Physics 11 IB **Simple Pendulum**

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1 Planning A

1.1 Research Question

The aim of this experiment is to identify the various factors that affect the period of a simple pendulum. Of these factors, investigate one factor which contributes to the change in period of the simple pendulum.

1.2 Hypothesis

When solving for the period of a pendulum, the following formula is obtained:

$$T = 2\pi\sqrt{\frac{L}{g}} \tag{1}$$

This shows that the period of a pendulum *only* depends on the length L of the pendulum, and the acceleration due to gravity g.

If we were to keep g constant, the only way to affect the period T of the pendulum would be to change the length L of the pendulum. If L is increased, then T increases, and the pendulum thus moves slower. Conversely, if L decreases, then T would also decrease, and as a consequence, the pendulum will move faster.

1.3 Variables

Independent: Length L of the pendulum.
Dependent: Period T of the pendulum.
Controlled: The acceleration due to gravity g.

2 Planning B

2.1 Materials

1. Cotton string
2. A metal ball of medium mass
3. Photo-gate blocker timer
4. Photo-gates
5. Meter-stick

2.2 Procedure

1. Tie the thread to the hook of the metal ball, and measure the length of string and the radius of the ball. The sum of these lengths will give the length L of the pendulum system.
2. Prepare the timer and set it to pendulum mode.
3. As the acceleration due to gravity is controlled, it has to be kept constant. This is not a problem if you are completing the entire experiment in one place.
4. Swing the pendulum through the photo-gates, and determine the amount of time it takes to complete one full oscillation. This is the period T of the pendulum. Repeat this 3 or 4 times to obtain an average. Record both the length L and the period T of the pendulum in a table.
5. Cut short the string with a blade or a pair of scissors, and find the new shorter length L of the pendulum. Repeat the above step and record the length-period pair. Cut short the thread 3 or 4 times, and repeat the same procedure, while recording the length-period pair for each new length L of the pendulum.
6. Graph the length-period pair on a piece of graph-paper. Analyze the resulting graph and explain the relationship between the length L and the period T of the pendulum.
7. What happens if the length L is doubled? Tripled? Halved? By what factor must one scale L, in order to quadruple the period T? How do these answers relate to equation (1) ?
8. Try changing the mass of the metal ball, while keeping the length the same. Does the change in mass have any effect on the period of the pendulum? Why or why not? Explain.
