Physics 221 - Simple Harmonic Motion

Procedure:
Your task today is to experimentally answer the questions posed for three simple harmonic oscillators: mass on a spring, simple pendulum and pasta with raisins.

- Your write up must include an answer to each question theoretically (according to the equations), and why you think this.
- Your write up must also include a clear description of how you experimentally answered these questions written so that a fellow classmate who has not done the lab, could reproduce your results exactly!
- Include data.
- Your results must be convincing, which means one example will not adequately support your answer.

I. Mass Attached to a Spring
The motion of a mass attached to a spring is simple harmonic motion if:

1. there is no friction and
2. if the displacement of the mass from its equilibrium position at \( x = 0 \) is “small”. The displacement must be small enough so that the spring is not stretched beyond its elastic limit and becomes distorted.

The period of a spring/mass system undergoing simple harmonic motion is described by:

\[
T = 2\pi \sqrt{\frac{m}{k}} \text{, notice } T \text{ and } m \text{ are not linearly related.}
\]

Period and frequency have the relationship, \( T = 1/f \)

Materials and equipment available: big spring, weight hanger, masses, stop watch, motion detector, and Logger Pro interface and software.

A. Does the period of the motion depend on the amplitude?
B. Does the period of the motion depend on the mass?
II. Simple Pendulum

The motion of a pendulum can be treated as simple harmonic if:
1. there is no friction and
2. if the displacement of the mass \( m \) from the equilibrium position is small, \( \theta \leq 15^\circ \)

The period of a pendulum undergoing simple harmonic motion is described by:

\[
T = 2\pi \sqrt{\frac{L}{g}}, \text{ notice } T \text{ and } L \text{ are not linearly related.}
\]

Period and frequency have the relationship, \( T = 1/f \)

Procedure

Materials and equipment available: masses, string, stopwatch or other type of timer.

A. Does the period of the motion depend on the mass?
B. Does the period of motion depend on the Length?

III. Pasta and Raisins/Marshmallows

Place a raisin or marshmallow on the end of a stick of spaghetti. Shake your hand back and forth to make the pasta/raisin system oscillate.

A. Does the period depend on the mass?
B. Does the period depend on the length?

Additional Questions:

a) Do you think this system's motion would fall under the classification of simple harmonic motion? Provide as much evidence as you can for your answer.

b) Do your answers to A and B above match a spring/mass system or a pendulum? How so?

c) Do you think this system can be modeled as a pendulum, spring, or neither? What are your reasons for each?