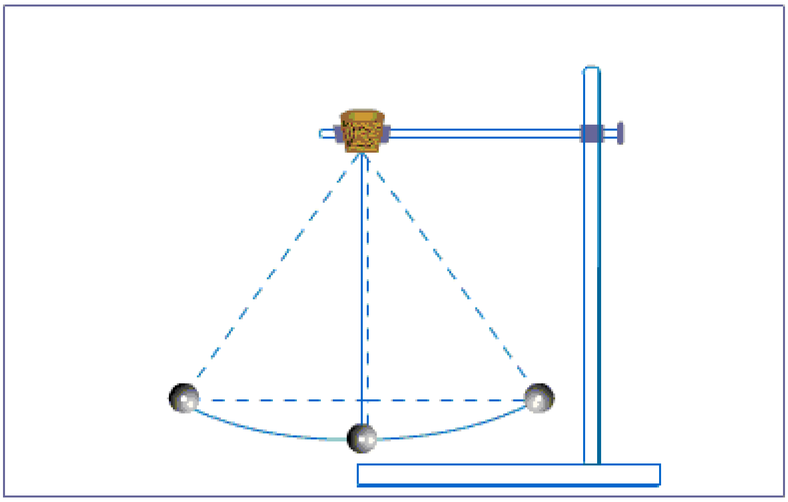
Experiment 4

Simple pendulum to calculate Acceleration due to Gravity ‘g’

A simple pendulum consists of a heavy or point mass suspended by an inextensible or non-elastic thread from a fixed point. The length of the pendulum is the distance from the point of suspension to the centre of gravity of the bob. The resting position of a simple pendulum is known as the mean position. One complete cycle from the maxim point of a pendulum about its mean position is known as an **oscillation** or **vibration.**



Aim: in this experiment, by mean of calculating the time period of a simple pendulum, ‘g’ will be calculated.

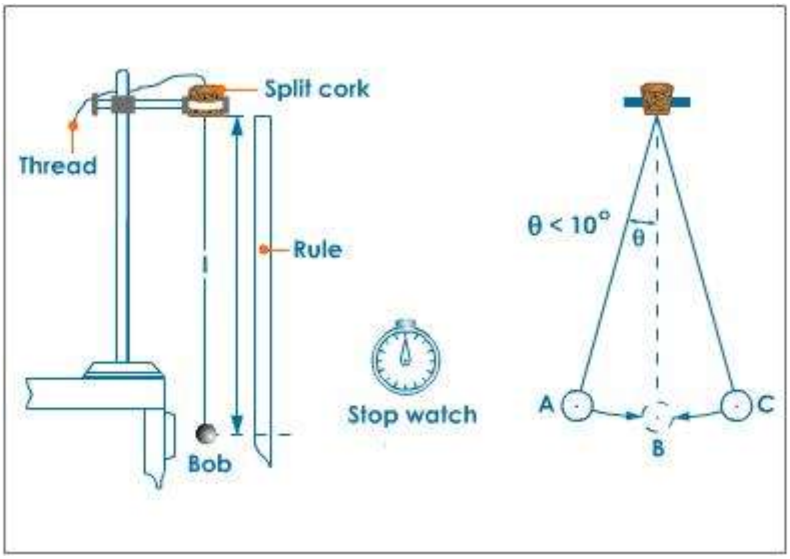
Apparatus: A meter rule, a stand, a metal bob, good quality string, stop clock.

Formula: The acceleration due to gravity is:

$$g = 4\pi^2 \frac{L}{T^2}$$

Procedure:

Tie the hook of the bob on one end of a thread (more than 1 meter). Clamp the other end firmly between the gaps of a split cork which is fixed to the clamp of the retort stand as shown in the diagram. Measure the length 'l' from the middle of the bob to the lower edge of the split cork.

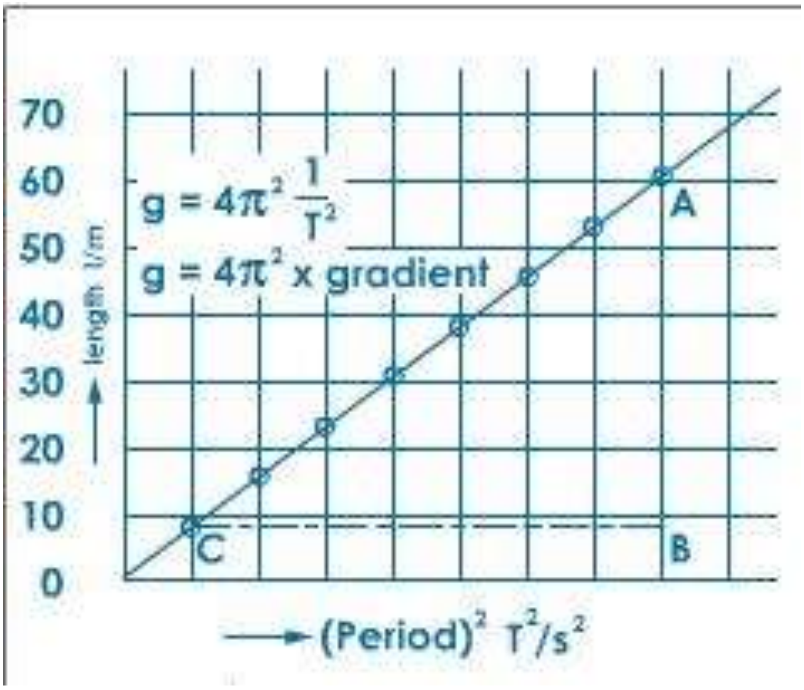


Pull the bob to one side (making an angle of 5^o with the vertical line) and allow it to oscillate in one plane. Using a stop watch record the time (t) is taken for 20 complete oscillations. Repeat the experiment for different lengths (l) and record the corresponding time (t) in the tabular form as shown below:

Observations:

Lengths 'l' of pendulum (cm)	Time for 20 Oscillations 't' (s)	Time for one oscillation 'T' (s)	T^2(S)^2	T^2/l (s^2 cm^{-1})
20				
40				
60				
80				
100				

Then: Draw a graph of l against T^2 as below.



Unless

$$g = 4\pi^2 \frac{L}{T^2}$$

Thus:

$$g = 4\pi^2\ slope$$

QUESTIONS:

1) From your data what effect does changing the mass have on the period (for a given value of the length L)?

2) What role, if any, does air resistance have on your results? Explain your reasoning.

3) Would you conclude that Galileo was correct in his observation that the period of a simple pendulum depends only on the length of the pendulum?

4) On the moon, the acceleration due to gravity is one-sixth that of earth. That is

g moon = g earth /6 = (9.8 m/s^2)/6 = 1.63 m/s^2 .

What effect, if any, would this have on the period of a pendulum of length L? How would the period of this pendulum differ from an equivalent one on earth?