

# **STEPPING STONE SCHOOL (HIGH)**

**CLASS – IX**

**PHYSICS**

**WORKSHEET- 6**

**Date – 20/05/2020, (Day- 6)**

**Chapter- MEASUREMENT (Pt.VI)**

**Topic- Simple Pendulum**

**Time limit: 30 minutes.**

**Please read the notes carefully and on the basis of it copy down the questions and solve them on a sheet of paper date wise. Keep the worksheet ready in a file to be submitted on the opening day.**

## **Simple Pendulum:**

It is a heavy point mass suspended from a rigid support by a mass less and inextensible string.

## **Terms related to simple pendulum:**

Oscillation: One complete to and fro motion of the bob of pendulum is called one oscillation.

Time period: It is the time taken to complete one oscillation. Its unit is second(s).

Frequency: It is the number of oscillations made in one second. Its unit is hertz (Hz).

Amplitude: The maximum displacement of the bob from its mean position on either side. It is measured in metre (m)

Effective length: It is the distance between the point of suspension of the bob to its centre of gravity.

**Relation between Time Period and Frequency:**

If T is the time period and f is the frequency then  $f = \frac{1}{T}$

**Factors affecting the time period of a simple pendulum:**

(i) The time period of oscillation is directly proportional to the square root of its effective length.

$$\text{i.e. } T \propto \sqrt{l}$$

(ii) The time period of oscillation is inversely proportional to the square root of acceleration due to gravity.

$$\text{i.e. } T \propto \frac{1}{\sqrt{g}}$$

**Independent factors:**

(i) The time period of oscillation does not depend on the mass or material of the bob.

(ii) The time period of oscillation does not depend on amplitude.

**Expression for the time period of simple pendulum:**

$$T = 2 \pi \sqrt{\frac{l}{g}}$$
$$\text{or } T^2 = 4 \pi^2 \frac{l}{g}$$

Where t = time period

l = effective length of pendulum.

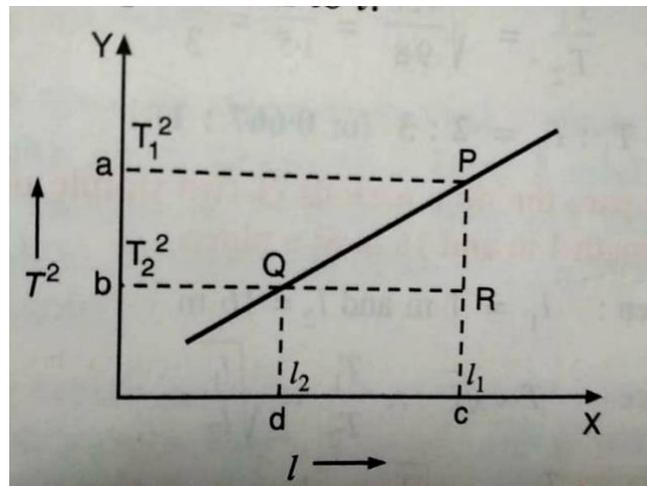
g = acceleration due to gravity.

## Seconds' pendulum:

A pendulum with a time period of oscillation equal to two seconds.

Graphical variation of square of time period ( $T^2$ ) with the length ( $l$ ) of a pendulum.

If a graph is plotted for the square of time period taken on Y- axis against the length  $l$  taken on X- axis, it comes out to be a straight line.



## Exercise:

### Answer the following questions:

1. Name two factors on which the time period of a simple pendulum depends.
2. How is the time period of a simple pendulum affected, if at all, in the following situations:
  - (a) the length is made four times.
  - (b) the acceleration due to gravity is reduced to one – fourth.
3. How do you measure the time period of a given pendulum?

4. Two simple pendulums A and B have equal lengths but their bobs weigh 50 gf and 150 gf respectively. What would be the ratio of their time period? Give reason for your answer.

5. Two simple pendulums A and B have lengths 1 m and 4m respectively at a certain place. Which pendulum will make more oscillations in 1 minute? Explain your answer.

6. What is a seconds' pendulum?

7. State the numerical value of the frequency of oscillation of a seconds' pendulum.

**Numericals:**

(1) A simple pendulum completes 40 oscillations in one minute. Find its (a) frequency (b) time period

(2) Compare the time periods of two pendulum of length 1m and 9m.

(3) The time periods of two simple pendulums at a place are in ratio 2: 1. What will be the ratio of their lengths?

Please tap on the hyperlink below to watch the video content of the topic simple pendulum and the time period of simple pendulum.

<https://www.youtube.com/watch?v=3XNKI89TjCY>

<https://www.youtube.com/watch?v=ascr9F-BK94>

