Name _____ **Practice Test 1** Astronomy 2071

(Last, First)

The real exam has 20 multiple choice questions (3 points each) and 8 short answer questions (5 points each). The real exam is a closed-book, closed-notes exam. You can use a pen/pencil, eraser and calculator for the exam. No wireless devices, phones or pre-programmed equations are allowed.

This practice test has 10 multiple choice questions and 4 short answer questions.

I agree to adhere to the W&M Honor Code in all aspects of this test

Your Signature: _____

Useful Formulas and Values

M_{sun} = 1.99 x 10^{30} kg

M_{earth}= 5.97 x 10^{24} kg

M_{moon} = 7.35 x 10^{22} kg

R_{sun} = 6.96 x 10^{8} m

R_{earth}= 6.38 x 10^{6} m

R_{moon} = 1.74 x 10^{6} m

$d_{earth \to moon}$ = 3.84 x 10^{5} km

G = 6.67 x 10^{-11} $\frac{m^3}{s^2 kg}$

g = 9.80 m/s^2

c = 3.00 x 10^{8} m/s

10^{9} nm = 10^{6} μm = 1 m

1 AU = 1.5 x 10^{11} m

1 ly = 9.46 x 10^{15} m

1 y = 3.16 x 10^{7} s

1000 m = 1 km

1 m = 100 cm

3600 arcsec = 1 degree

1 pc = 3.26 ly

1 pc = 3.09 x 10^{16}m

d = vt

$F = \frac{GMm}{d^2}$

$V = \sqrt{\frac{GM}{d}}$

$V = \sqrt{\frac{2GM}{R}}$

$g = \frac{GM}{R^2}$

$p^2 = a^3$

$M = \frac{4\pi^2 a^3}{Gp^2}$

$\frac{L}{2\pi d} = \frac{\alpha}{360^o}$

$V_{sphere} = \frac{4}{3}\pi r^3$

$A = \pi r^2 = \pi D^2/4$

$C = 2\pi r$

σ = 5.671 x 10^{-8} $\frac{W}{m^2 K^4}$

h = 6.62 x 10^{-34} J s

$L = \sigma T^4$

L = Power/Area

$E = \frac{hc}{\lambda}$

$T = \frac{2.9\ x\ 10^6 nm \cdot K}{\lambda_{max}}$

$v = c \cdot \frac{\Delta\lambda}{\lambda_o}$

R = 1.097 x 10^{7} m^{-1}

$\frac{1}{\lambda} = R(\frac{1}{4} - \frac{1}{n^2})$

$Area_{sphere} = 4\pi R^2$

$v = c = \lambda\nu$

$\theta = 2.5 \text{ x } 10^5 \frac{\lambda}{D}$

Light gathering power $\propto D^2$

Multiple Choice Section. Circle the letter of the correct answer

1. Evaluate the expression: $\sqrt{\frac{(1.23x10^2)^3}{(9.87x10^3)^2}}$
   (A) 1.25 x 10^{-2}
   (B) 1.38 x 10^{-1}
   (C) 2.71 x 10^{-1}
   (D) 1.91 x 10^{-2}

2. In modern astronomy, the constellations are
   (A) 12 regions of sky through which the Sun, Moon, and planets move as seen from Earth.
   (B) clusters of stars that are held together by the mutual gravitational attractions of the individual stars in the cluster.
   (C) 88 regions of sky, covering the entire sky.
   (D) only used for astrology.

3. Which of the following is true during the equinoxes?
   (A) The Sun is on the ecliptic.
   (B) The Sun is on the celestial equator.
   (C) The Sun rises due east and sets due west.
   (D) All of the above.

4. Who was the first astronomer to use a telescope to observe the night sky?
   (A) Copernicus
   (B) Newton
   (C) Tycho Brahe
   (D) Galileo

5. If you are lucky enough to get a chance to visit different planets of our Solar System, which of the following statements will be true?
   (A) Your weight will change, but your mass will remain the same.
   (B) Your mass will change, but your weight will remain the same.
   (C) Both your weight and mass will remain the same.
   (D) Both your weight and mass will change.

6. The speed an object needs to move away from the gravitational pull of the Earth is called
   (A) Orbital velocity.
   (B) Escape velocity.
   (C) Rotational velocity.
   (D) Random velocity.

7. Radio waves travel through space at what speed?
   (A) much faster than the speed of light
   (B) slower than the speed of light
   (C) at the speed of light, 3 x 10^8 m/s
   (D) faster than the speed of light, since their wavelength is longer

8. The total energy flux F of radiation emitted per unit area by a blackbody (e.g., star) is related to its temperature T and a constant σ by which equation?
   (A) $FT^4 = \sigma$
   (B) $F^4 = \sigma\ T$
   (C) $F = \sigma/T$
   (D) $\mathbf{F = \sigma T^4}$

9. The phenomenon of refraction, the change in direction of a light beam as it enters a dense but transparent material, is caused by the
   (A) slowdown of light in denser material.
   (B) speedup of light as it enters denser material.
   (C) change in the color or wavelength of light as it enters denser material.
   (D) reflection of part of the light at the surface.

10. By what factor is the amount of light gathered by the 10-m diameter Keck telescope on Mauna Kea, Hawaii, greater than that gathered by the 2.5-m diameter Mount Wilson telescope?
   (A) 4
   (B) 16
   (C) 256
   (D) 2

Short Answer Section Your answer must be legible for credit.

1. What is parallax and how is it used to measure distance?

   Parallax is the apparent shift in angle caused by a change in the observer's position. An angular shift relative to more distant stars of 1 arc second across the earth's radius (1 AU) gives a distance of 1 parsec (3.26 light years).

2. What are the relative positions of the Moon, Sun and Earth when the Moon is full? What are the relative positions of the Moon, Sun and Earth when there is a new Moon?

   For a full moon, the order is sun, earth and moon. For a new moon the order is sun, moon and earth.

3. What are epicycles and what were their purpose?

   Epicycles are small circles the planets moved on while they orbited the Earth in Ptolemaic (geocentric) models. Epicycles were used in geocentric models to account for retrograde motion of planets. Retrograde motion is when a planet seems to move backwards in its orbit as seen from the Earth.

4. Name three astronomical observations made by Galileo with his telescope.

   The sun has spots and rotates (is not perfect)

   Jupiter has four moons like a mini solar system

   The Milky way has an uncountable number of stars (geocentric is too simple)

   Phases of Venus found to disagree with the geocentric model

5. What is a CCD and what is the advantage of a CCD over other devices?

   A CCD (Charge Coupled Device) is an electronic device that detects light. CCDs used in astronomy can have up to billions of pixels for very large surveys of the night sky. The main advantage is their high quantum efficiency (95% or more) compared to the human eye or film (10% - 20%)