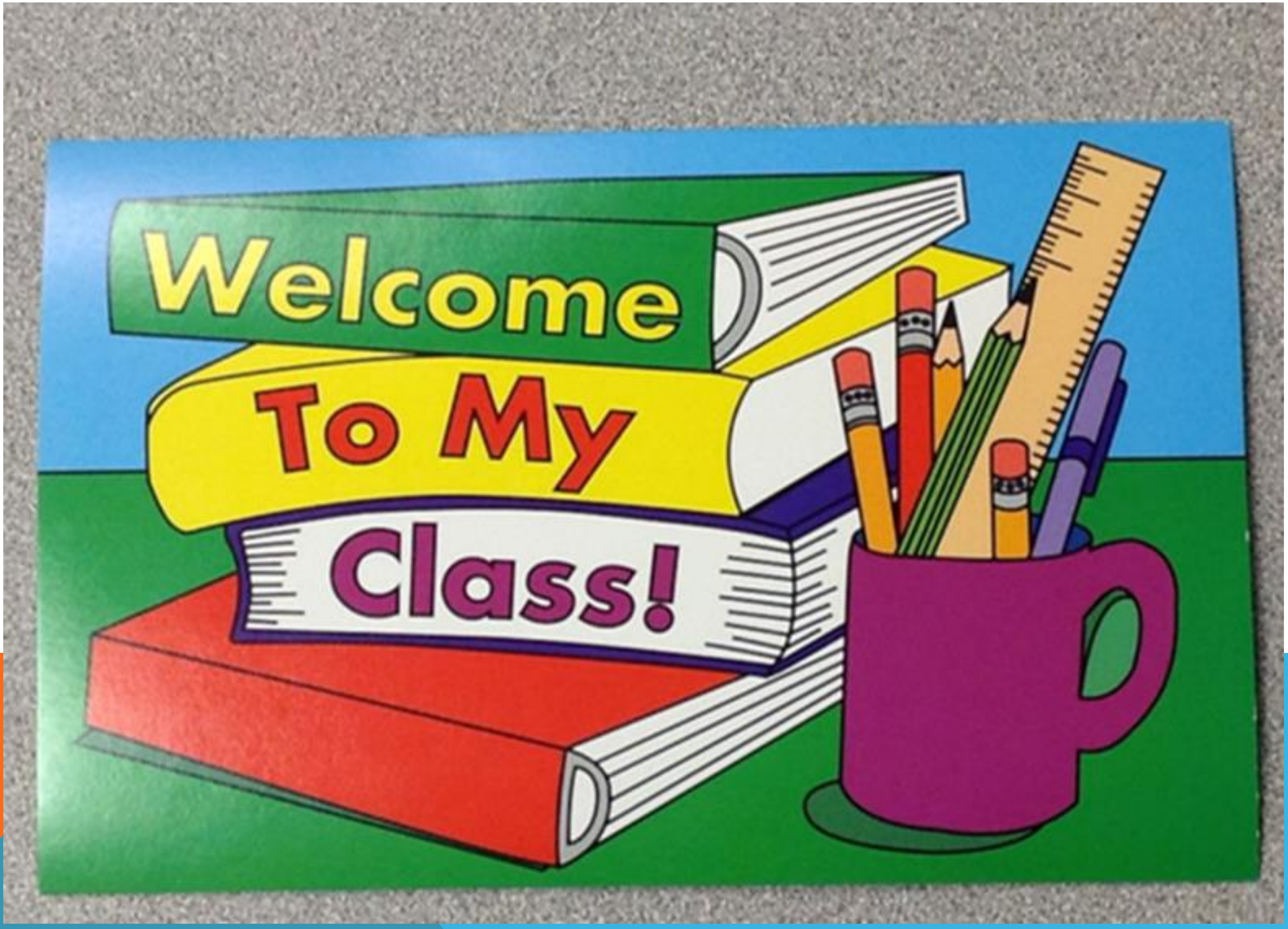
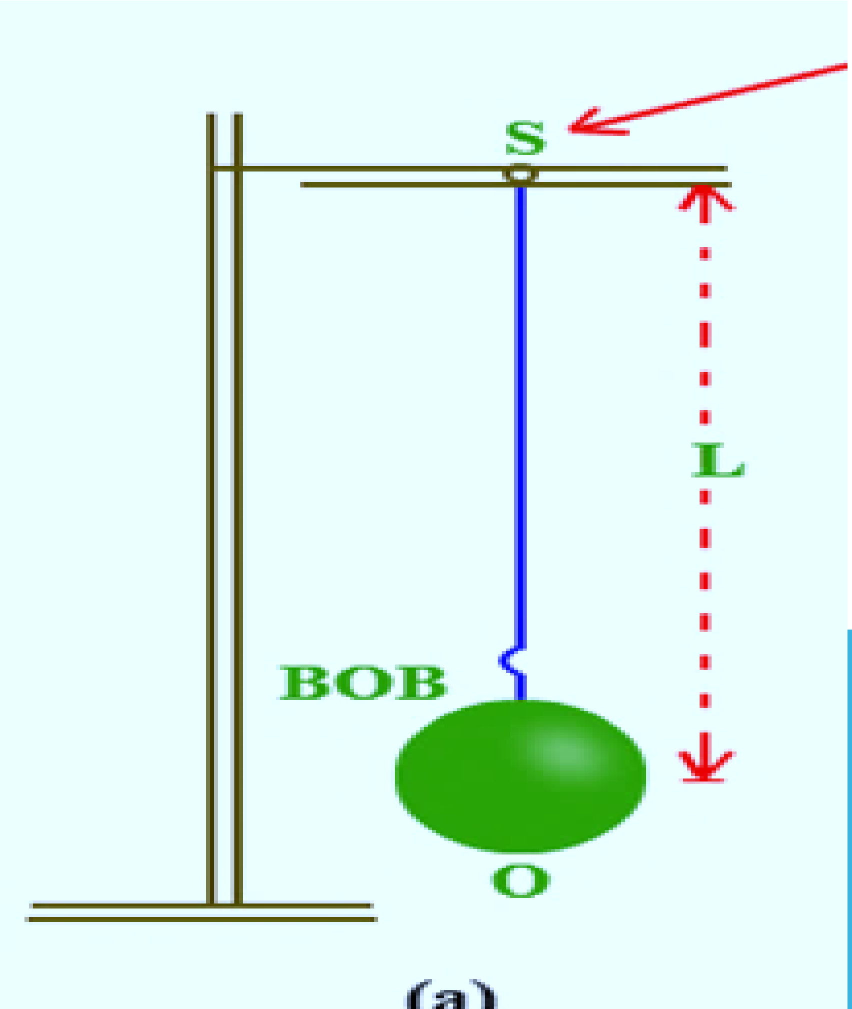
Pakistan School
Kingdom of Bahrain

CLASS:10 SUBJECT: PHYSICS



ENGAGING STARTER

Identify the given thing:



TOPIC

- Motion of simple pendulum
- Terms and features of SHM

OBJECTIVE

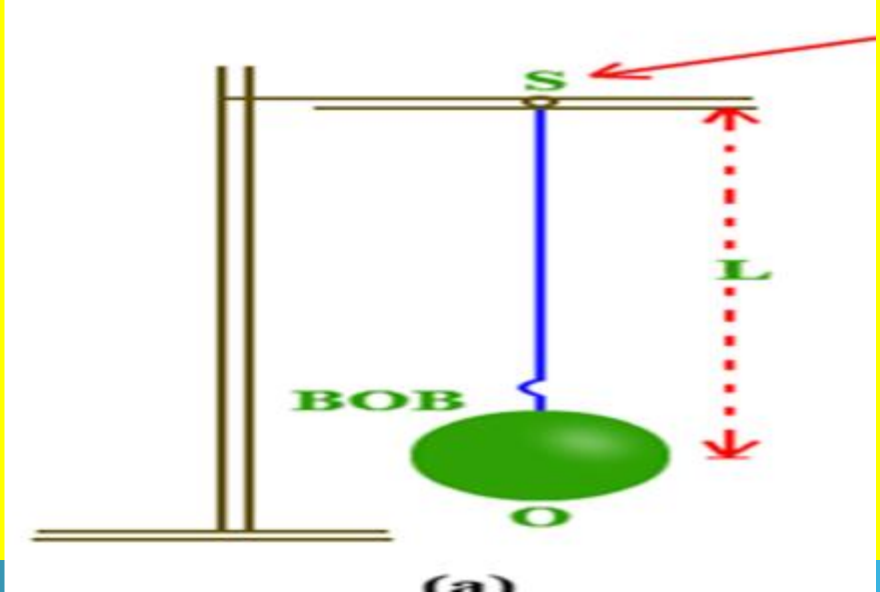
At the end of this lesson students will be able to :

Describe the terms related to simple harmonic motion .

Solve the problems related to motion of simple pendulum

SIMPLE PENDULUM:

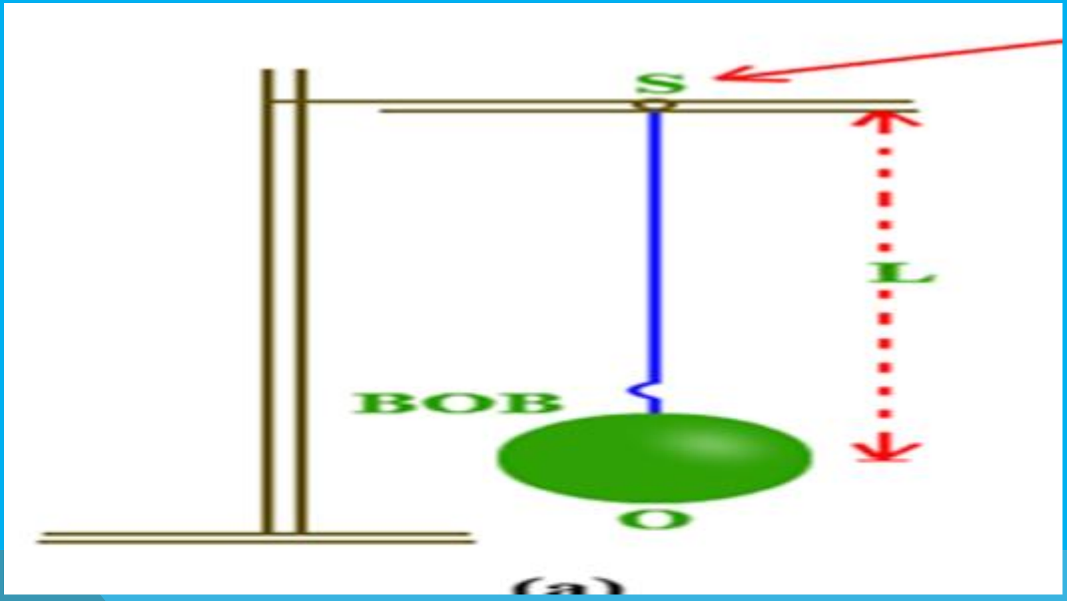
A simple pendulum consists of a single isolated bob suspended from friction less support by light inextensible string. A small bob of mass “m’ is suspended by light inextensible string of length l.



VELOCITY OF BOB BETWEEN ‘A’ AND ‘B’:

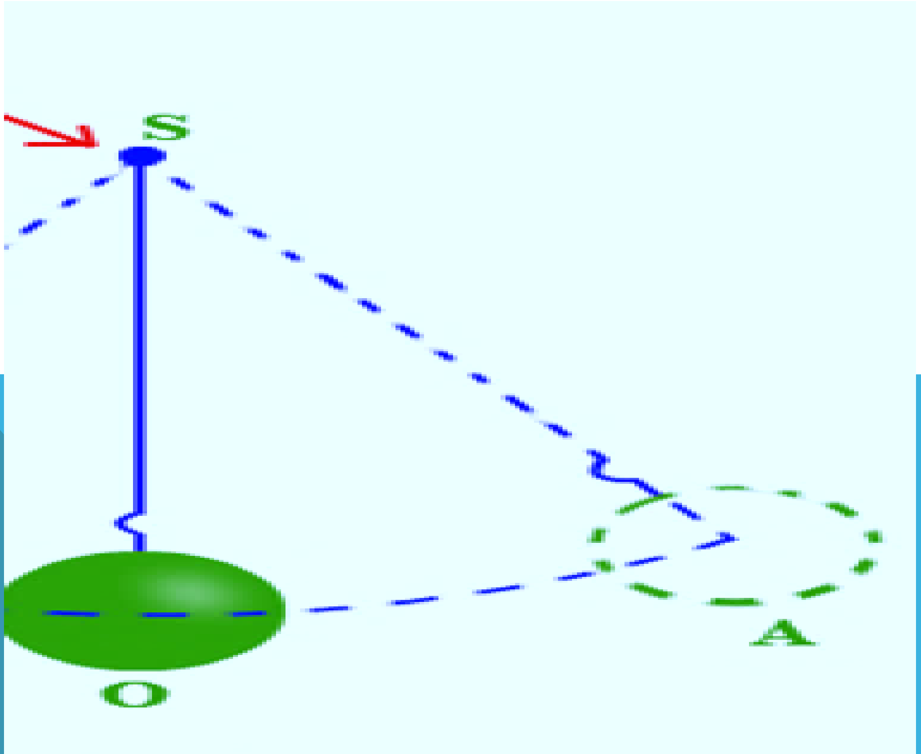
In equilibrium position,

- the pendulum is held stationary in a vertical position at point “O”.



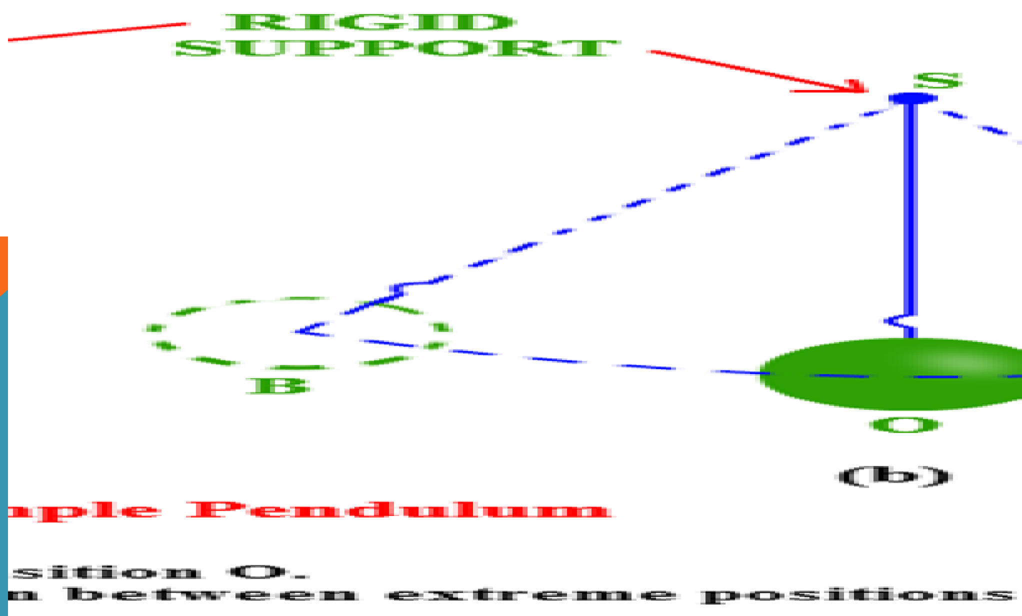
WHEN THE BOB IS DISTURBED FROM ‘O’ TO ‘A’

It starts moving towards the mean position under the action of gravitational force.



AT POSITION 'O'

At 'O' the velocity of bob is maximum and due to inertia, the bob will not stop at 'O' and move to the other end 'B' and the velocity of the bob begin to decrease, and it becomes zero at 'B'.

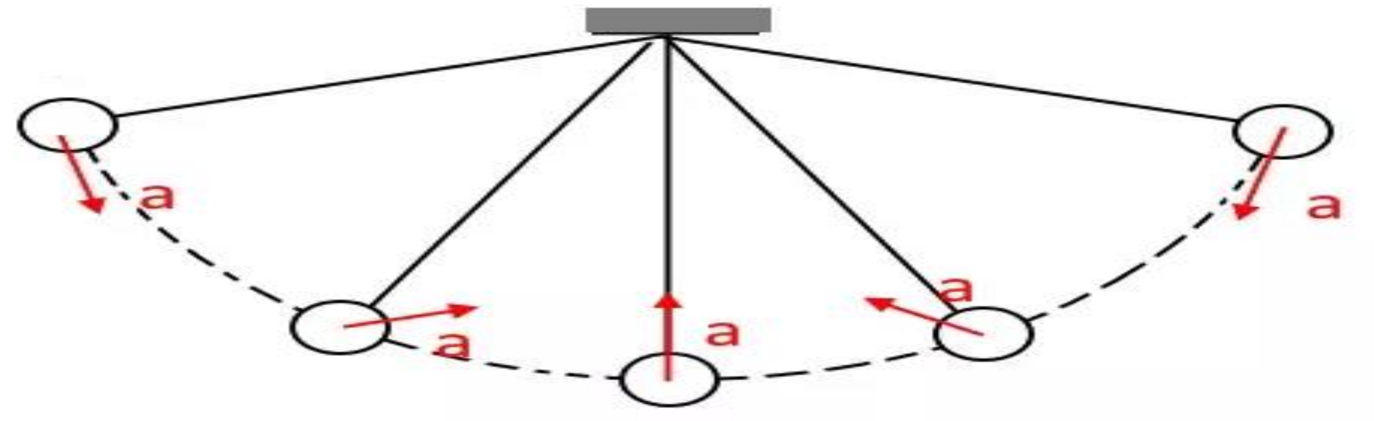


ACCELERATION OF BOB BETWEEN A AND B:

The direction of acceleration remain same towards 'O' during motion from point 'O' to 'B' because the speed of bob start decreasing.

This means that the direction of acceleration always towards mean position.

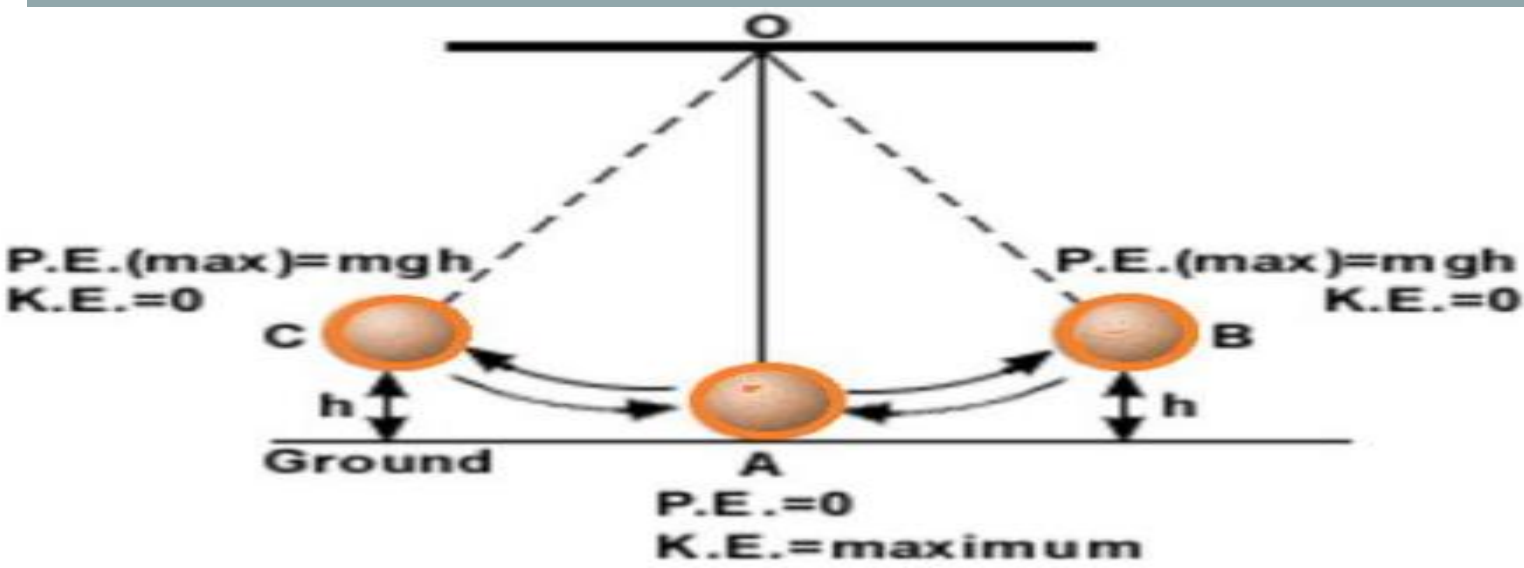
This show that acceleration is always directed towards the mean position and is directly proportional to the displacement . So we can say that motion of simple pendulum is simple harmonic motion.



ENERGY CHANGES BETWEEN A AND B:

At point ‘O’ the bob is at lowest position so the potential energy of the bob is minimum.

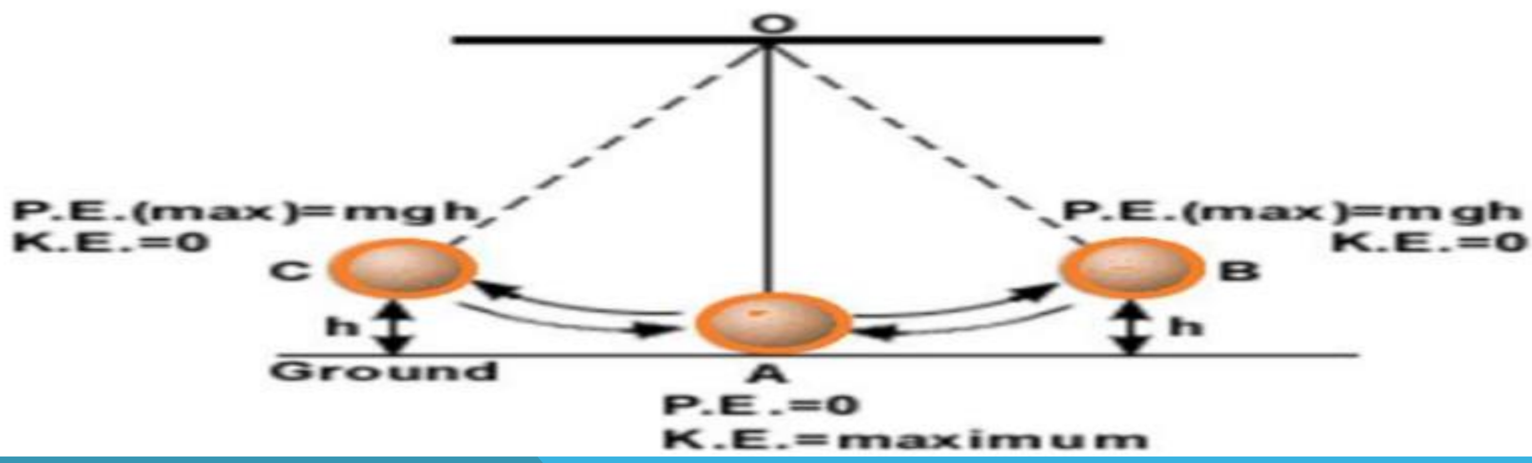
At points 'A’ and B, at the highest level the potential energy is maximum and K.E 'of the bob is minimum i.e. zero.



ENERGY CHANGES DURING SHM

In between extreme and mean position, the energy of the bob is partly potential and partly kinetic. But the total

energy remains the same.



SOME FEATURES OF SIMPLE HARMONIC MOTION.

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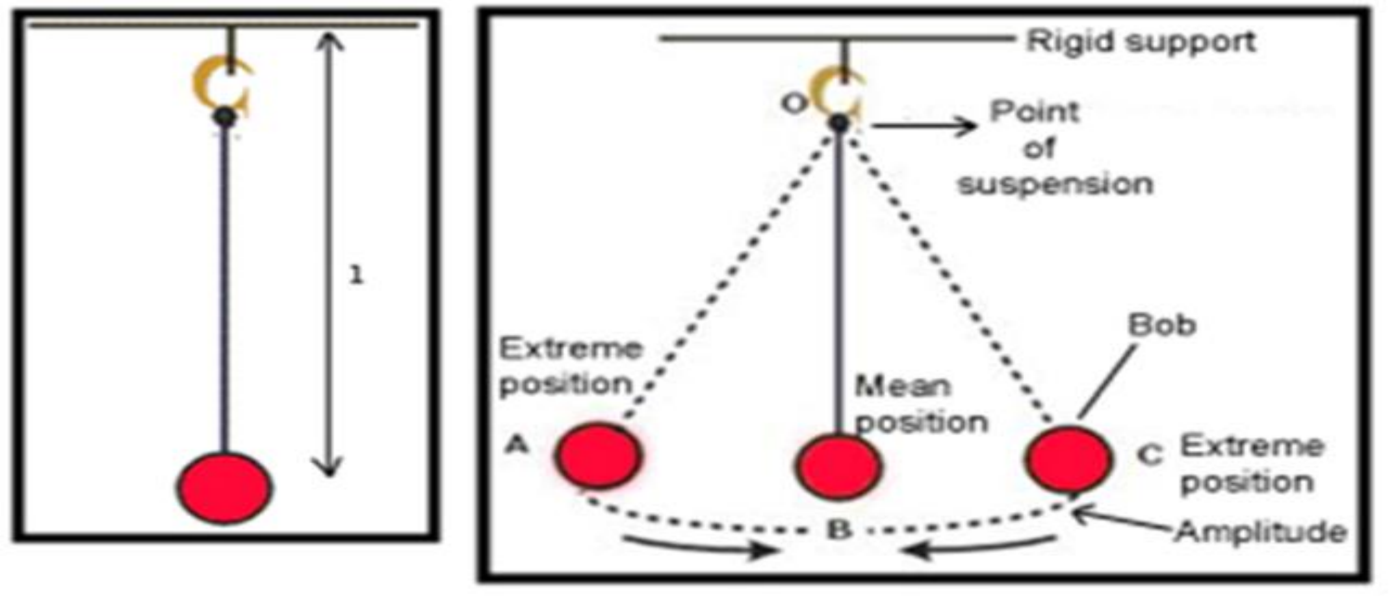
Important features of – SHM

- A body executing SHM always vibrates about a fixed position.
- Its acceleration is always directed towards the mean position.
- The magnitude of acceleration is always directly proportional to its displacement from mean position i.e. (Acc = 0, at mean position and maximum at extreme position)
- Its velocity will be maximum at mean position and zero at the extreme position.

TERMS OF SIMPLE HARMONIC MOTION

<u>Vibration:</u> One complete round trip of vibrating body about its mean position is called one vibration.



TIME PERIOD (T):

Time Period (T): The time taken by a vibrating body to complete one vibration. Its Unit is (sec).

For mass spring system:

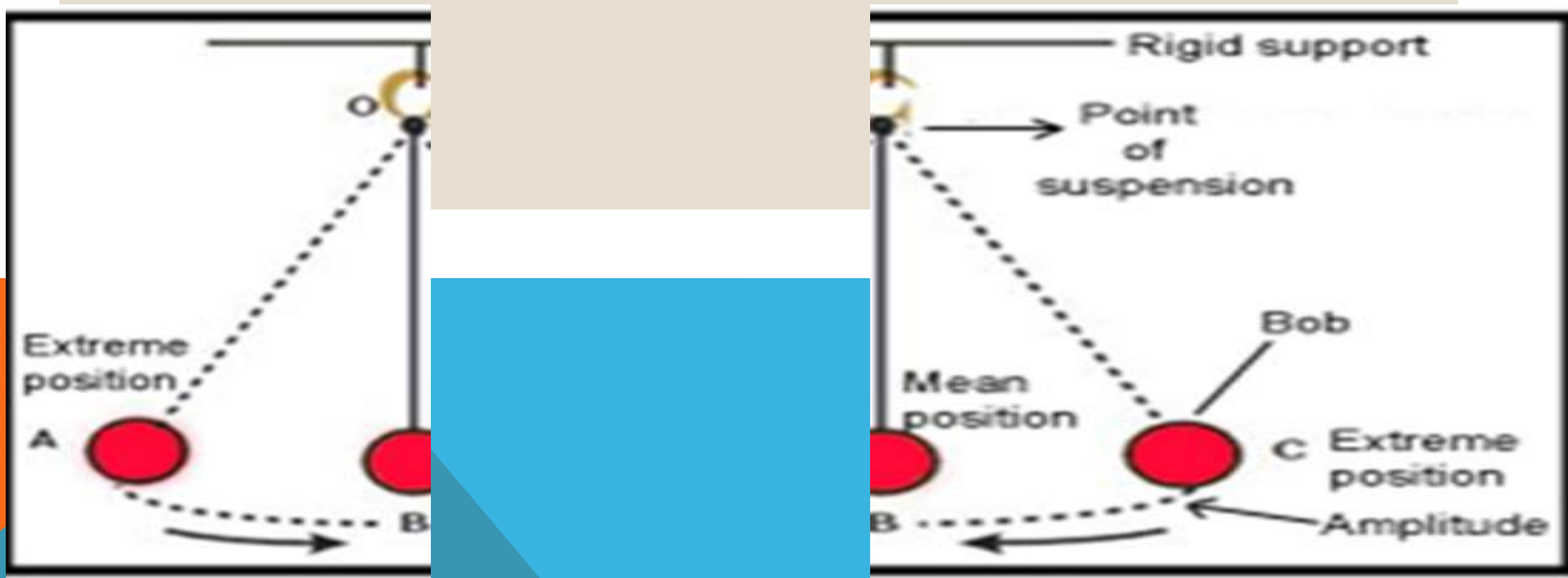
T = $2\pi\sqrt{(m/k)}$

For Simple Pendulum:

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

AMPLITUDE (A) :

The maximum displacement of a vibrating body on either side from its mean position.



FREQUENCY:

Number of vibrations or cycles completed in one second is called frequency . Its Unit is Hertz.

$$f = \frac{1}{T}$$

SI unit: cycle/second $= 1/s = s^{-1}$

A BALL IS DROPPED FROM A CERTAIN HEIGHT ONTO THE FLOOR AND KEEPS BOUNCING. IS THE MOTION OF THE BALL SIMPLE HARMONIC? EXPLAIN.

ANSWER

No, In case of a bouncing ball, when it hits the floor then there will be no restoring force or acceleration opposite to the downward displacement. So, it does not fulfill the Condition of simple harmonic motion. Secondly, in case of bouncing ball, the acceleration due to gravity remains the same, while for S.H.M the acceleration should vary at different points during the motion of the body.

A STUDENT PERFORMED TWO EXPERIMENTS WITH A SIMPLE PENDULUM. SHE/HE USED TWO BOBS OF DIFFERENT MASSES BY KEEPING OTHER PARAMETERS CONSTANT. TO HIS/HER ASTONISHMENT THE TIME PERIOD OF THE PENDULUM DID NOT CHANGE! WHY?

Answer: '

As we know that the time period of simple pendulum only depends upon the length of simple pendulum as given in its formula, i.e.

$$\boxed{T = 2\pi\sqrt{\frac{L}{g}}}$$

The value of ‘g’ will remain constant up to a certain height. So, by changing mass of

the bob or amplitude, there will be no effect on the time period, of simple pendulum.

PLENARY

- Simple pendulum consists of string and ....
- At extreme position potential energy will be ....(maximum /minimum)
- Kinetic energy will be maximum at mean position .   T/F.
- The distance on either side of mean position is called .... (area / amplitude)
- Frequency has formula ....

HOMEWORK

Write down the important features of simple harmonic motion.


STAY HOME!
STAY SAFE!

ALLAH HAFIZ