Copying Is Not Allowed Per _____ Name_____
HW 2.1 Newton's Law of Universal Gravitation

USEFUL INFORMATION:

Moon-Earth distance = 3.84×10^{8} m
Earth radius = 6.38×10^{6} m
Earth mass = 5.98×10^{24} kg
Sun-Earth distance = 1.5×10^{11} m
Sun mass = 2.0×10^{30} kg
Moon mass = 7.4×10^{22} kg
Moon radius = 1.74×10^{6} m
G = 6.67×10^{-11} Nm^2 / kg^2

1. Calculate the force of gravity on a spacecraft 12,800,000 m above the Earth's surface if its mass is 1400 kg.

2. A hypothetical planet has a radius *2.5* times that of Earth, but has the same mass. What is the acceleration due to gravity near its surface?

3. At the surface of a certain planet, the gravitational acceleration g has a magnitude of 12.0 m/s^2. A 2.10-kg brass ball is transported to this planet. What is (a) the mass of the brass ball on the Earth *(b)* on the planet; *(c)* the weight of the brass ball on the Earth *(d)* on the planet?

4. What is the radius of the planet in question 3 if it has a mass of 4.59 E 27 kg?

5. What is the force of attraction (gravity) between a typical Bowie High School girl (mass = 50 kg) and a typical Bowie High School boy (mass = 90 kg) if they are sitting on a bench 0.10 m apart?

6. Calculate the value of g, the acceleration of gravity, at (a) 3200 **m**, and *(b)* 3200 **km**, above the Earth's surface.

7. If the gravitational force between the electron (9.11 E -31 kg) and the proton (1.67 E -27 kg) in a hydrogen atom is 1.0 E -47 N, how far apart are the two particles?

8. Given that the acceleration of gravity at the surface of Mars is 3.73 m/s^2 and that Mars' radius is 3,400,000 m, determine the mass of Mars.

9. Find the distance between a 0.300 kg billiard ball and a 0.400 kg billiard ball if the magnitude of the gravitational force is 8.92 E -11 N.

10. Saturn's moon Mimas has a mass of 3.8 E 19 kg and a **diameter** of 394,000 m. Calculate the acceleration of gravity on Mimas.

11. Two masses $\mathbf{m_1}$ and $\mathbf{m_2}$ are separated by a distance **r**. The force of gravitational attraction between the two masses is **F**.

    A. If $\mathbf{m_1}$ is doubled how does **F** change?

    B. If neither of the masses is changed, but **r** is doubled, how does **F** change?

    C. If **r** is not changed, but both masses are doubled, how does **F** change?

    D. If **r** is halved and both masses are doubled, how does **F** change?