travel just 1 light-year.
B) The Milky Way Galaxy is about 100,000 light-years in diameter.
C) A light-year is about 10 trillion kilometers.
D) It will take me light-years to complete this homework assignment.
E) It's about 4 light-years from here to Alpha Centauri.
- 34) The gravitational force that the Earth exerts on the Moon is equal and opposite to that which the Moon exerts on the Earth. Therefore, according to Newton's second law of motion, 34) B
A) the Earth has a larger acceleration than the Moon, because it has a larger mass.
B) the Moon has a larger acceleration than the Earth, because it has a smaller mass.
C) the Moon and the Earth both have equal accelerations, because the forces are equal.
- 35) Which object has aged the most since it emitted the light we see today? 35) D
A) Pluto B) the Sun
C) a star near the center of the Milky Way D) a star in the Andromeda Galaxy

- 36) How can an electron in an atom lose energy to go from a higher energy level to a lower energy level? 36) A
- A) It releases a photon equal in energy to its own energy drop.
 - B) It exchanges gravitational potential energy for kinetic energy.
 - C) It loses gravitational potential energy.
 - D) It loses kinetic energy.
 - E) It absorbs a photon equal in energy to its own energy drop.
- 37) The astronauts feel weightless in the International Space Station, which orbits the Earth once every 90 minutes. Why? 37) D
- A) because the gravity from the Moon cancels out the gravity from Earth
 - B) because there is no gravity in space
 - C) because they are moving so fast
 - D) because they and the space station are both falling around the Earth
- 38) If the Moon is setting at 6 A.M., the phase of the Moon must be 38) D
- A) waning crescent.
 - B) new.
 - C) third quarter.
 - D) full.
 - E) first quarter.
- 39) Which of the following best describes why we have seasons on Earth? 39) C
- A) The tilt of Earth's axis causes the northern hemisphere to be closer to the Sun than the southern hemisphere in summer, and vice versa in winter.
 - B) Earth's elliptical orbit means we are closer to the Sun and therefore receive more intense sunlight at some times of year than at others.
 - C) The tilt of Earth's axis causes different portions of the Earth to receive more or less direct sunlight at different times of year.
 - D) The varying speed of Earth in its orbit around the Sun gives us summer when we are moving fastest and winter when we are moving slowest.
- 40) Earth is made mostly of metals and rocks. Where did this material come from? 40) C
- A) It was made by nuclear fission of uranium and other radioactive materials.
 - B) It was made by our Sun.
 - C) It was produced by nuclear fusion in stars.
 - D) It was created by chemical reactions in interstellar space.
 - E) It was produced in the Big Bang.
- 41) Why do the patterns of the stars in our sky look the same from year to year? 41) B
- A) because the stars in the constellations are not moving
 - B) because the stars in the constellations are so far away
 - C) because the stars in the constellations move so slowly-typically about the speed of a snail-that their motions are not noticeable
 - D) because the stars in the constellations all move at the same speeds and in the same directions, so they don't change their relative positions

- 42) Which of the following conditions must exist for a solar eclipse to occur? 42) C
A) The only condition is that the phase of the Moon must be new.
B) Moon phase is full, and the Moon is passing through the Earth's orbital plane.
C) Moon phase is new, and the Moon is passing through the Earth's orbital plane.
D) The only condition is that the phase of the Moon must be full.
- 43) Studying a spectrum from a star can tell us a lot. All of the following statements are true except one. Which statement is *not* true? 43) D
A) Shifts in the wavelengths of spectral lines compared to the wavelengths of those same lines measured in a laboratory on Earth can tell us the star's speed toward or away from us.
B) The peak of the star's thermal emission tells us its temperature: hotter stars peak at shorter (bluer) wavelengths.
C) We can identify chemical elements present in the star by recognizing patterns of spectral lines that correspond to particular chemicals.
D) The total amount of light in the spectrum tells us the star's radius.
- 44) Place the following items in order of actual physical size, from smallest to largest. 44) A
A) planet, star, solar system, galaxy
B) star, planet, galaxy, solar system
C) planet, star, galaxy, solar system
D) star, planet, solar system, galaxy
E) planets and stars are about the same size, solar system, galaxy
- 45) A typical galaxy is a _____. 45) D
A) large, glowing ball of gas powered by nuclear energy
B) relatively small, icy object orbiting a star
C) nearby object orbiting a planet
D) collection of a few hundred million to a trillion or more stars, bound together by gravity
E) system consisting of one or a few stars orbited by planets, moons, and smaller objects
- 46) Suppose you drop a 10-pound weight and a 5-pound weight on the Moon, both from the same height at the same time. What will happen? 46) C
A) Both weights will float freely, since everything is weightless on the Moon.
B) The 10-pound weight will hit the ground before the 5-pound weight.
C) Both will hit the ground at the same time.
D) The 5-pound weight will hit the ground before the 10-pound weight.
- 47) Which of the following objects would be most likely to produce an emission-line spectrum? 47) B
A) a light bulb
B) a neon light
C) the Earth
D) a star like our Sun
- 48) One of the most fundamental discoveries about the universe has been that it is expanding. "The universe is expanding" means 48) A
A) distances between most galaxies are getting larger.
B) the cosmological horizon is growing with time.
C) our estimate for the size of the universe has increased over the last century.
D) galaxies are growing with time.

- 49) During the time that a planet is in its period of *apparent retrograde motion*, _____.
- A) the planet appears to rise in the west and set in the east, rather than the usual rising in the east and setting in the west
 - B) the planet is getting closer to the Sun in its orbit
 - C) over many days or weeks, the planet moves westward relative to the stars, rather than the usual eastward relative to the stars
 - D) the planet moves backwards (clockwise as viewed from above Earth's north pole) in its orbit of the Sun
- 50) Orion is visible on winter evenings but not summer evenings because of
- A) the precession of Earth's axis.
 - B) baseball on television.
 - C) interference from the full moon.
 - D) the location of Earth in its orbit.
 - E) the tilt of Earth's axis.
- 51) What is a *circumpolar* star?
- A) a star that makes a daily circle around the celestial sphere
 - B) a star that is close to the north celestial pole
 - C) a star that is close to the south celestial pole
 - D) a star that is visible from the Arctic or Antarctic circles
 - E) a star that always remains above your horizon
- 52) Which of the following statements correctly describes the *law of conservation of energy*?
- A) The total quantity of energy in the universe never changes.
 - B) It is not really possible for an object to gain or lose potential energy because energy cannot be destroyed.
 - C) The fact that you can fuse hydrogen into helium to produce energy means that helium can be turned into hydrogen to produce energy.
 - D) An object always has the same amount of energy.
 - E) Energy can change between many different forms, such as potential, kinetic, and thermal, but it is ultimately destroyed.
- 53) Suppose you lived on the Moon. Which of the following would be true?
- A) Your mass would be less than your mass on Earth, but your weight would be the same as it is on Earth.
 - B) Both your weight and your mass would be less than they are on Earth.
 - C) Both your weight and your mass would be the same as they are on Earth.
 - D) Your weight would be less than your weight on Earth, but your mass would be the same as it is on Earth.
- 54) Approximately where is it currently high tide on Earth?
- A) wherever it is currently noon
 - B) on the portion of Earth facing directly toward the Moon and on the portion of Earth facing directly away from the Moon
 - C) only on the portion of the Earth facing directly toward the Moon
 - D) anywhere that ocean water laps upon the shore

49) C

50) D

51) E

52) A

53) D

54) B

- 55) The difference between *speed* and *velocity* is that _____. 55) A
A) velocity also includes a direction
B) velocity is the same as acceleration but speed is different
C) they are expressed in different units
D) velocity is calculated using a physics equation
- 56) Suppose you kick a soccer ball straight up to a height of 10 meters. Which of the following is true about the gravitational potential energy of the ball during its flight? 56) C
A) The ball's gravitational potential energy is greatest at the instant the ball leaves your foot.
B) The ball's gravitational potential energy is greatest at the instant it returns to hit the ground.
C) The ball's gravitational potential energy is greatest at the instant when the ball is at its highest point.
D) The ball's gravitational potential energy is always the same.
- 57) During a lunar eclipse the Moon's phase must be 57) C
A) 3rd quarter. B) new. C) full. D) 1st quarter.
- 58) Suppose we look at a photograph of many galaxies. Assuming that all galaxies formed at the same time after the Big Bang, which galaxy appears to us as the youngest? 58) A
A) the galaxy that is furthest from us
B) the galaxy that appears largest to us
C) the galaxy that appears bluest to us
D) the galaxy that is closest to us
E) All galaxies would appear to have the same age.
- 59) The *wavelength* of a wave is 59) C
A) equal to the speed of the wave times the wave's frequency.
B) how strong the wave is.
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) the distance between a peak of the wave and the next trough.
- 60) Our solar system consists of _____. 60) B
A) a few hundred billion stars, bound together by gravity
B) the Sun and all the objects that orbit it
C) the Sun and the planets, and nothing else
D) the Sun and several nearby stars, as well as the planets and other objects that orbit these stars