Work Sheet

Student Name: ______________________________

Team members:
1.- ____________________ 2.- ____________________

3.- ____________________ 4.- ____________________

Instructor: ______________________________

Introduction

Analysis

Mass-Spring Oscillator:

1. Show that $x = x_0 cos(\omega t)$ is a solution of equation (12.5). Do this by substituting equation (12.6) into both sides of equation (12.5) and solving the necessary derivatives. Then solve for ω and see if your answer matches equation (12.7).

2. Calculate the natural frequency f, in Hz, from the average period of the system.

3. Calculate the spring constant k in base SI units. To do this, create a plot of force vs. length and find the slope of the best fit line.

4. Calculate the theoretical frequency using equations (12.3) and (12.7).

5. Calculate the relative percentage error of the frequency and discuss any differences.

Resonance:

1. Compare (by relative percentage error) the measured natural frequency f from the previous section to your measured resonant frequency f_r. Use f as your theoretical value. Why are they different? Explain.

The Pendulum:

1. From equations (12.10) and (12.3), calculate the theoretical value of the period T.

2. Compare this theoretical T to your measured periods using percent error.

3. The slight change of the period with amplitude is caused by the restoring force becoming non-linear due to the $sin(\theta)$ term in equation (12.8). Is this apparent in your data? Explain.

4. Calculate the percent error in the period of the pendulum for your largest amplitude swing versus your smallest amplitude swing. Use the small amplitude period as the theoretical value.

Conical Pendulum:

1. Determine the angle θ of your pendulum. Hint: Figure (12.1) may be helpful. You will need to use trig!

2. Calculate the theoretical value of the period T, using equation (12.11).

3. Using percent error, compare your measured period to the theoretical value and explain any differences.

Conclusion