VII. Discussion Questions

1. If you know the volume of water in mL, how is its mass in kg determined?

$$1\,mL = 1\,cm^3 = 1\,gm\ x\ \frac{1\,kg}{1{,}000\,gm} = 0.001\,kg$$

2. What is the equation for the frequency *f* of a simple pendulum?

$$f = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$$

3. What is the equation to determine percent difference between experimental and calculated values?

   To calculate the percent difference, use the following equation, as shown above:

$$\%\ \text{difference} = \frac{experimental\ value - calculated\ \ value}{calculated\ \ value} x100$$

4. What could explain the differences between the experimental and calculated frequency values?

   There are several possibilities: human error in timing, inconsistent motion due to the movement of the person swinging it, wind, and possibly other factors.

5. Why are the percent differences for frequency *f* and angular speed ω the same for a given trial?

$$f = \frac{1}{2\pi}\sqrt{\frac{g}{L}} \text{ and } \omega = 2\pi f = \sqrt{\frac{g}{L}} \quad \rightarrow \quad \frac{\omega}{f} = 2\pi \text{, which is a constant}$$

   The percent differences calculated for *f* must then be the same as those calculated for ω and vice versa.

6. What could explain the differences between the experimental and calculated angular speed values?

   There are several possibilities: human error in timing, inconsistent motion due to the movement of the person swinging it, wind, and possibly other factors.

7. Does the mass of the pendulum used in this lab have any affect on the period T ? Explain why or why not.

   No. $T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{\frac{g}{L}}} = 2\pi\sqrt{\frac{L}{g}}$. Mass does not appear in this equation.

8. What characteristics of a physical pendulum affect its period, speed, and frequency?

   The characteristics of a physical pendulum that affect its period, speed, and frequency are its moment of inertia, mass, and length. For a physical pendulum $\omega = 2\pi f = \sqrt{\frac{mgL}{I}}$

9. What characteristics of a simple pendulum affect its period, speed, and frequency?

   The only characteristic of a simple pendulum that affects its period, speed and frequency is the pendulum length. Gravity also affects them, however, it is not a characteristic of the pendulum itself.

10. Does the pendulum used in this lab behave like a simple pendulum or a physical pendulum? Explain how you know.

    Simple pendulum. Neither the moment of inertia or mass have an effect on the period T or angular velocity ω as would be the case for a physical pendulum.

11. In the past, why were pendulums used in clocks? You may need to do some research to find the answer.

    Check out these sites:

    http://www.howstuffworks.com/clock.htm

    http://en.wikipedia.org/wiki/Pendulum_clock

    http://galileo.rice.edu/sci/instruments/pendulum.html