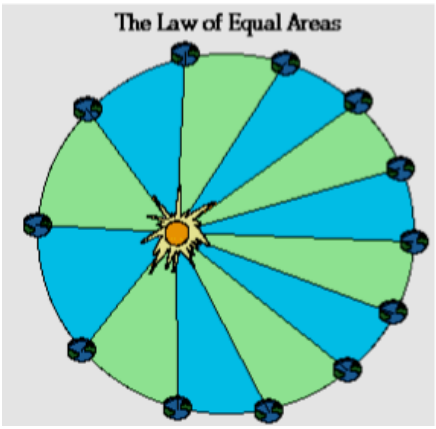
Kepler's Laws Practice Name:_____ Block:_____

1. Kepler's first law of planetary motion states that ____. Choose one.
   a. the Sun is at the center of the solar system
   b. planets orbit the Sun in elliptical orbits, with the Sun located at one focus
   c. planets orbit the Sun in circular orbits, with the Sun located at the center
   d. gravity provides the force that holds the planets in orbit about the Sun

2. Kepler's second law of planetary motion states that a line connecting a planet to the Sun ____. Choose one.
   a. is longest in winter and shortest in summer
   b. sweeps out more area during a winter month than during the summer month
   c. sweeps out the same amount of area in any two equal periods of time
   d. sweeps out the same amount of area regardless of the planet.



3. A planet would move ____.
   a. at the same speed at all times during its orbit about the Sun
   b. at faster speeds when positioned closer to the Sun during its orbit
   c. at slower speeds when positioned closer to the Sun during its orbit

4. Kepler's third law of planetary motion states that the ratio of ____.
   a. the orbital period to the orbital radius is the same for all planets
   b. the orbital periods of any two planets equals the ratio of the orbital radii
   c. all planets would orbit with the same orbital period
   d. the period squared to the radius cubed is the same ratio for all planets

5. A planet that is further from the Sun would take _____ time to orbit the Sun compared to planets that are closer to the Sun.
   a. more
   b. less
   c. the same amount of

6. Planetary data for the nine planets are shown below. Radius and period data are expressed relative to the Earth's radius and period.

Planet	Period (years)	Average Orbital Radius (Astronomical Units)
Mercury	0.241	0.39
Venus	0.615	0.72
Earth	1.00	1.00
Mars	1.88	1.52
Ceres (dwarf)	4.60	2.77
Jupiter	11.8	5.20
Saturn	29.5	9.54
Uranus	84.0	19.18
Neptune	165	30.06
Pluto (dwarf)	248	39.44
Eris (dwarf)	558	67.78

Taking two planets at a time, compare the ratio of the square of the period to the ratio of the cube of their radius.

$(T_{Mars} / T_{Earth})^2 =$	_____	$(R_{Mars} / R_{Earth})^3 =$	_____
$(T_{Jupiter} / T_{Earth})^2 =$	_____	$(R_{Jupiter} / R_{Earth})^3 =$	_____
$(T_{Neptune} / T_{Uranus})^2 =$	_____	$(R_{Neptune} / R_{Uranus})^3 =$	_____
$(T_{Pluto} / T_{Uranus})^2 =$	_____	$(R_{Pluto} / R_{Uranus})^3 =$	_____
$(T$_____ / T_____$)^2 =$	_____	$(R$_____ / R_____$)^3 =$	_____

Mass of the Sun = 1.99 x 10^{30} kg Radius of Earth = 6.4 x 10^{6} m Mass of the Earth = 6.0 x 10^{24} kg

7. Mercury is observed to have an orbital period of 88 days. Use the mass of the Sun to calculate how far Mercury is from the Sun. (Hint: 1 day = 86,400 seconds) PSYW

8. The moon Phobos orbits Mars in just 8 hours at an average distance of 9380 km. Calculate the mass of the planet Mars. (Hint: 1 hour = 3,600 seconds, make sure you use correct units!) PSYW

9. The Sun (and our solar system) is about 1.0 x 10^{21} meters from the center of the Milky Way galaxy and it takes approximately 225,000,000 years to orbit the galaxy once. PSYW

   (a) How much mass is there in the Milky Way galaxy?

   (b) If all of the mass was composed of stars exactly like our Sun, how many "Suns" would that be?

10. The International Space Station only orbits at an altitude of 400,000 meters above the Earth's surface. PSYW
    (a) How far from the Earth's center is the space station?

    (b) How long should it take the space station to complete one orbit around the Earth?