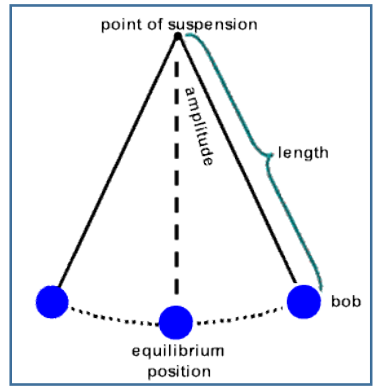
Name ____________________ date______ period___ mailbox_______

Kinetic and Potential Energy Lab – Pendulum Study

Background Information: If you've ever ridden on a swing at a playground then you are familiar with a pendulum. A swing is similar to a pendulum, except that a weight (called a pendulum bob) is placed at the end of one string that hangs from a fixed position, rather than *you* seated at the end of a pair of chains affixed to a seat or old tire. The physics of the movement of a pendulum is so precise that pendulums are often used in clocks and metronomes (instruments used to keep time for musicians). A pendulum swings back and forth at a steady pace under the influence of gravity. The amount of time it takes a pendulum to complete one swing, (out and back), is called the period of the pendulum. The mechanics and timing of clocks before the digital age was of course critical to people around the world and pendulums played their part. Thus, the physics of pendulums on earth have been studied intimately for ages. Pendulums represent the epitome of energy transformations between potential and kinetic energy as they swing back and forth. Once the initial gravitational potential energy of a pendulum is set in motion, there is a constant exchange between potential and kinetic for as long as the pendulum's bob continues to swing. There can be many variables that impact the timing of a pendulum's swing back and forth. In this study, we will consider two.



Directions: To help our experimental data we will have multiple pendulums swinging at several lab stations around the room. Be sure to observe the pendulums and record your data precisely and accurately using proper scientific techniques.

Experiment: For experimental purposes we will consider two different variables that may influence period of the pendulum.

- Team 1 will investigate the **mass** of a pendulum bobs' effect on the pendulum's period time.
- Team 2 will consider the pendulum's **string length** on the length of the period time.

Procedure for Team 1 & Team 2:

1. Pull the pendulum out so that the string makes a 45° angle with the metal stand. Start the pendulum's swing from this point every time.
2. Release the pendulum and count the number of swings (to and fro) for 30 seconds. Repeat three times.
3. Record the number of swings in the data table below. Calculate the average number of swings for each.

Team-1 *How does the **mass** of the pendulum affect the number of swings in 30 seconds?*
Hypothesis 1: If the mass increases, **then** the number of swings will
(circle one) increase/decrease/ remain the same **because** ……

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____(3pt)

Team-2

*How does the **string length** of the pendulum effect the number of swings in 30 seconds?*
Hypothesis 2: compose an **if…then… because…** statement.

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____(3pt)

Answer the following after questions after completing the graphs:

*Relationship between **Mass** and Period duration in Pendulums*

1. The name of the weight that is tied to the bottom of the string is called a ____________________ (1pt)

2. Conclusion - How does the change in mass have an effect on the number of swings? **Explain the relationship. Complete sent.**

____

____

____(3pt)

3. What is a possible sources of error when performing this part of the lab? (What were some factors/actions that may have caused the data to be inaccurate?)

____

____(3pt)

4. Does the data support your hypothesis?

____

____(1pt)

Name ____________________ date______ period___ mailbox_______

Answer the following after questions after completing the graphs:

*Relationship between **Length of String** and Period duration in Pendulums*

1. The length of time it takes for a pendulum to swing out and back is called the _____________________ (1pt)

2. Conclusion - How does the length of the pendulum have an effect on the number of swings in 30 seconds? **Explain the relationship. Complete sent.**

____

____

____(3pt)

3. What is a possible sources of error when performing this part of the lab? (What were some factors/actions that may have caused the data to be inaccurate?)

____

____(3pt)

4. Does the data support your hypothesis?

____

____(1pt)

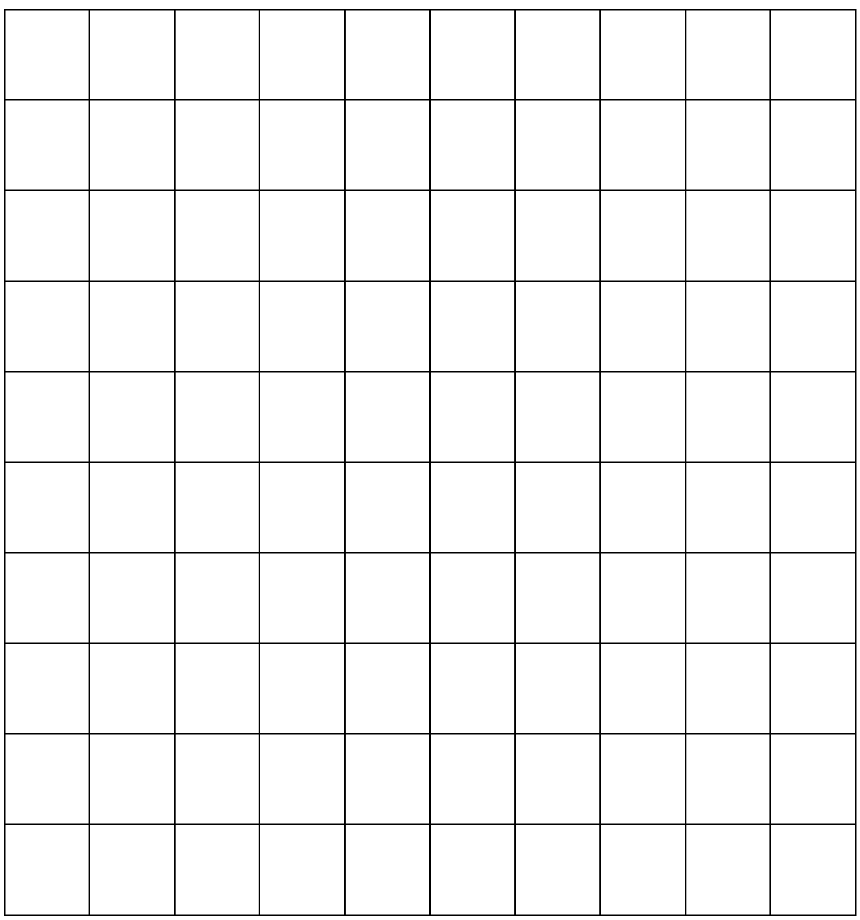
<u>Data Table Team 1</u>	Trial 1	Trial 2	Trial 3	Trial 4	Avg. # of swings
Mass 1 (lightest) ____ grams					
Mass 2 (light) ____ grams					
Mass 3 (medium) ____ grams					
Mass 4 (heavy) ____ grams					

Graphing Directions: Label both the x & y axes. Determine the DV and IV. Label appropriate numbers along both axes utilizing the majority of the graphing space. Then plot the data from the appropriate table above.

What is the IV_______________? What is the DV_______________?

*<u>Relationship between **Mass** and Period duration in Pendulums</u>*

____
Y axis



_______________ X axis (10pt)

Data Table Team 2	Trial 1	Trial 2	Trial 3	Trial 4	Avg. # of swings
Length 1 (shortest) ____ (cm)					
Length 2 (medium) ____ (cm)					
Length 3 (longer) ____ (cm)					
Length 4 (longest) ____ (cm)					

Graphing Directions: Label both the x & y axes. Determine the DV and IV. Label appropriate numbers along both axes utilizing the majority of the graphing space. Then plot the data from the appropriate table above.

What is the IV________________? What is the DV________________?

*Relationship between **Length of String** and Period duration in Pendulums*

____
Y axis

_______________ X axis (10pt)

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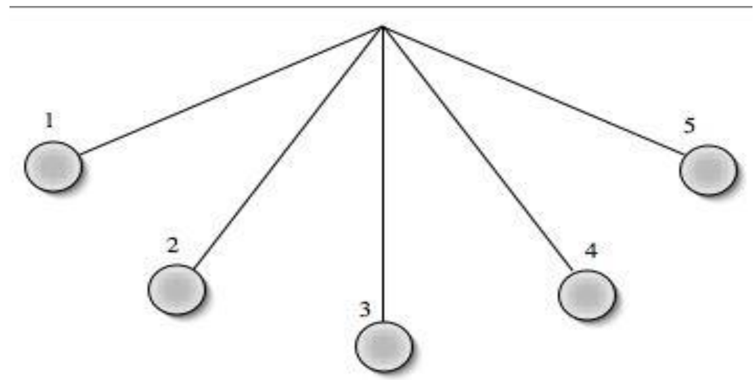
Physics of Pendulums Questions



1. At the start of each trial, the pendulum bob was raised up at an angle from its resting position. What specific *form* of energy did the pendulum bob have at this point (motionless still in your hand)?

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2. When the pendulum bob was released from its starting position and it started to swing downward, which main type of energy did it have, kinetic or potential energy? Explain.
Use the diagram of the pendulum to answer the questions below.

____

____

3. Write the number(s) from the diagram where the pendulum bob has potential energy:

_________ & _________

4. Write the numbers from diagram where the pendulum bob has kinetic energy:

____

5. Where does the bob have the ***most*** kinetic energy?

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6. Where does the bob have the least potential energy?

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7. Recall the Law of Conservation of Energy (or) reference your notes. How does the energy in a swinging pendulum represent the LoCoE? **Explain with details and proper vocabulary.**

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____(10pt)