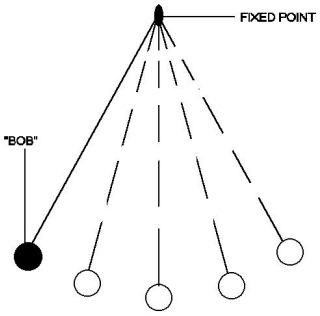
Name _____ Date _____ Period _____

Lab: What affects the Period of a Pendulum

C O N C E P T U A L P H Y S I C S : U N I T 2

Purpose: This lab will help you discover which of the following three variables (**Length**, **Angle** of Drop, **Mass** of Pendulum) will affect the period of a pendulum.



What is Period?: The time it takes (in seconds) for a pendulum to make **one complete back-and-forth swing**. The units for period are: **# of seconds / 1 complete back-and-forth swing.** Period is represented by the letter ***T*.**

How to time the period of the pendulum: READ THIS CAREFULLY!

Let your pendulum make 10 complete back-and-forth swings and divide the number of seconds it took by 10. Then, let your pendulum make 20 complete swings and divide the number of seconds it took by 20. (Remember: **Period = # of seconds / 1 complete back-and-forth swing**). If the two numbers agree, then you have a pretty accurate period for that pendulum. If they don't, try again. **Example:** Say it took 18.24 seconds for your pendulum to swing 10 times. Then to find the period of one swing you would divide 18.24 by ten. So it has a period of 1.824.

Your Task: You and your group are going to determine which of the following three components of a pendulum affect its period. There may be only one component which affects the period, there may be two, or perhaps all three affect the period. Once you have determined which one (s) affect the period, you are also going to determine **how** they affect the period.

The three components of a pendulum which you will be studying are:

1) The **mass** at the end of the string (called the "bob") – measured in grams.
2) The **length** of the pendulum (from where it is tied to the MIDDLE of the mass) – measured in METERS (remember, rulers measure in centimeters)
3) The **angle** from which the pendulum is let go. DO NOT pull the pendulum up so high that there is slack in the string when it is released. Only release it from a height where it will remain taught throughout its swing. – measured in degrees away from a hanging down position. Hanging down is 0^o. So, pulling it all the way horizontal would be 90^o. Use a protractor to measure the angle.

You and your group need to create at least **3 different lengths** of pendulums using at least **3 different masses** and dropping it from at least **3 different angles**.

HINT: Only change **one variable at a time**! Don't try to change the length when you change the mass (for example). It is too difficult to determine what's going on if too many things are changing. *(Remember what a "**controlled experiment**" was from last year? You must keep all of the variables constant but one!)*

Hypothesis: In the space provided below, write your hypothesis about what you think will affect the period of the swinging pendulum before you begin this lab. Just simply a statement *(your "educated guess")* about which of the three things (length, mass, angle) you thought were going to have an effect on period. I will ask you when you have completed the lab, whether or not your results agreed with your hypothesis…….remember….part of the Scientific Method we talked about. Your hypothesis must be an "*If, then, because*" statement

Your Hypothesis:

How to read your Protractor correctly: <u>READ THIS CAREFULLY!</u>

When the string hangs straight down, that should be 0^o. However, you will notice that your protractor will read 90^o (if you hold it so that the straight edge of the protractor is parallel with the ceiling) Therefore, you must always SUBTRACT the number you read on your protractor from 90^o to get the correct reading. For example: If you get a 30^o angle reading, it is really 60^o.

<u>Data Table:</u> Your data table should look like the one below.

Understanding the data table:

Time: This is the entire time it took to make the swings. (you should time at least 10 swings)

# of Swings: This is the number of swings the pendulum made over that time period.

Period: This is time/#of swings (you can get Excel to make that calculation for you!)

Constants: There will be two constants. You must list their values. For example, in the first set of trials, you will be changing the Length but keeping the Mass and the Angle constant. You must list those constant values.

Trail #	Length	Time	# of Swings	Period	
Trial 1					**Constants**
Trial 2					Mass:
Trial 3					Angle:
Trial 4					
Trial 5					

	Mass	Time	# of Swings	Period	
Trial 1					
Trial 2					**Constants**
Trial 3					Length:
Trial 4					Angle:
Trial 5					

	Angle	Time	# of Swings	Period	
Trial 1					
Trial 2					**Constants**
Trial 3					Length:
Trial 4					Mass:
Trial 5					

Questions: Write your answers to the questions in the spaces provided.

1.Does the mass of the bob affect the period of a pendulum? Finish this statement: "As the mass of the bob increases, the period of the pendulum (increases, decreases, stays the same)?

2. Does the length of the pendulum affect the period of a pendulum? Finish this statement: "As the length increases, the period of the pendulum (increases, decreases, stays the same)?

3. Does the angle from which the pendulum is released affect the period of a pendulum? Finish this statement: "As the angle from which the pendulum is released increases, the period of the pendulum (increases, decreases, stays the same)?

4. What is the definition of “period” (Hint, it’s in the lab).

5. Did the results you gathered in this lab agree or not with your original hypothesis? Explain.

6. Why was it important to only change one variable at a time?

7. If you have ever seen a Grandfather clock, the length of the pendulum is used to adjust how fast or slow the clock is running. Explain.