Name: _____   Period: _____   Date: _____

Simple Harmonic Motion Worksheet

Equations Needed:

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Period of a Pendulum = $2 \cdot Pi \cdot \sqrt{\dfrac{Length\ of\ Pendulum}{Acceleration\ due\ to\ gravity}}$

$$T = 2\pi\sqrt{\frac{m}{k}}$$

Period of a Mass-Spring = $2 \cdot Pi \cdot \sqrt{\dfrac{Mass}{Spring\ Constant}}$

$$f = \frac{1}{T}$$

Frequency = $\dfrac{1}{Period}$

$$T = \frac{1}{f}$$

Period = $\dfrac{1}{Frequency}$

1. M.I.T. Physics Professor Walter Lewin performs a demonstration while riding a pendulum bob. He finds that 10 complete oscillations on the pendulum ($10T$) takes 45.6 seconds.
   a. How long is the cable that Professor Lewin is riding?
   b. What is the frequency of the pendulum's motion?

Knowns   **Unknowns**   **Formula**

2. A powerful experimental sewing machine is powered by a mass-spring system. This sewing machine is capable of stitching 1,500 stiches in one minute.
   a. How many stitches can this machine stitch is one second?
      i. This is a measure of the sewing machine's period or frequency?
   b. If the sewing machine has a spring constant of 0.5 N/m, how large is the mass that powers the oscillation motion of the machine? (Don't forget to find T first)

Knowns   **Unknowns**   **Formula**

3. An astronaut travels to a far-away moon with a 1.5 m long pendulum. She finds it takes her pendulum 6.0837 seconds to complete one full oscillation.
   a. What is the acceleration due to gravity on this moon?
      i. What is the frequency of this pendulum?
      ii. If this pendulum were brought back to Earth, how would its frequency on Earth compare to its frequency while on the moon?

Knowns   **Unknowns**   **Formula**

4. Which of the following mass and spring combinations has the longest period?

Mass (m)	Spring Constant (k)	Period
200 grams	15 N/m	
350 grams	35.5 N/m	
3175 grams	125 N/m	

Knowns   **Unknowns**   **Formula**

5. You are designing a grandfather clock to have a period of 2 seconds. How long should the pendulum be?
   a. How heavy should the pendulum bob be?

Knowns   **Unknowns**   **Formula**

6. During an extremely foggy day during the medieval era, an architect wants to determine the height of a building. He cannot see to the top of his building, but he stands on the roof and lowers a pendulum to the ground.
   a. If the pendulum swings with a period of 12 seconds, what is the height of the building?

Knowns	**Unknowns**	**Formula**

7. When a mass of 25 grams is attached to a certain spring, it makes 20 complete vibrations in 4 seconds. What is the spring constant of the spring?

Knowns	**Unknowns**	**Formula**