PHYSICS 12 GRAVITATION WORKSHEET 1

1. A 65 kg boy stands 1.5 m away from a 50 kg girl.
   a) Calculate the force of attraction (gravitational, not the naughty kind) between them.
   b) Determine the gravitational field strength of the girl at the boy's position.

2. Compute the value of **g** at a point in space that is 7.0×10^6 m from the center of the Earth.

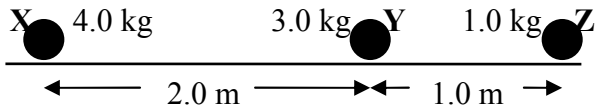
3. How much would a 60.0 kg person weigh on Mercury, given a planetary radius of 2.43×10^6 m and a mass of 3.20×10^{23} kg?

4. Calculate the distance between two electrons that have a gravitational force of attraction of 2.78×10^{-70} N.

5. Two spherical balls are placed so that their centers are 2.6 m apart. The gravitational force of attraction between the two balls is 2.75×10^{-12} N. What is the mass of each ball if one is twice the mass of the other?

6. The radius of the Earth is 6.4×10^6 m while that of Mars is 3.4×10^6 m. If the mass of Mars is 0.107x the mass of theEarth, what would Normie Neutron, weighing 590 N on Earth, weigh on Mars?

7. Three balls are placed as shown. What are the magnitude and direction of the net gravitational force exerted on mass **Y** by mass **X** and mass **Z**?



8. If the gravitational force between a planet of mass **M** and a satellite of mass **m** at distance **d** is **F**, what is the force (relative to **F**) exerted by another planet of mass **4M** on a satellite of mass **0.5m**, at a distance **2d**?

9. a) Determine the force of attraction between a 130. kg satellite in orbit 265 km above the surface of Mercury, which has a planetary mass of 3.2×10^{23} kg and a radius of 2.43×10^6 m.
   b) What is the speed of this satellite in its stable orbit?

10. Find the average speed of the following planets as they orbit the Sun:
    a) Mercury (orbital radius: 5.80×10^{10} m)
    b) Saturn (mass: 5.68×10^{26} kg; orbital radius: 1.43×10^{12} m)

11. a) Calculate the velocity that a cannonball must be shot at, horizontally from the top of Mt. Everest (altitude: 8850 m) in order to orbit the Earth, ignoring air resistance.
    b) How long would it take for the ball to return to the cannon, in seconds and minutes?

12. A 4.0×10^3 kg satellite orbits the planet in a circular orbit of radius 2.0×10^4 km every 1.0×10^3 s. What is the mass of the planet?

13. A 10 000 kg spaceship is drifting along on a long mission towards the outer edge of the solar system. It has put out a small experimental satellite of mass 25 kg which revolves around the ship at a distance of 120 m under their mutual gravitational attraction. Calculate:
a) the period of revolution of the satellite as it orbits the ship.
b) the speed of the satellite in this orbit.

14. What would be the period of a spaceship orbiting the Earth at an altitude equal to the radius of the Earth?

15. A satellite circles a newly discovered planet in our solar system once every 98 minutes at a mean orbital radius of 6.88×10^6 m. From this motion, calculate:
a) the mass of the planet.
b) the centripetal acceleration acting on the satellite.

16. Astronomical observations indicate that the sun is tracing a circular orbit around the center of our galaxy. The radius of orbit is 2.7×10^{20} m with period **T** = 200 million years.
a) Calculate the total mass of the central stars.
b) Assume all of these stars have the same mass as our sun. How many does this represent?

17. a) Determine the value of **g** on the Moon's surface.
b) What is the centripetal acceleration of any point on the moon's equator <u>due to its rotation</u>?

18. If a small planet were discovered whose distance from the sun was 8 times that of earth, how many times longer would it take to circle the Sun?

1. a) 9.6×10^{-8} N b) 1.5×10^{-9} N/kg 2. 8.1 N/kg 3. 217 N 4. 0.446 m 5. 0.37 kg & 0.75 kg 6. 2.2×10^2 N 7. 0 8. 0.5F 9. a) 3.8×10^2 N b) 2.8×10^3 m/s 10. a) 4.8×10^4 m/s b) 9.6×10^3 m/s 11. a) 7.90×10^3 m/s b) 5.08×10^3 s or 84.7 minutes 12. 4.7×10^{27} kg 13. a) 1.01×10^7 s b) 7.46×10^{-5} m/s 14. 1.43×10^4 s, or 4 hrs 15. a) 5.57×10^{24} kg b) 7.86 m/s^2 16. a) 2.9×10^{41} kg b) 1.5×10^{11} stars 17. a) 1.6 N/kg b) 1.2×10^{-5} m/s^2 18. 22.6 times