Simple Harmonic Motion Virtual Modeling Lab

This is not a pure modeling exercise, since you know the equations for both the period of an oscillating spring and for the period of a pendulum. This exercise will see how well data fits the mathematical model from the equation.

Part 1: Start with the Masses and Springs simulation. Click on the "lab" tab but you can minimize the energy graph. You can move the damping slider to "none" so it will keep oscillating for as long as you want.

1. From the notes, which factor(s) affect the period of the oscillating spring system?

2. In a classroom environment, we don't have a huge selection of springs. So to simulate what we would do in class, keep the spring constant and change the mass (IV), then measure the period (DV).

3. Data: Use the stopwatch to Collect Data in the table below:

Mass (kg)	Time (s)	# Oscillations	Period (s)

4. Graph: Create a graph of period vs mass on Graphical Analysis and insert below.

5. Linearize the Graph: Change one of your axes to get a straight line. Insert screenshot below.

6. Equation: Using your variables, your slope, and your y-intercept write the equation of the line.

7. The period of an oscillating mass on a spring is $T = 2\pi\sqrt{\frac{m}{k}}$. Knowing this, use your data to calculate the spring constant. How could you check your results? Show your work and any additional data below.

Part 2: Start with the Pendulum Lab simulation. Click on the "lab" tab but you can minimize the energy graph. You can move the damping slider to "none" so it will keep oscillating for as long as you want.

8. From the notes, which factor(s) affect the period of the pendulum?

9. In a classroom environment, we can't change the acceleration due to gravity. So to simulate what we would do in class, keep g constant and change the length (IV), then measure the period (DV).

10. Data: Use the stopwatch to Collect Data in the table below:

Length (m)	Time (s)	# Oscillations	Period (s)

11. Graph: Create a graph of period vs length on Graphical Analysis and insert below.

12. Linearize the Graph: Change one of your axes to get a straight line. Insert screenshot below.

13. Equation: Using your variables, your slope, and your y-intercept write the equation of the line.

14. The period of a pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$. Knowing this, use your data to calculate the acceleration due to gravity. Is it what it should be?

Summary:

1. Does the mathematical model of the data create equations that match the theoretical equations from the notes?

2. For the oscillating springs data, what shape graph would you expect if you could change the spring constant? Either describe it or sketch it. You do not need to collect data, just predict from the equation. How could you linearize the graph?

3. For the pendulum data, what shape graph would you expect if you could change the gravitational acceleration? Either describe or sketch. You do not need to collect data, just predict from the equation. How could you linearize the graph?