

MULTIPLE CHOICE QUESTIONS

Choose the correct answer from the following choices:

i) Which of the following is an example of simple harmonic motion?

- a)** Motion of a simple pendulum **b)** The motion of ceiling fan
c) The spinning of the Earth on its axis **d)** A bouncing ball on a floor

ii) If the mass of the bob of a pendulum is increased by a factor of 3, the period of the pendulum's motion will:

- a)** be increased by a factor of 2 **b)** remain the same
c) be decreased by a factor of 2 **d)** be decreased by a factor of 4

iii) Which of the following devices can be used to produce both a transverse and longitudinal wave?

- a)** a string **b)** a ripple tank
c) a helical spring (slinky) **d)** a tuning fork

iv) Waves transfer:

- a)** Energy **b)** frequency
c) wavelength **d)** velocity

v) Which of the following is a method of energy transfer?

Conceptual Questions

10. 1 If the length of a simple pendulum is doubled what will be the change in its time period?

Answer

Let the initial length of simple pendulum is ' l ', and after making it double, it becomes

' l' ', i.e. $l' = 2l$.

Time period of simple pendulum is given by,

$$T = 2\pi\sqrt{\frac{l}{g}} \dots\dots\dots(1)$$

And $T' = 2\pi\sqrt{\frac{l'}{g}}$

Or $T' = 2\pi\sqrt{\frac{2l}{g}}$

$$T' = \sqrt{2} \left[2\pi\sqrt{\frac{l}{g}} \right]$$

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

So, $T' = \sqrt{2}T$

$$T' = 1.41T$$

It shows that the time period of simple pendulum will increase by 1.41 times by making the length double.

10. 2 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 fulfil the condition of simple harmonic motion. Secondly, in case of bouncing ball, the acceleration due to gravity remains the same, while for SHM the acceleration should vary at different points during the motion of the body.

10. 3 A student performed two experiments with a simple pendulum. He/She 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

Time period of simple pendulum only depends upon the length of simple pendulum as given in its formula, i.e.

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

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.

10. 4 What type of waves do not require any material medium for their propagation?

Answer

Mechanical waves: like sound waves, water waves, waves produced in strings or springs etc.

10. 5 Plane waves in the ripple tank undergo refraction when they move from deep to shallow water. What change occurs in the speed of the waves?

Answer

In case of plane waves in the ripple tank when refraction takes place while moving from deep to shallow water. The speed of the wave is decreased due to decrease in wave length while frequency remains the same, as given by wave equation below.

$$v = f\lambda$$

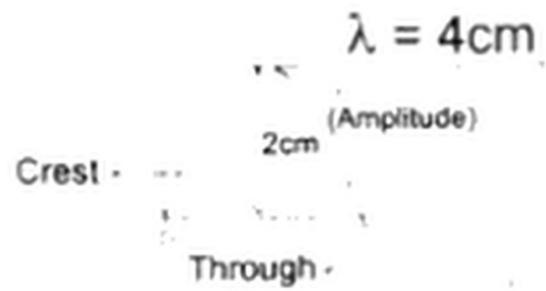
Review Questions

10. 2 Think of several examples in our daily life of motion that are simple harmonic?

Answer

1. Pendulum used in a clock.
2. A boy swinging on a swing.
3. See-saw; when his moved up & down.
4. Human ear drum oscillating back & forth.

10. 6 Draw a transverse wave with an amplitude of 2cm and a wavelength of 4cm. Label a crest and trough on the wave.

Answer

10.10 Does increasing the frequency of a wave also increase its wave length? If not, how are these quantities related?

Answer

No, by increasing frequency, the wave length decreases as given by the following relation,

$$v = f\lambda$$

Or

$$f = \frac{v}{\lambda}$$

Or

$$f \propto \frac{1}{\lambda} \quad (\text{for constant value of velocity})$$

[Note: The answer of the remaining questions is given in the topics.]

