PENANG SANGAM HIGH SCHOOL
WEEK 11 LESSON NOTES
PHYSICS – Y13

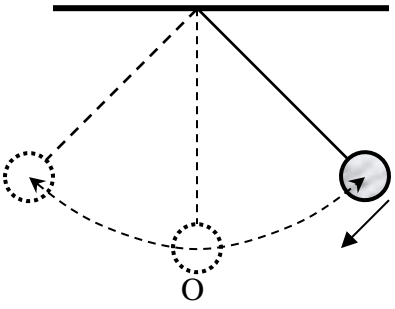
STRAND 2: OSCILLATORY MOTION : SIMPLE HARMONIC MOTION

SUB-STRAND: Characteristics of SHM
CONTENT LEARNING OUTCOME: to understand the characteristics of a Simple Harmonic Motion.

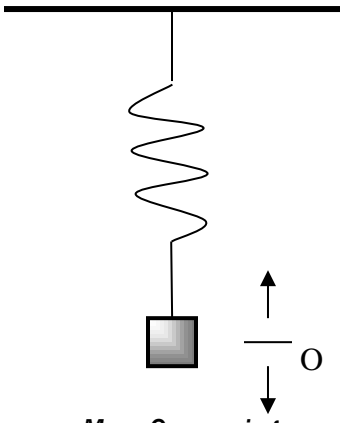
Oscillatory Motion

Any motion, which repeats over in regular cycles, is called a periodic motion. One common type of periodic motion is called simple harmonic motion (**SHM**).

Example



Pendulum

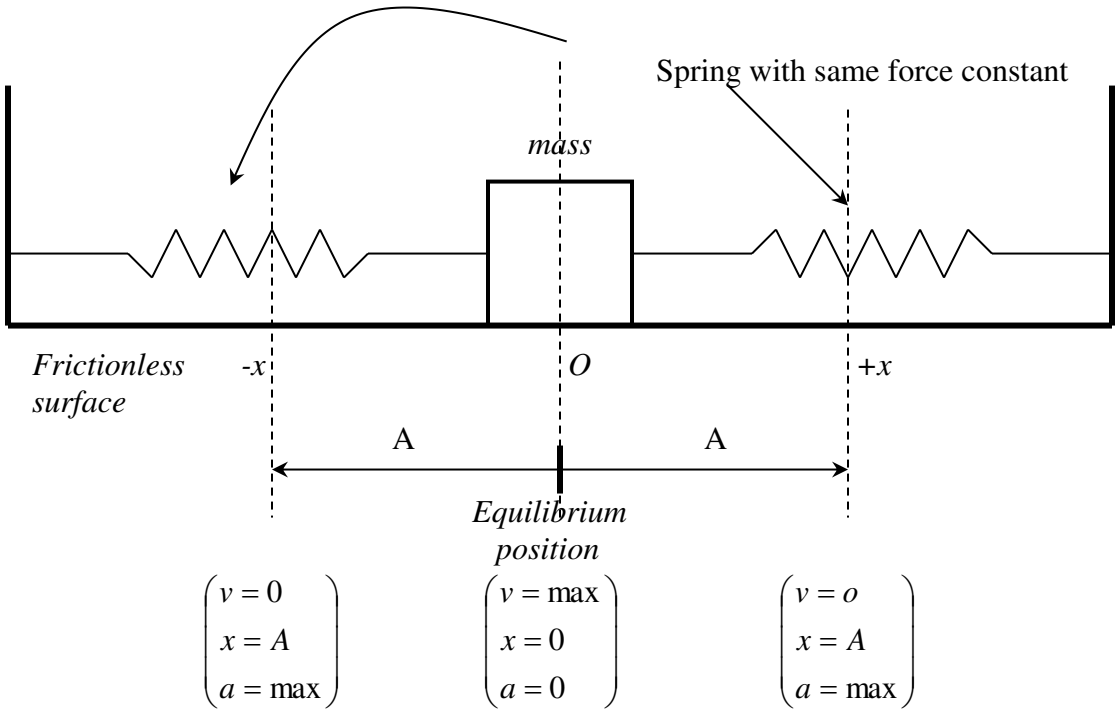


Mass On a spring

SHM: **Definition** The motion where the acceleration of an object is **negative** or opposite to its displacement from a central position while it oscillates along the same path between two extreme points.

The Characteristics of SHM

1. The mass undergoing SHM oscillates between **2 extreme positions** on either side of the **central point**.
2. The displacement of the mass will be taken from the **central point**, the position the mass will take if allowed to come to **rest**.
3. The oscillating mass takes exactly the same time to complete one cycle, this time being the **period (T)** of SHM.
4. The oscillating mass is fastest when passing through the central point and momentarily at **rest** at the **extreme points** of the path.
5. The **acceleration** is always centrally directed and increases to a **maximum** towards the **extremes** and is **zero** at the **centre**.
   During the oscillation, the displacement, velocity, acceleration, Kinetic Energy and Potential Energy of the mass is as given below.



$\begin{pmatrix} v=0 \\ x=A \\ a=\max \end{pmatrix}$ $\begin{pmatrix} v=\max \\ x=0 \\ a=0 \end{pmatrix}$ $\begin{pmatrix} v=o \\ x=A \\ a=\max \end{pmatrix}$

1. Amplitude (A) – maximum displacement from the central position.
2. Frequency (f) – the number of oscillations per second. $\left(Hz = \frac{1}{s} or\_ s^{-1} \right)$
3. Period (T) – time taken for one complete revolution (s).

2 EXAMPLES OF SHM ARE; A SIMPLE PENDULUM
MASS ON A SPRING

1. In a simple harmonic motion an object completes 20 vibrations in 4 seconds. The angular frequency of the simple harmonic motion in $rads^{-1}$ is
   A. 10 B. 20 C. 10 π D. 20 π

2. When an object is oscillating with simple harmonic motion, its motion through the equilibrium position can best be described by
   A. zero velocity and maximum force.
   B. zero acceleration and minimum speed.
   C. zero acceleration and maximum speed.
   D. zero amplitude and maximum acceleration