

Exam

Name _____

Quiz 1

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

1) At approximately what time would a full moon be on your meridian?

A) 6 A.M.

B) midnight

C) 6 P.M.

D) 9 A.M.

E) noon

2) Kepler's third law, $p^2 = a^3$, means that

A) the period of a planet does not depend on its mass.

→ B) planets that are farther from the Sun move at slower average speeds than nearer planets.

C) all orbits with the same semimajor axis have the same period.

D) a planet's period does not depend on the eccentricity of its orbit.

E) All of the above are correct.

3) Which of the following is *not* one of, nor follows directly from, Kepler's laws?

A) As a planet moves around its orbit, it sweeps out equal areas in equal times.

B) The orbit of each planet about the Sun is an ellipse with the Sun at one focus.

→ C) The force of attraction between any two objects decreases with the square of the distance between their centers.

D) More distant planets move at slower speeds.

E) A planet travels faster when it is nearer to the Sun and slower when it is farther from the Sun.

4) What is a *circumpolar* star?

A) a star that is close to the north celestial pole

B) a star that is visible from the Arctic or Antarctic circles

C) a star that is close to the south celestial pole

D) a star that makes a daily circle around the celestial sphere

→ E) a star that always remains above your horizon

5) Why did Ptolemy have the planets orbiting the earth on "circles upon circles" in his model of the universe?

→ A) to explain the fact that planets sometimes appear to move westward, rather than eastward, relative to the stars in our sky

B) to explain why the Greeks were unable to detect stellar parallax

C) to properly account for the varying distances of the planets from the earth

D) to explain why more distant planets take longer to make a circuit through the constellations of the zodiac

E) to explain why Venus goes through phases as seen from the earth

6) Which of the following is not true about Aldebaran?

→ A) It is a young star


B) It is known as the "eye of the bull"

C) It is in the constellation Taurus


D) It is a red giant star

E) It is part of the winter circle


7) If the Moon is rising at midnight, the phase of the Moon must be

-  A) third quarter.
- B) waxing crescent.
- C) first quarter.
- D) full.
- E) waning crescent.

8) When Copernicus first created his Sun-centered model of the universe, it did not lead to substantially better predictions of planetary positions than the Ptolemaic model. Why not?

-  A) Copernicus used perfect circles for the orbits of the planets.
- B) Copernicus placed the planets in the wrong order going outward from the Sun.
- C) Copernicus misjudged the speeds at which the planets orbit the Sun.
- D) Copernicus placed the Sun at the center but did not realize that the Moon orbits the earth.
- E) Copernicus misjudged the distances between the planets.

9) Why do we see essentially the same face of the Moon at all times?

- A) because the Moon does not rotate
- B) because the Moon has a nearly circular orbit around the earth
- C) because the Sun illuminates only one half at a time
-  D) because the Moon's rotational and orbital periods are equal
- E) because the other face points toward us only at new moon, when we can't see the Moon

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 10) What is the name of the bright star in Orion's "knee"?
- 11) What star is just about directly overhead in the late evening this time of year?
- 12) Describe two observations that Galileo made that helped support the Copernican model of the solar system.
- 13) Describe what the seasons would be like if the Earth's axis was tilted 90 degrees (instead of the actual tilt of 23.5 degrees).

Name _____

Quiz 2

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

1) We can learn a lot about the properties of a star by studying its spectrum. All of the following statements are true except one. Which one?

A) The peak of the star's thermal emission tells us its temperature: Hotter stars peak at shorter (bluer) wavelengths.



B) The total amount of light in the spectrum tells us the star's radius.

C) We can look at Doppler shifts of spectral lines to determine the star's speed toward or away from us.

D) We can identify chemical elements present in the star by recognizing patterns of spectral lines that correspond to particular chemicals.

2) A skater can spin faster by pulling in her arms closer to her body or spin slower by spreading her arms out from her body. This is due to

A) conservation of momentum.

B) conservation of energy.

C) Newton's third law.

D) the law of gravity.



E) conservation of angular momentum.

3) The mass of Jupiter can be calculated by

A) measuring the orbital speed of one of Jupiter's moons.

B) measuring the orbital period and distance of Jupiter's orbit around the Sun.



C) measuring the orbital period and distance of one of Jupiter's moons.

D) knowing the Sun's mass and measuring how Jupiter's speed changes during its elliptical orbit around the Sun.

E) knowing the Sun's mass and measuring the average distance of Jupiter from the Sun.

4) You observe a distant galaxy. You find that a spectral line normally found in the visible part of the spectrum is shifted toward the infrared. What do you conclude?



A) The galaxy is moving away from you.

B) The composition of the galaxy is changing.

C) The galaxy is moving toward you.

D) The galaxy is made purely of hydrogen.

E) The galaxy has very weak gravity.

5) The fact that Voyager 10 continues to speed out of the solar system, even though its rockets have no fuel, is an example of

A) Newton's third law of motion.

B) the universal law of gravitation.


C) Newton's second law of motion.




D) Newton's first law of motion.

E) none of the above

6) At which lunar phase(s) are tides most pronounced (e.g., the highest high tides)?

- A) new moon
- B) full moon
- C) first quarter
-  D) both new and full moons
- E) both first and third quarters


7) Which of the following *best* describes the origin of ocean tides on Earth?

-  A) Tides are caused by the difference in the force of gravity exerted by the Moon across the sphere of the earth.
- B) Tides are caused primarily by the gravitational force of the Sun.
- C) Tides are caused by the $23\frac{1}{2}^\circ$ tilt of the earth's rotational axis to the ecliptic plane.
- D) Tides are caused on the side of the earth nearest the Moon because the Moon's gravity attracts the water.
- E) The Moon's gravity pulls harder on water than on land, because water is less dense than rock.


8) Grass (that is healthy) looks green because

- A) it transmits green light and emits other colors.
-  B) it reflects green light and absorbs other colors.
- C) it absorbs green light and emits other colors.
- D) it emits green light and absorbs other colors.

9) When an electron in an atom goes from a higher energy state to a lower energy state, the atom

- A) absorbs a photon of a specific frequency.
- B) can absorb a photon of any frequency.
- C) can emit a photon of any frequency.
- D) absorbs several photons of a specific frequency.
-  E) emits a photon of a specific frequency.

10) Suppose you see two stars: a blue star and a red star. Which of the following can you conclude about the two stars? Assume that no Doppler shifts are involved. (*Hint: Think about the laws of thermal radiation.*)

- A) The red star is more massive than the blue star.
- B) The red star has a hotter surface temperature than the blue star.
-  C) The blue star has a hotter surface temperature than the red star.
- D) The blue star is more massive than the red star.
- E) The blue star is farther away than the red star.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

11) What is the name of the bright star in Leo?


12) When you "follow the arc" of stars in the handle of the Big Dipper, what star do you come to?

13) State Newton's three laws of motion.


Quiz 3

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


1) According to the nebular theory, how did the Oort cloud form?

- A) It is material left over from the interstellar cloud that never contracted with the rest of the gases to form the solar nebula.
-  B) It is made of planetesimals that formed beyond Neptune's orbit and never accreted to form a planet.
- C) It is made of planetesimals formed in the outer solar system that were flung into distant orbits by encounters with the jovian planets.
- D) It is made of planetesimals between the orbits of Mars and Jupiter that never formed into a planet.
- E) It consists of objects that fragmented from the protosun during a catastrophic collision early in the formation of the solar system.


2) At approximately what time would a first quarter moon rise?

- A) midnight
- B) 6 P.M.
- C) 9 A.M.
-  D) noon
- E) 6 A.M.


3) Why did the solar nebula heat up as it collapsed?

- A) Collisions among planetesimals generated friction and heat.
- B) Nuclear fusion occurring in the core of the protosun produced energy that heated the nebula.
- C) Radiation from other nearby stars that had formed earlier heated the nebula.
- D) The shock wave from a nearby supernova heated the gas.
-  E) As the cloud shrank, its gravitational potential energy was converted to kinetic energy and then into thermal energy.


4) Which of the following are relatively unchanged fragments from the early period of planet building in the solar system?

- A) Oort cloud comets
- B) meteorites
- C) asteroids
- D) Kuiper belt comets
-  E) all of the above


5) What was the *frost line* of the solar system?

- A) the distance from the Sun where temperatures were low enough for metals to condense, between the Sun and the present-day orbit of Mercury
- B) the distance from the Sun where temperatures were low enough for hydrogen and helium to condense, between the present-day orbits of Jupiter and Saturn
- C) the distance from the Sun where temperatures were low enough for rocks to condense, between the present-day orbits of Mercury and Venus
-  D) the distance from the Sun where temperatures were low enough for hydrogen compounds to condense into ices, between the present-day orbits of Mars and Jupiter
- E) the distance from the Sun where temperatures were low enough for asteroids to form, between the present-day orbits of Venus and Earth


6) What happened during the *accretion* phase of the early solar system?

- A) The solar nebula differentiated into metals inside of the frost line and ices beyond.
- B) Atoms and molecules in the gas bonded together and solidified.
- C) Earth gained its oceans from icy planetesimal capture.
-  D) Particles grew by colliding and sticking together.
- E) Large planetesimals captured atmospheres from the solar nebula.


7) Which of the following statements is *not* an observed pattern of motion in our solar system?

- A) Almost all moons orbit their planet in the same direction as the planet's rotation.
-  B) Most planets orbit at the same speed.
- C) Most planetary orbits lie nearly in the same plane.
- D) Most planets rotate in the same direction in which they orbit.
- E) All planets orbit the Sun in the same direction.


8) Why are the inner planets made of denser materials than the outer planets?

- A) In the beginning, when the protoplanetary disk was spinning faster, centrifugal forces flung the lighter materials toward the outer parts of the solar nebula.
- B) Denser materials were heavier and sank to the center of the nebula.
- C) The Sun's gravity pulled denser materials toward the inner part of the solar nebula, while lighter gases escaped more easily.
- D) When the solar nebula formed a disk, materials naturally segregated into bands, and in our particular solar system the denser materials settled nearer the Sun while lighter materials are found in the outer part.
-  E) In the inner part of the nebula only metals and rocks were able to condense because of the high temperatures, whereas hydrogen compounds, although more abundant, were only able to condense in the cooler outer regions.

9) What are the main constituents of the jovian planets?

- A) ammonia and water
- B) nitrogen and methane
-  C) hydrogen and helium
- D) rocky minerals and water, as on Earth
- E) ammonia and methane

10) According to our theory of solar system formation, what is Pluto?

- A) Pluto is simply an oddball planet, and thus represents one of the "exceptions" that the nebular theory cannot explain.
- B) Pluto is a terrestrial planet that was shot out from the inner solar system to its present location as the most distant planet.
- C) Pluto is a very small jovian planet.
- D) Pluto is a terrestrial planet that happened to form at a large distance from the Sun.
-  E) Pluto is the largest of the Kuiper-belt comets. (well, it's nearly the largest!)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

11) Explain why the early Earth did not form with water, and how it gained it later in its formation.


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Quiz 4

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


1) Why does the earth have the strongest magnetic field among the terrestrial worlds?

- A) It is the only one that has a metallic core.
- B) It is the most volcanically active world.
- C) It is by far the largest terrestrial world.
- D) It rotates much faster than any other terrestrial world.
-  E) It is the only one that has both a partially molten metallic core and reasonably rapid rotation.


2) *Olympus Mons* is a

-  A) large lava plain on the Moon.
- B) shield volcano on Mars.
- C) stratovolcano on the Moon.
- D) shield volcano on Venus.
- E) stratovolcano on Mercury.


3) The sky is blue because

- A) the Sun mainly emits blue light.
- B) the atmosphere absorbs mostly blue light.
- C) the atmosphere transmits mostly blue light.
- D) molecules scatter red light more effectively than blue light.
-  E) molecules scatter blue light more effectively than red light.

4) There are no auroras on Venus because it

- A) lacks an ionosphere.
- B) is too hot.
- C) lacks atmospheric oxygen.
- D) lacks strong winds.
-  E) lacks a strong magnetic field.

5) The *Caloris Basin* on Mercury covers a large region of the planet, but few smaller craters have formed on top of it. From this we conclude that

- A) erosion destroyed the smaller craters that formed on the basin.
- B) Mercury's atmosphere prevented smaller objects from hitting the surface.
- C) the *Caloris Basin* was formed by a volcano.
- D) only very large impactors hit Mercury's surface in the past.
-  E) the *Caloris Basin* formed toward the end of the solar system's period of heavy bombardment.

6) What would happen to Earth if we somehow moved our planet to the orbit of Venus?



- A) Earth would suffer a runaway greenhouse effect and become as hot or hotter than Venus.
- B) Being so much closer to the Sun would almost immediately cause the surface of Earth to melt, and all our cities would then be destroyed by the hot lava.
- C) The fact that we have oceans would moderate the temperature change due to moving our planet, so temperature would hardly change at all.
- D) Temperatures would rise only slightly, but enough to melt the polar caps.

7) Which of the following best describes why the smaller terrestrial worlds have cooler interiors than the larger ones?



- A) They have relatively more surface area compared to their volumes.
- B) They were cooler when they formed.
- C) The smaller ones are farther from the Sun.
- D) They have relatively fewer radioactive elements.
- E) They had more volcanic eruptions in the past, which released their internal heat.

8) Every summer, when you look low on the southern horizon around midnight, you are looking towards



- A) the outer parts of our galaxy
- B) the center of our galaxy
- C) the Moon
- D) Jupiter
- E) Toronto

9) Why isn't the earth's atmosphere mostly hydrogen?



- A) Earth formed too close to the Sun for any planetesimals to have hydrogen.
- B) Light gases such as hydrogen move faster than heavier gases and escape from the earth's gravitational field.
- C) All the hydrogen was blasted away during the early bombardment stage of the solar system.
- D) All the hydrogen reacted with oxygen and formed the oceans.
- E) The hydrogen is frozen in the polar ice caps.

10) How did the lunar *maria* form?



- A) Volatiles escaping from the Moon's interior heated and eroded the surface in the regions of the *maria*.
- B) Large impacts fractured the Moon's lithosphere, allowing lava to fill the impact basins.
- C) The giant impact that created the Moon left smooth areas that we call the *maria*.
- D) The *maria* are the result of gradual erosion by micrometeorites striking the Moon.
- E) The early bombardment created heat that melted the lunar surface in the regions of the *maria*.

11) What is the troposphere?




- A) the highest layer in the atmosphere
- B) the part of the atmosphere that absorbs ultraviolet
- C) the part of the atmosphere that absorbs optical light
- D) the part of the atmosphere that absorbs X rays
- E) the lowest layer in the atmosphere


Quiz 5

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


1) Where did comets that are now in the Oort cloud originally form?

-  A) near the jovian planets
 B) inside Jupiter's orbit
 C) outside Neptune's orbit
 D) within the solar nebula, but far outside the orbit of Pluto
 E) all of the above

2) Which moon has the most substantial atmosphere?

- A) Ganymede B) Mimas C) Io D) Europa  E) Titan


3) What mechanism is most responsible for generating the internal heat of Io that drives the volcanic activity?

- A) bombardment
 B) radioactive decay
 C) accretion
 D) tidal heating
 E) differentiation


4) Which direction do a comet's dust and plasma tails point?

-  A) perpendicular to the ecliptic plane B) straight behind the comet in its orbit
 C) generally away from the Sun D) always almost due north


5) Why is Jupiter denser than Saturn?

- A) It is made of a different composition than Saturn, including a higher proportion of hydrogen compounds and rocks.
 B) Its core is much larger than Saturn's.
 C) The extra mass of Jupiter compresses its interior to a greater extent than that of Saturn.
 D) It has a greater proportion of helium to hydrogen compared to Saturn.
 E) It is unknown why this is so.


6) What is Jupiter's Great Red Spot?

-  A) a long-lived, high-pressure storm
 B) the place where reddish particles from Io impact Jupiter's surface
 C) a hurricane that comes and goes on Jupiter
 D) a large mountain peak poking up above the clouds
 E) the place where Jupiter's aurora is most visible


7) Why do asteroids and comets differ in composition?

- A) Comets formed from the jovian nebula, while asteroids did not.
-  B) Asteroids formed inside the frost line, while comets formed outside.
- C) Comets are much larger than asteroids.
- D) Asteroids and comets formed at different times.
- E) Asteroids are much larger than comets.


8) How do astronomers think Jupiter generates its internal heat?

- A) radioactive decay
- B) internal friction due to its high rotation rate
-  C) by contracting, changing gravitational potential energy into thermal energy
- D) nuclear fusion in the core
- E) chemical processes


9) Planetary rings are

- A) composed of a large number of individual particles that orbit their planet in accord with Kepler's third law.
- B) nearer to their planet than any of the planet's large moons.
- C) known to exist for all of the jovian planets.
-  D) orbiting in the equatorial plane of their planet.
- E) all of the above

10) When we see a meteor shower, it means that:

- A) you should duck and run for cover to avoid being¹ blasted on the head by a rock from space.
- B) an Earth-approaching asteroid has recently come very close to our planet.
-  C) the solar wind is unusually strong.
- D) Earth is crossing the orbit of a comet.

11) Why isn't there a planet where the asteroid belt is located?

- A) There was too much rocky material to form a terrestrial planet, but not enough gaseous material to form a jovian planet.
- B) A planet once formed here, but it was broken apart by a catastrophic collision.
-  C) The temperature in this portion of the solar nebula was just right to prevent rock from sticking together.
- D) Gravitational tugs from Jupiter prevented material from collecting together to form a planet.
- E) There was not enough material in this part of the solar nebula to form a planet.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

12) Briefly describe the evidence suggesting that a 10-km asteroid or comet hit the earth at the time of the dinosaur extinction.

13) Briefly describe how an impact could lead to a mass extinction.


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Quiz 6

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


1) "Hot Jupiters" in other star systems are

- A) Gas giant planets far from their stars which generate heat by gravitational contraction
- B) Gas giants which shine via nuclear reactions in the cores
-  C) Gas giants found very close to their host stars.
- D) Massive terrestrial planets found near Jovian planets


2) Which of the following is not true of the transit technique for finding planets:

- A) It can give us measurements of a planet's size.
- B) It can give us measurements of a planet's chemical composition
- C) It can give very accurate measurements of the planet's mass
-  D) It can detect planets no matter how their orbit is tilted relative to our viewpoint.


3) What processes are involved in the sunspot cycle?

- A) variations of the solar thermostat
- B) gravitational contraction of the Sun
-  C) the winding of magnetic field lines due to differential rotation
- D) wave motions in the solar interior


4) The Doppler technique searches for planets by

-  A) Measuring the changing velocity of the star as it is pulled on by an orbiting planet.
- B) Blocking the light from a star so we can see the its nearby planets
- C) Watching a star's position in the sky change as a planet tugs on it
- D) Measuring the velocity of a planet as it orbits its host star

5) At approximately what time would a first quarter moon rise?

- A) 6 A.M.
- B) 9 A.M.
- C) 6 P.M.
- D) midnight
-  E) noon

6) What happens in the radiative zone of the Sun?

- A) The sun's magnetic field traps hot gas and makes it radiate.
-  B) Photons move energy outwards by doing a slow "random walk" as they interact with matter.
- C) Photons fly freely through this region due to its low density.
- D) Nuclear reactions produced hydrogen and helium.
- E) Radioactive elements release energy.

- 7) In the late 1800s, Kelvin and Helmholtz suggested that the Sun stayed hot thanks to *gravitational contraction*. What was the major drawback of this idea?
- A) It predicted that the earth would also shrink, which would make it impossible to have stable geology on our planet.
 - B) It predicted that the Sun would shrink noticeably as we watched it, and the Sun appears to be stable in size.
 - C) It is physically impossible to generate heat simply by making a star shrink in size.
 - D) It predicted that the Sun could last only about 25 million years, which is far less than the age of the earth.
- 8) The fact that so many of the planets find orbiting other stars are so much more massive than the planets in our solar system probably is a sign that
- A) The planets we find around other stars are much younger than our planets
 - B) Our solar system is not typical of other planetary systems
 - C) We are looking at types of stars which can only make high mass planets.
 - D) Our techniques for finding planets can currently only find these kinds of planets
- 9) The fundamental nuclear reaction occurring in the core of the Sun is:
- A) radioactive decay.
 - B) nuclear fusion of hydrogen to helium.
 - C) nuclear fission.
 - D) nuclear fusion of helium to carbon.

10) An easy way to identify the constellation Cassiopeia in the fall sky is to...

- A) Look for a W-shaped group of stars
- B) Look for four stars forming a square
- C) Follow the stars in Orion's Belt to Cassiopeia
- D) Look for the double star cluster
- E) Follow the arc of stars in the Big Dipper's handle

11) What happens to energy in the *convection zone* of the Sun?

- A) Energy is consumed in the convection zone by the creation of electrons and positrons.
- B) Energy is transported outward by the rising of hot plasma and the sinking of cooler plasma.
- C) Energy slowly leaks outward through the diffusion of photons that repeatedly bounce off ions and electrons.
- D) Energy is produced in the convection zone by nuclear fusion.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

12) Describe how we think "Hot Jupiters" may have formed.

13) Describe the story explaining why Cassiopeia was thrown into the night sky