Spring 2007 **Astronomy - Test 1** **Test form A**

Name _____

Do not forget to write your name and fill in the bubbles with your student number, **leaving the last bubble blank**, and fill in test form A on the answer sheet. Write your name above as well. You have 60 minutes. For each question, mark the best answer. The formulas you may want are:

$$\sin\left(\frac{\theta}{2}\right) = \frac{\ell}{2d} \qquad F = \frac{GMm}{d^2} \qquad P^2 = a^3 \qquad (M + m)\, P^2 = a^3$$

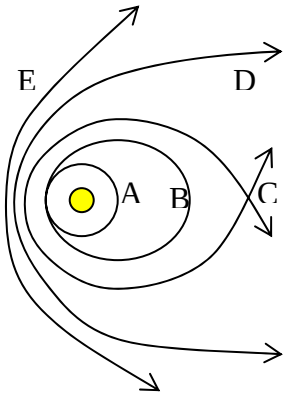
$$c = \lambda f \qquad c = 3\times10^8 \text{ m/sec} \qquad \frac{v_r}{c} = \frac{\lambda_1 - \lambda_0}{\lambda_0} \qquad E = hf$$

$$P = knT \qquad \lambda_{\text{Peak}} T = 2900 \text{ K}\cdot\mu\text{m}$$

1. The moons Ganymede and Titan are almost exactly the same size, but Titan is substantially farther away. From this, we can conclude that the *angular* size of Titan is
   A) Larger than the angular size of Ganymede
   B) Smaller than the angular size of Ganymede
   C) Almost exactly the same angular size as Ganymede
   D) There is insufficient information to conclude any of these

2. The reason it is colder in the winter than in the summer is because
   A) The Sun is closer to the Earth during the winter
   B) The Sun is farther from the Earth during the winter
   C) Demeter, the goddess of the harvest, mourns the absence of her daughter Persephone during the winter, and therefore doesn't warm the Earth
   D) The Sun beats more directly down on the Earth during the winter
   E) The Sun beats down more at an angle on the Earth during the winter

3. According to Newton, which of the curves sketched at right could *not* represent the orbit of an object about the Sun?



4. According to the Bohr model of the atom, what kind of light comes out of an atom when the electrons have been bumped up to high energy states?
   A) They produce a spectrum consisting of several distinct lines at definite wavelengths, with nothing in between
   B) They produce a spectrum consisting of several broad bands of a variety of wavelengths, with dark separations between
   C) They produce a continuous spectrum, with all wavelengths of the visible spectrum
   D) They produce a dark line spectrum, with almost all wavelengths, but a few missing
   E) None of the above

5. In astronomy, what is an arc-second?
   A) It is a unit of time much smaller than a second
   B) It is a unit of time much larger than a second
   C) It is a unit of angle measure much smaller than a degree
   D) It is a unit of angle measure much larger than a degree
   E) None of the above

6. According to Newton's laws, what determines the amount of force required to keep a rocket moving at constant speed in a straight line in empty space (ignore any gravity)?
   A) It depends on the mass, but not the velocity
   B) It depends on the velocity, but not the mass
   C) It depends on the velocity and the mass, but not the shape
   D) It depends on the velocity, the mass, and the shape
   E) According to Newton, *no* force is required to move in a straight line at constant speed

7. Which of the following tells us that the Moon is a sphere, rather than a flat disk?
   A) The way the Moon is illuminated during its various phases
   B) The shape of the Earth's shadow on the Moon during lunar eclipses
   C) The apparent shape of the Sun during solar eclipses
   D) The presence of dark "maria" and light "highlands" on the Moon's surface
   E) The precession of the Earth's axis over long periods of time

8. Which of the following represents a difference between electromagnetic forces and gravitational forces?
   A) Gravity is typically much stronger than electromagnetic forces
   B) Gravity affects only objects with charge; electromagnetism affects everything
   C) Gravity is always attractive; electromagnetism can be either repulsive or attractive
   D) Gravity holds the solar system together, but electromagnetism doesn't hold anything together
   E) I have no idea; please mark this one wrong

9.What is the significance of the escape velocity?

A) It is the minimum speed needed to go into a circular orbit
B) It is the minimum speed needed to go into an elliptical orbit
C) It is the minimum speed needed to experience free fall
D) It is the minimum speed needed to leave an object and never come back
E) It is the minimum speed needed to keep the object from stopping

10. Suppose we have exactly one photon of the following colors. Which one has the lowest energy?

A) Orange B) Green C) Yellow D) Blue E) Violet

11. Suppose we took a box full of hydrogen molecules, and replaced them with the same number of oxygen molecules (Oxygen molecules are 16 times heavier than hydrogen molecules). Under what condition would the pressure in the box remain the same? Assume we have an ideal gas in both cases.

A) If the temperature were also increased by a factor of 16
B) If the temperature were also decreased by a factor of 16
C) If the temperature were also increased by a factor of 4
D) If the temperature were also decreased by a factor of 4
E) If the temperature was also the same

12. What is the physical meaning of the wavelength λ of a wave?

A) It is the distance between one wave and the next
B) It is the number of waves that occur in each meter
C) It is the speed at which the wave moves
D) It is how many waves occur per second
E) It is how long in time you have to wait for a wave to go by

13. The Moon is pulling gravitationally on the Earth; this is a cause of tides. Which of the following is *not* an effect of this tidal force on the Earth-Moon system?

A) A bulge of water occurs on the side of the Earth facing the Moon
B) A bulge of water occurs on the side of the Earth facing away from the Moon
C) The Moon is slowly moving away from the Earth
D) The Earth is gradually spinning faster
E) All of these *are* effects of the tidal force of the Moon on the Earth

14. According to Kepler's laws, which of the following describes the orbits of the planets?

A) They orbit on a circle with the Earth at the center
B) They orbit on an ellipse with the Earth at the center
C) They orbit on an ellipse with the Earth at one focus
D) They orbit on an ellipse with the Sun at the center
E) They orbit on an ellipse with the Sun at one focus

15. The temperature in this room right now is probably around

A) 0 K B) 29 K C) 290 K D) 2900 K E) 29,000 K

16. If you looked at the angular size of the Sun and the Moon during an eclipse, which one would be bigger
    A) The angular size of the Sun is always bigger
    B) The angular size of the Moon is always bigger
    C) The angular size of the two is always exactly the same
    D) The Moon is bigger during a total eclipse; the Sun is bigger during an annular eclipse
    E) The Sun is bigger during a total eclipse; the Moon is bigger during an annular eclipse

17. Suppose that a radio source emits waves with a frequency of 2.00×10^{7} /s. What is the wavelength of the corresponding radio waves?
    A) 0.0667 m B) 0.667 m C) 15.0 m D) 6.00×10^{15} m E) 1.67×10^{-16} m

18. On March 3, there will be a total lunar eclipse. When, approximately, will the moon be new?
    A) March 6 B) March 10 C) March 18 D) March 25 E) April 2

19. In the formula $P = knT$, which of the factors is a constant?
    A) P B) k C) n D) T E) none of them are constants

20. How does the plane of the orbit of the Moon around the Earth compare to the plane of the orbit of the Earth around the Sun?
    A) It is in the same plane, and it goes around the same direction
    B) It is tilted a little bit (about 5°), and goes around in the same direction
    C) The two planes are nearly perpendicular
    D) It is in the same plane, but it goes around the opposite direction
    E) The Moon's orbit is not even approximately a plane, since it is orbiting both the Earth and the Sun.

21. Miranda is a moon of Uranus. What would we need to know to figure out the gravitational pull of Uranus on Miranda?
    A) The mass of Uranus and Miranda, but not their separation
    B) The mass of Uranus and Miranda, and also their separation
    C) The mass of Uranus and their separation, but not the mass of Miranda
    D) The mass of Miranda and their separation, but not the mass of Uranus
    E) Their separation, but not the mass of either object

22. Which of the following would give you a rough idea of the temperature of a star?
    A) The mass of the star
    B) The brightness (how bright the star looks) of the star
    C) The luminosity (how bright the star really is) of the star
    D) The color of the star
    E) The distance to the star

23. According to Newton, when does a planet move fastest as it orbits the Sun?
    A) It always moves at the same speed
    B) When it is increasing its distance from the Sun
    C) When it is decreasing its distance from the Sun
    D) When it is far from the Sun
    E) When it is close to the Sun

24. What is the significance of the constellations in the zodiac?
    A) It is the constellations that the Sun passes through over the course of a year
    B) It is the constellations that the Moon passes through over the course of a year
    C) It is the constellations farthest from the path of the Sun
    D) It is the constellations farthest from the path of the Moon
    E) It's a really cool word to use when you play Scrabble™.

25. Which types of astronomical observations are commonly done from the surface of the Earth?
    A) Visible light, but not radio waves
    B) Visible and radio waves, but not ultraviolet or X-rays
    C) Visible, radio, and ultraviolet, but not X-rays
    D) Visible, radio, and X-rays, but not ultraviolet
    E) Visible, radio, ultraviolet, and X-rays

26. The atmosphere of the Earth distorts incoming light rays, blurring the image in a good telescope. This problem can be fixed by doing what?
    A) Building a telescope with a very large diameter
    B) Moving the eyepiece back and forth to compensate
    C) Injecting gasses into the telescope tube that compensate for the blurring
    D) Flexing the mirror, or moving segments of the mirror, controlled by a computer to compensate
    E) Placing the telescope at a very low altitude, where the atmosphere is more stable

27. Why do electrons stay in atoms, rather than wandering away?
    A) They are at rest, and so there is no force or reason for them to wander away
    B) The nucleus has positive charge, and the electrons have negative charge, so they are attracted to it
    C) Both the nucleus and the electrons have mass, and gravity holds them in place
    D) The nuclear force in the nucleus pulls on the electrons
    E) Cyanoacrylate, more commonly known as Superglue, holds them in place

28. Compared to the stars, which of the following objects travel sometimes west to east and sometimes east to west
    A) Mercury and Venus, but not Mars, Jupiter or Saturn or the Moon
    B) All planets, but not the Moon
    C) Mercury, Venus, and the Moon, but not Jupiter or Saturn
    D) All planets, plus the Moon, but not the Sun
    E) All planets, the Moon, and the Sun

29. Why are the Earth, Moon, and Sun all spheres?
    A) The rotation of the objects, balanced by gravity, causes the spherical shape
    B) The rotation of the objects, balanced by pressure, causes the spherical shape
    C) The gravity of the objects, balanced by pressure, causes the spherical shape
    D) The gravity of the objects, balanced by gravity of the rest of the universe, causes the spherical shape
    E) The pressure of the objects, balanced by the pressure of space, causes the spherical shape

30. Who is famous for making the best pre-telescopic observations of the heavens?
    A) Newton B) Kepler C) Copernicus D) Tycho Brahe E) Carlson

31. What change did Newton make to Kepler's third law, regarding the period of objects in orbit?
    A) He said that the period also depends on the combined mass of the two objects
    B) He said that the period also depends on the rotation
    C) He said that the period also depends on the separation
    D) He said that the period also depends on the number of moons
    E) He made no change; Newton's version and Kepler's version are identical

32. The type of electromagnetic waves with the shortest wavelength of all are called
    A) gamma rays
    B) X-rays
    C) violet visible light
    D) red visible light
    E) radio waves

33. The phrase *blue shift* refers to a shift in the spectrum from a source that is shifted towards the blue caused by
    A) Increasing the temperature of the source
    B) Decreasing the temperature of the source
    C) Filtering the light from the source through a blue filter
    D) Moving the source rapidly away from you
    E) Moving the source rapidly towards you

The following question is worth one extra credit point. Please give the best answer expressing your opinion. All answers will be counted as correct.

34. Because of the change in daylight savings time, we are probably going to shift all labs <u>next</u> semester one hour later. This means they would run 8:00-10:00 and 10:00-12:00. If you were signing up for astronomy, how would you feel about being forced to take astronomy lab one hour later?
    A) It's fine, or it's even preferable
    B) A minor inconvenience
    C) A major inconvenience
    D) I'd hate it, but I'd do it
    E) I'd drop astronomy instead