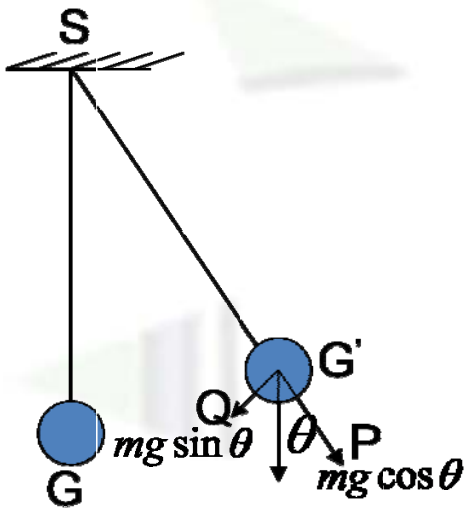
Simple Pendulum:

Simple pendulum consists of a small heavy bob (a sphere) and a thread. Ideal simple pendulum is defined as a heavy rigid point mass suspended by a weightless, inextensible, perfectly flexible string from a rigid support which does not yield under the weight of the bob.

Thus ideal simple pendulum is just an imagination and can not be realized in practice.

The concept of ideal simple pendulum just gives an idea about the choice of the bob string and support.

Time period of a Simple Pendulum:



$SG = l$ = distance between the point of suspension and C.G of the bob.

m = mass of the bob

Force acting on the bob:

(1) Gravitational force mg along vertically downward direction

(2) Tension of the string

Resolving mg into two mutually perpendicular components

Component along G'P = $mg\cos\theta$

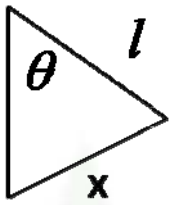
Component along G'Q = $mg\sin\theta$

$mg\cos\theta$ Balance the tension of the string and

$mg\sin\theta$ Restores the bob back to its original position and is know is restoring force.

Restoring force = $-mg\sin\theta$ Negative sign indicates the restoring nature

Restoring force = $-mg\frac{x}{l}$



$\sin\theta = \frac{x}{l}$

This force acting on the bob produces acceleration in the bob

Using Newton's second law

m x acceleration = $-mg\frac{x}{l}$

Acceleration $= -\frac{g}{l}displacement$

Acceleration $\alpha - displacement$

Hence the oscillation is simple harmonic motion.

$T = 2\pi\sqrt{\frac{displacement}{acceleration}}$

$T = 2\pi\sqrt{\frac{l}{g}}$

The negative sign indicates that displacement and acceleration are oppositely directed.