Name: _____ ID No.:_____ Date: _____
Section: _____ Score: _____

Preparatory Physical Science (PHSC 001)
Experiment No. 3
The Simple pendulum

Experiment Objectives

In this experiment, the student will measure the number of pendulum's swings and to investigate and conclude

- The relationship between the number of swings and the point of release of pendulum
- The relationship between the number of swings and the mass of the pendulum
- The relationship between the number of swings and the length of the pendulum

Methodology

Consists of counting the number of swings of the pendulum for specific time when the pendulum is released from 30^0 and 20^0 positions. The number of swings is counted for the same time interval for different masses and different lengths of the pendulum.

Key Terms

System
Pendulum
Variable
Independent variable
Dependent variable

Theory

A ***system*** is defined as any collection of items or objects that is working together in such a way that all or some influence the system's behavior and performance. The pendulum is a system. The ***pendulum*** shown in Figure 3.1, the one that we will build and use is made of a piece of string or thread and a mass (bob) hangs at its end. When hung from a support and put into a motion, the mass at its end swings back and forth. For a given time, the number of swings can be counted. That number of counts is the outcome of this experiment. The length and mass of the pendulum are the two items/objects of the system (pendulum) that we will investigate their dependence on its performance (i.e. swings).

In any experiment, there are certain variables that we should take care of. A ***variable*** is any physical quantity such as length, mass, volume, pressure, time etc that we can change in the experiment to see whether it can affect the outcome. From the early classes in mathematics, you have learned that an ***independent variable*** is one that we know and a ***dependent variable*** is the one that we do not know. In this laboratory exercise, you will work and classify your variables in accordance to these two categories.

In a controlled experiment like this that we will do, we chose or set values for the independent variables (point of release, mass of pendulum, and length of pendulum) and see how the outcome (number of swings) , the dependent variable, is influenced by this choice.

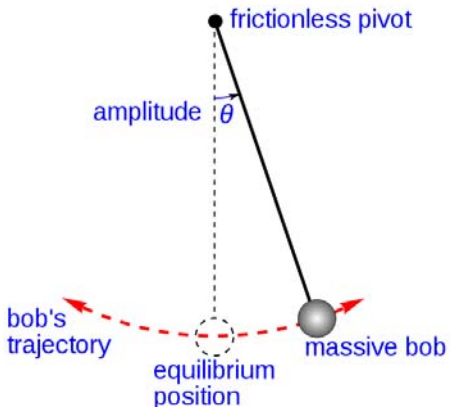


Figure 3.1: The simple pendulum

Materials

- String
- Two steel balls of different masses
- Ruler or meter tape
- Support base
- Support rod, 600mm
- Double clamp
- 10 cm support rod
- Protractor

Part1: number of swings versus point of release

Method:

1. Set up your pendulum. Measure exactly 65cm from the point of attachment to the steel ball along the string. Fold the string back at exactly the 60 cm mark. Make a loop of the 5 cm string. The loop should be large enough to hang over the small support rod attached to the double clamp.

2. Make sure the length of the string is 60 cm. You just build your pendulum

3. Hold the mass in your hand and displace it at a 30^0 with the vertical position. Use the protractor to measure the angle (amplitude).

4. Release the ball and count the number of swings for 20 seconds. You do not have to count the number of swings the moment you release the ball, you can wait for few seconds and then count.

5. Repeat step 6 for one more time and take the average

6. Change the point of release to a lesser angle (say 20^0). Repeat steps 6 and 7. Record your data in Table 1.

Table1

Pendulum's length = 60 cm,
Mass = ……. gram,
Time for counted swings = 20 second

Point of release	**30^0**		**20^0**	
Number of swings	***Trial 1***	***Trial 2***	***Trial 1***	***Trial 2***
Average number of swings				

Part 2: Number of swings versus mass of pendulum

Method

1. Change the mass of the pendulum.

2. Repeat steps 5 through 8 of part 1 method. Record your data in Table 2

Table2

Pendulum length = 60cm,

Mass = ……. gram,

Time for counted swings = 20 second

Point of release	**30^0**		**20^0**	
Number of swings	***Trial 1***	***Trial 2***	***Trial 1***	***Trial 2***
Average number of swings				

Part 3: Number of swings versus pendulum's length

Method

1. Use either mass for the pendulum.

2. For a 60 cm length count the number of swings for 20 second.

3. Shorten the length to 55 cm and repeat step 2.

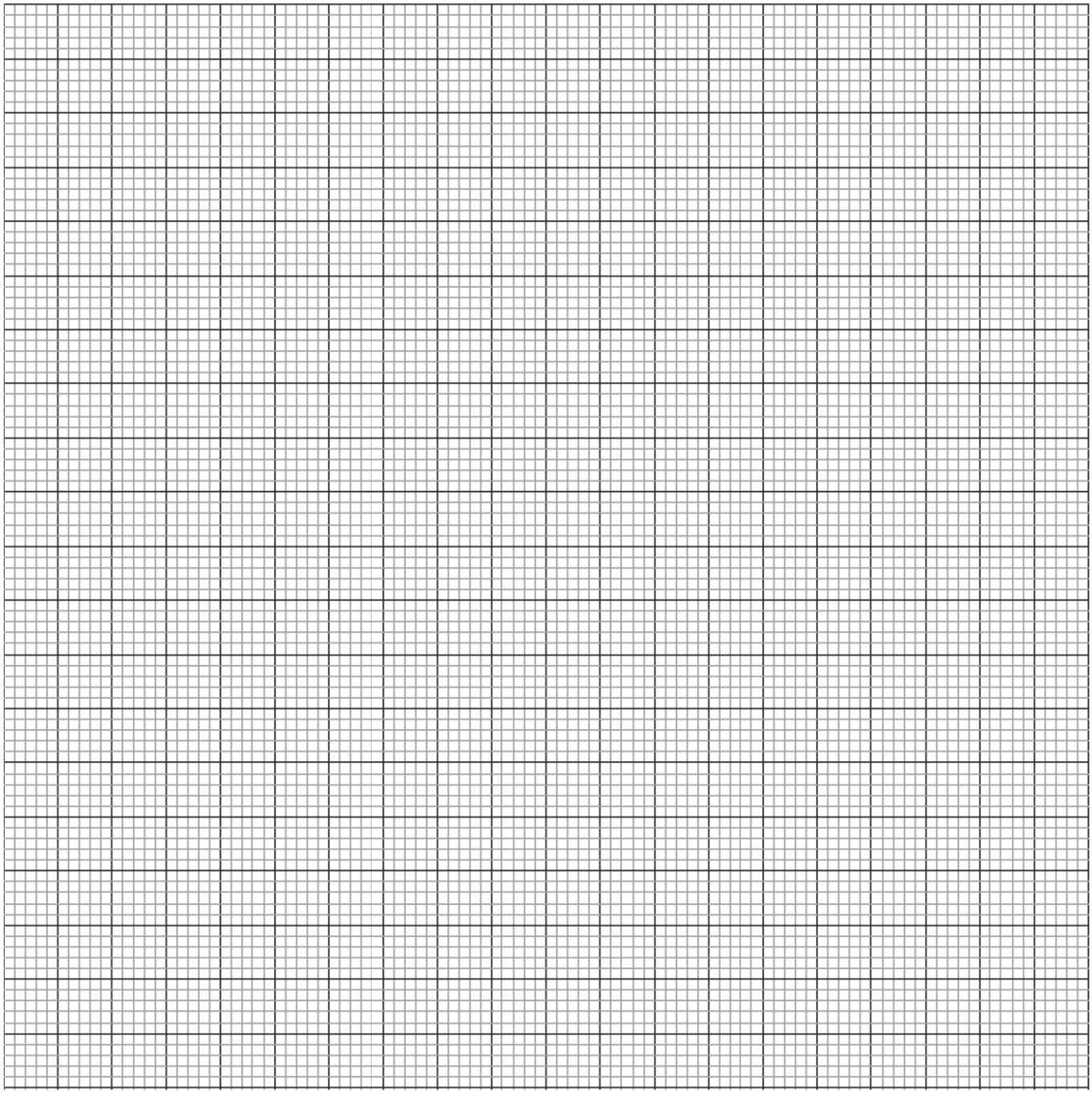
4. Repeat step 3 for another 5 cm cut in length. Record data in Table 3

5. Plot the number of swings in 20 second versus pendulum's length.

Table 3

Mass pendulum = …….. gram

length (cm)	**Number of swings**
60	
55	
50	
45	
40	
35	
30	
20	



60 55 50 45 40 35 30 20

Pendulum's Length (cm)

Questions

1. What is your conclusion of part 3?

2. What is your conclusion of part 2?

3. What is your conclusion of part 3?

4. The periodic time is the time for one complete cycle. The pendulum completes a cycle when it comes back to the released point. Find the periodic time of your pendulum in seconds.

5. If you perform this experiment on the moon do you expect to obtain the same periodic time? Explain

6. If you leave the pendulum for a while it will go to rest at the equilibrium point at the middle of its swing (why?)