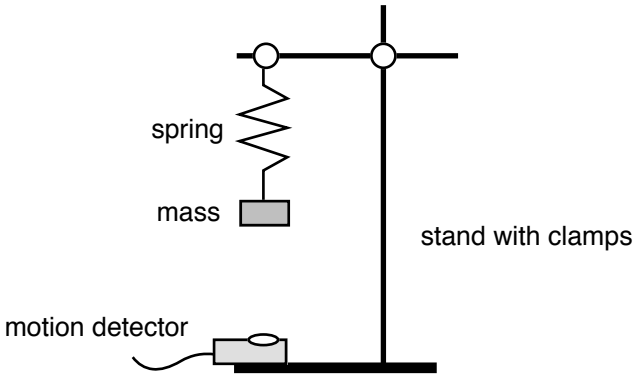
Lab 15-3: **SHM Energy Conservation**

Names:

Purpose:
1. To analyze the energy transformations of a mass oscillating on a spring
2. To predict a variety of graphs concerning the motions and energies of an oscillating mass, and then confirm (or refute) those predictions

Diagram:



Procedure:
Now that you have thought about the graphs, it's time to see if you were correct!

1. Use a little tape to secure the mass to the hanger. Open up the file "17c Energy in SHM.cmbl."
2. Make sure that the mass on the spring is at rest, and place the motion detector directly under the mass. Make sure the motion detector is set to "cart" mode. Hit the "zero" button on the graph – this will cause Logger Pro to call the equilibrium position of the mass x=0.
3. Pull the mass down a little bit and let it go, if it is oscillating nicely, click on record and let Logger Pro make position and velocity graphs. If the graphs look smooth, then you do not need to take any more data.
4. Set all four axes to "Autoscale" by double clicking on each graph, then choosing "Axes Options."
5. Go through the questions, copying and pasting the required graphs and answering the questions as you go.

Graphs & Conclusions:
Position, Velocity and Acceleration verses time of the oscillating mass. Include the bestfit curves.

Copy and Paste Graphs Here

1. What were the best fit equations for the position, velocity and acceleration vs time graphs?

2. Those equations were all fit to "A sin(Bt + C) + D" D should have been very close to zero for all of them. One of the other letters should have been the same for all three functions – which was it and why?

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3. What was the period of the oscillations?

4. Given the equation for the position vs time, you should be able to predict the amplitudes of the velocity and acceleration vs time. Do that, and compare your answers to the actual best fit equations.

5. All three equations were fit to a sine graph. There were three different "C" constants. Look at the difference between the values of C between the position and velocity and between the position and the acceleration. Do those differences make sense?

6. From your period and mass, determine the spring constant.

Mass on Spring: _____ Spring Constant: _____

Enter the mass and spring constant into Logger Pro.

Velocity and Acceleration verses Position. Include the slope of the straight line.

Copy and Paste Graphs Here

7. Velocity vs Position was not a function – explain why that makes sense.

8. What was the best fit equation for the Acceleration vs Position graph?

9. You should have been able to predict that equation based on the best fit equations from original graphs. Do that and compare your answer with the best fit line.

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Kinetic Energy verses time & Kinetic Energy verses position

Copy and Paste Graphs Here

10. Where was the object when it had the most kinetic energy? How about the least kinetic energy?

Potential Energy verses time & Potential Energy verses position

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11. How do these graphs compare to the Kinetic Energy graphs?

Three graphs at once: Kinetic, Potential and Total Energy of Mass verses time

Copy and Paste Graphs Here

12. How well was energy conserved based on your graphs?

Three graphs at once: Kinetic, Potential and Total Energy of Mass verses position

Copy and Paste Graphs Here

13. Based on these graphs, how well was energy conserved?

14. What forms of energy were not taken into account in your graphs of Total Energy. How important were they to your results?

15. How close were your predictions from the prelab?