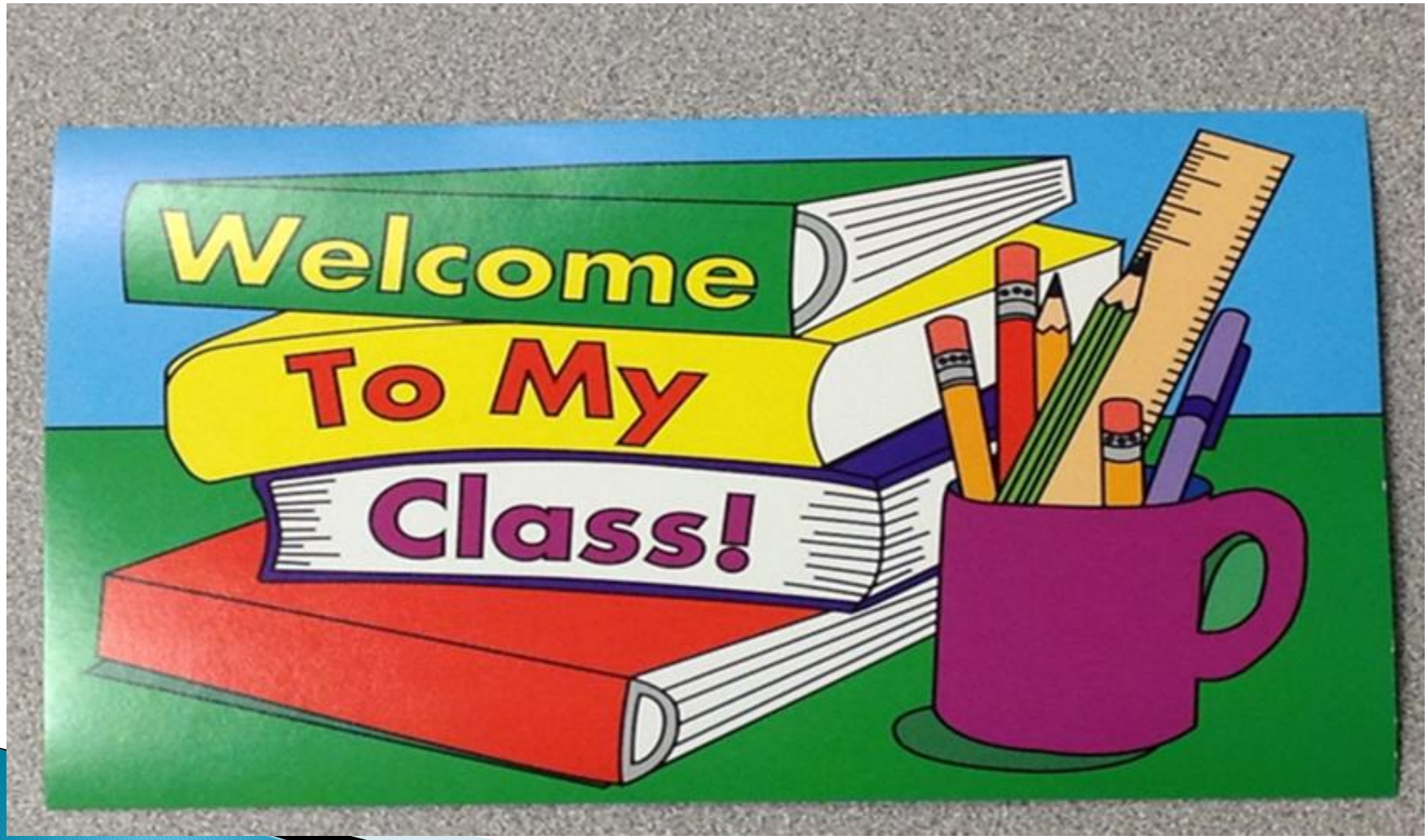
Pakistan School
Kingdom of Bahrain

Class : 10 Subject : 9



Engaging starter

- Differentiate between these two sides of picture:

- Describe any two types of motion.
- What is the difference between vibration and rotation?

Topic

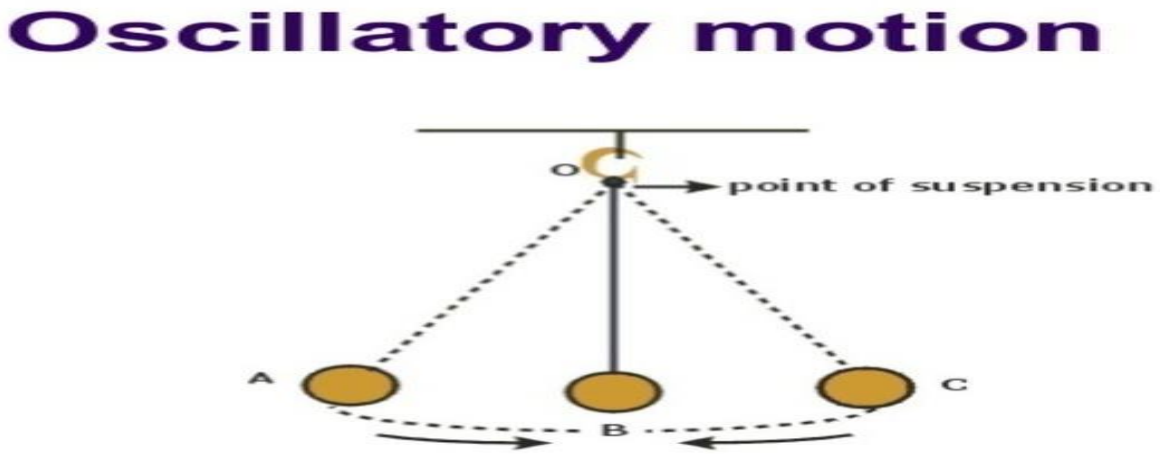
- Simple Harmonic motion:

Objective

- At the end of this lesson students will be able to :
- Define simple harmonic motion
- Describe mass spring system executing simple harmonic motion

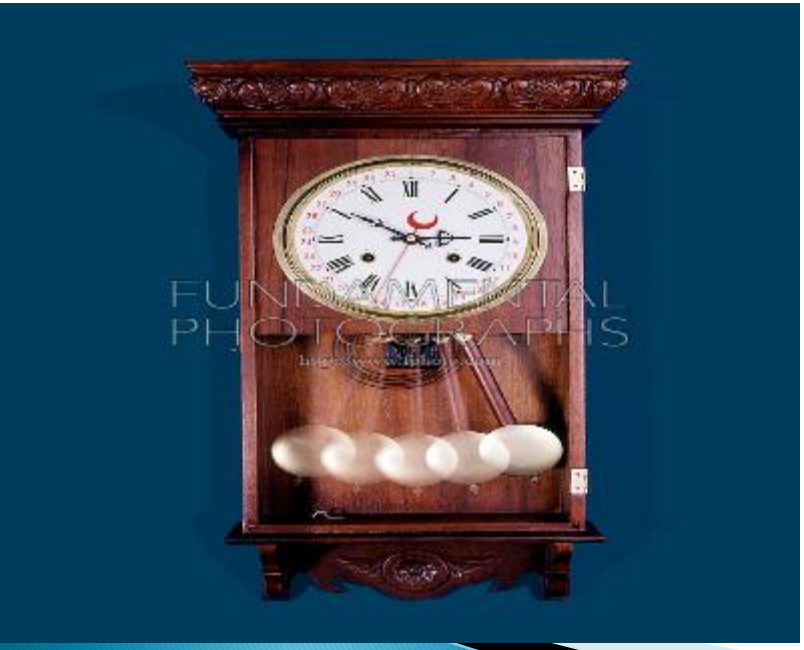
SHM

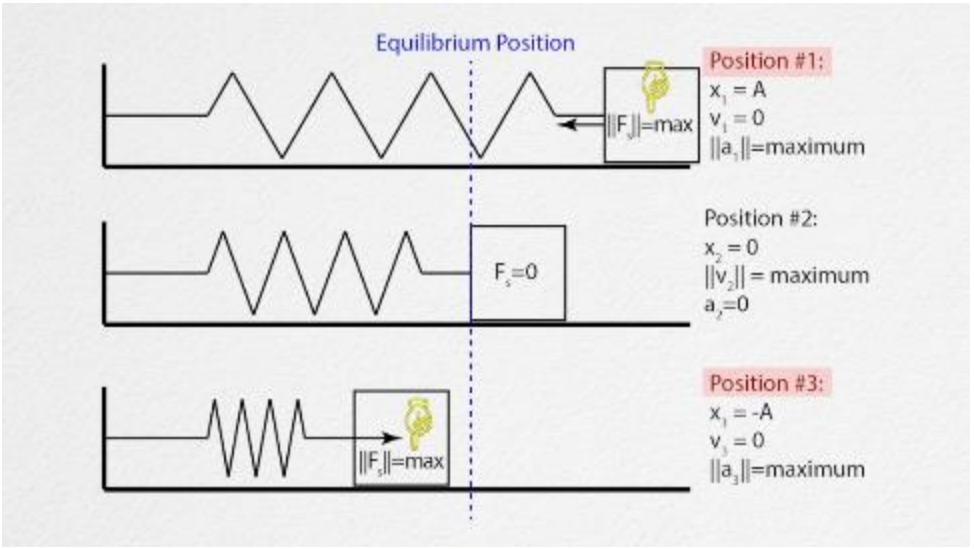
- Definition :
- Simple harmonic motion occurs when the net force is directly proportional to the displacement from the mean position and always directed towards the mean position.



Examples in everyday life of objects executing SHM.

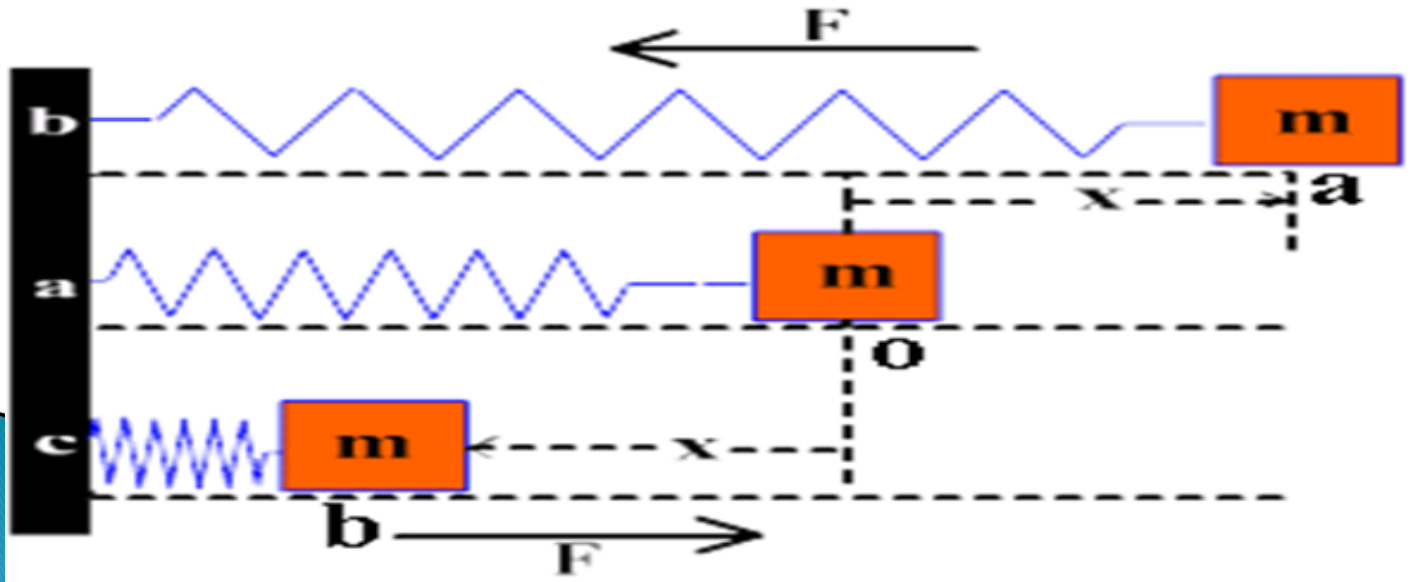
- Oscillating pendulum.
- Oscillating mass spring system.
- Pendulum of wall clock





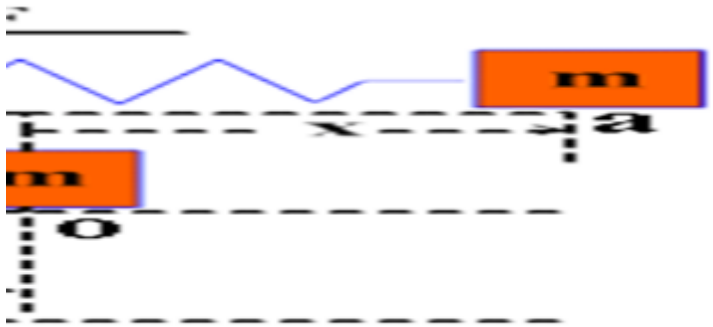
Motion of mass attached with a spring:

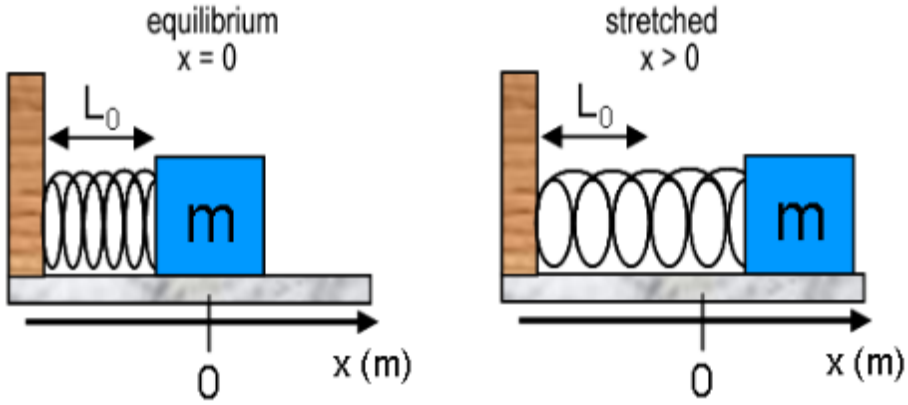
- Consider a body of mass m is attached to a spring and is placed on a horizontal surface other end of the spring is attached with a firm support. There is no extension in the spring in this state. This means that body is at equilibrium position.



Extreme Position A:

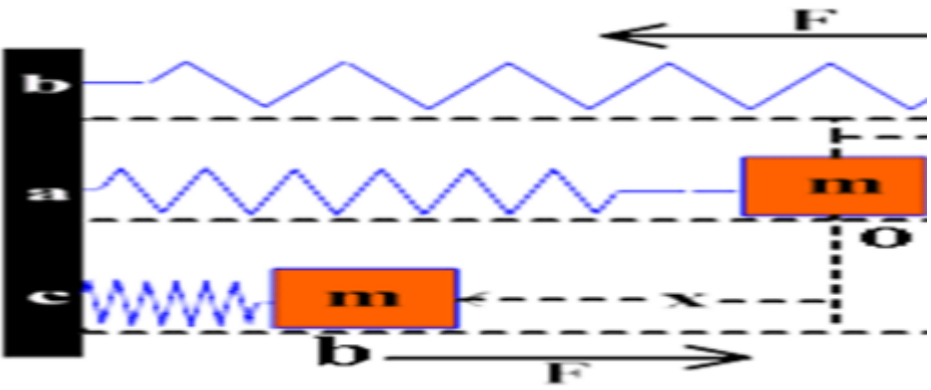
- If an external force is applied on the mass m the length of the spring increases by an amount x and mass move from O to a new position A which is called extreme position.

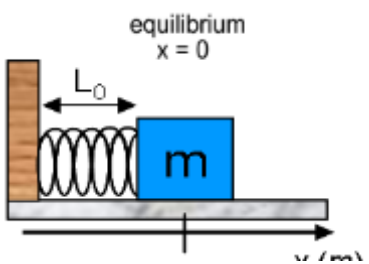


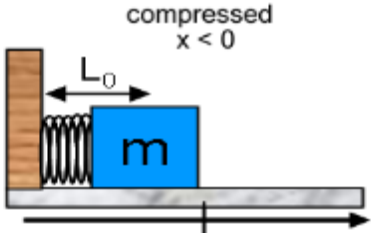


Extreme Position B:

- If an external force is applied on the mass m the length of the spring decreases by an amount x and mass move from O to a new position B which is called extreme position.
- (while compressing spring)



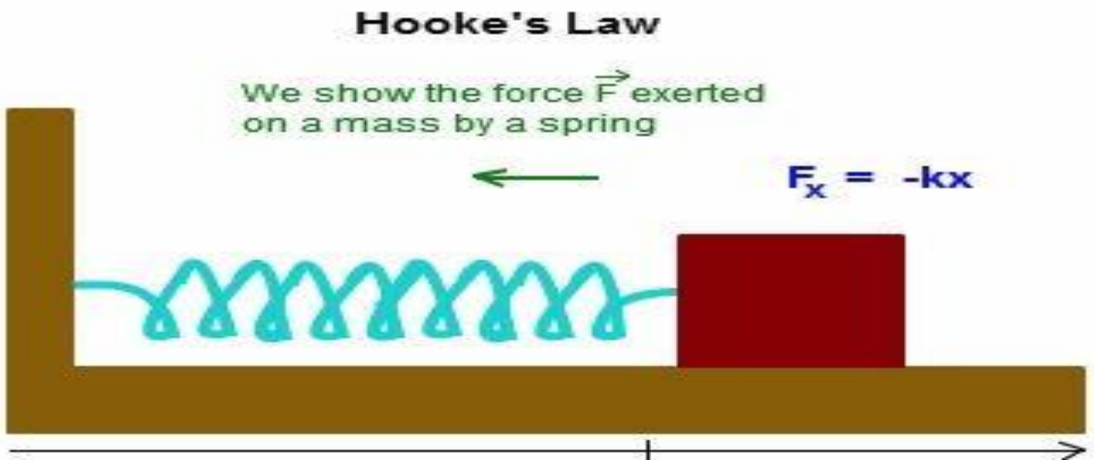




- Hooke's Law:

- The external force applied on the spring is directly proportional to the increase in length. i.e.
- ⇨ $F_{ext} \propto x$
- ⇨ $F_{ext} = K x$ Where "K" is constant and is called spring constant.

- Spring Constant:
- The ratio of external force acting on a spring to the increase in length is called spring constant mathematically it can be written as:
- ⇨ $K = \frac{F_{ext}}{X}$
-
- Its unit is Nm-1



What is meant by restoring force?

- Restoring force: When an external force is applied on the spring, its length will increase. After releasing the force, the spring will move towards mean position. The motion of spring towards mean position is due to a force which is called restoring force.
- Or
- Restoring force always pushes or pulls the object performing oscillatory motion towards mean position.
- Mathematically
- If displacement is x and mass m then restoring force is
- $F = -kx$ ..... (a)
- Here negative sign indicates that restoring force of spring is opposite to the direction of motion or displacement of body from mean position.
- https://images.app.goo.gl/YZuuZsqXBFFTNAcD8

- Now from Hook's law we know that
- $F = - k x$.....(1)
- From Newton's Second Law
- $F = m a$.....(2) by using eq. (2) in (1) we get
- $ma = - k x$.
- $a = - \frac{k}{m} x$ by replacing sign of equality and constants
- We get => $a \alpha - x$
- This shows that acceleration is directly proportional to displacement from the mean position and negative sign shows that it is directed towards mean position. https://images.app.goo.gl/QXHXgr7Y8aQ7GvjG6

Plenary

- In vibratory motion body will move in a circle. T/F
- Simple harmonic motion is a type of…… (Translatory motion or vibratory motion)
- Means position = ……(from where the body start vibration / up to where the body vibrates
- In SHM net force is always directed towards …….
- In SHM the number of extreme position are ….
- What is restoring force?
- In SHM acceleration is always directly proportional to …….

Homework

- Search and write some examples of objects executing SHM in daily life .
- Prove that mass spring system executing SHM.


STAY HOME!
STAY SAFE!

ALLAH HAFIZ