Raw Data Sheet

Student Name: _____

Team members:
1.- _____ 2.- _____

3.- _____ 4.- _____

Instructor: _____

a) Mass-Spring Oscillator

Table 1: Data to obtain the spring constant.

mass (g)					
length (cm)					

Hanging Mass, M 150 (g)

Table 2: Data to obtain the Natural Frequency of the system

Trial	Number of Oscillations	Time (s)	Period (s)
1			
2			
3			
4			
5			
Average Period			

b) Resonance

Resonance Frequency, f_r _____ (Hz)

Document how the mass moves in relation to the plunger when it is driven above and below the resonant frequency.

c) Pendulum

length, l _____ (cm)

Table 3: Data to show deviations from simple harmonic oscillator behavior.

Amplitude (cm)					
Period (s)					

d) Conical Pendulum

Number of Orbits, N _____

Time, t _____ (s)

Period, T _____ (s)

radius, r _____ (cm)

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