Physics 20

# Chapter 8 Review Worksheet

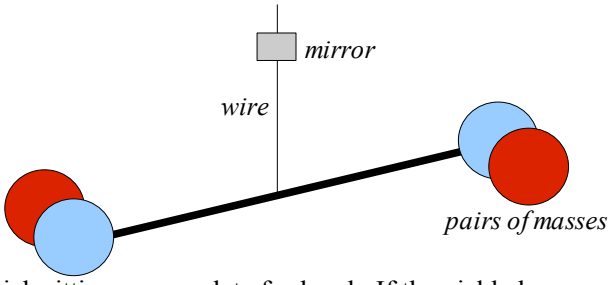
1. Brahe and Kepler formed a great team, although they only spent about one year together at the end of Brahe's life. **Explain** how they formed a great partnership.

   *Brahe had a lifetime's worth of data that he couldn't interpret, and Kepler had a flair for theories but had no hard data to work from. They complimented each others' weaknesses.*

2. **Describe** Kepler's Three Laws of Planetary Motion.

   *1st Law: The shape of orbits are ellipses.*
   *2nd Law: Equal areas in equal times*
   *3rd Law: The period squared divided by the radius of orbit cubed equals a constant for any single object being orbited.*

3. **Sketch** the torsion balance that Cavendish used to measure the value of "G".




4. I have a pickle and sandwich sitting on my plate for lunch. If the pickle has a mass of 200g, the sandwich is 525g, and they are 5cm apart, **determine** how much gravitational attraction is between them.

$$F_g = \frac{G m_1 m_2}{r^2}$$

$$F_g = \frac{6.67\text{e-}11 \, x \, 0.200 \, x \, 0.525}{0.05^2}$$

$$F_g = 3\text{e-}9 \; N$$

5. I am on the International Space Station in orbit 420km above the surface of the earth. A grade five student asks me what I think of being some place that has no gravity. I explain that although there is less gravity, there is almost 9.81m/s$^2$. **Determine** the acceleration due to gravity where I am.

$$g = \frac{Gm}{r^2}$$

$$g = \frac{6.67\text{e-}11 \, x \, 5.98\text{e}24}{(420000 + 6.37\text{e}6)^2}$$

$$g = 8.65 \; m/s^2$$

6. Now the same grade five student asks me how fast I am going in the space station while I orbit. **Determine** my orbital velocity. *Note: If the formula you use is not on the data sheet, you must show how you derived it.*

$$F_c = F_g$$

$$\frac{mv^2}{r} = \frac{G m_1 m_2}{r^2}$$

$$v = \sqrt{\frac{Gm}{r}}$$

$$v = \sqrt{\frac{Gm}{r}}$$

$$v = \sqrt{\frac{6.67\text{e-}11 \, x \, 5.98\text{e}24}{(420000 + 6.37\text{e}6)}}$$

$$v = 7.66\text{e}3 \; m/s$$

7. **Explain** how an object traveling with sufficient horizontal velocity can remain in orbit around a large body like the Earth.

   *By moving with enough horizontal velocity, the curvature of the parabola of the projectile motion matches the curvature of the planet. The object falls constantly, but can never hit the surface as it constantly curves away.*