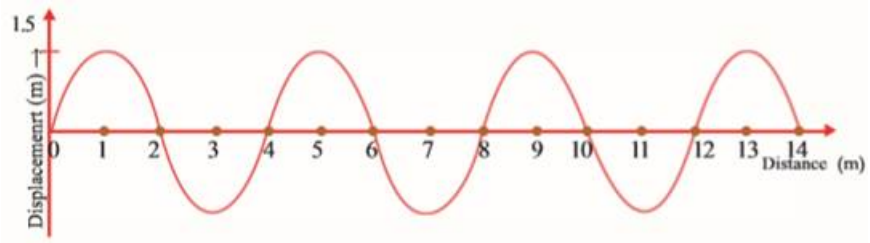
1. Wave motion

Let us Assess

1 A. Question

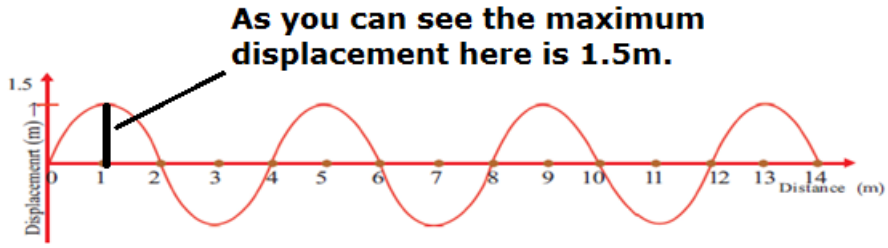
Observe the graph.



Find out the amplitude of the wave.

Answer

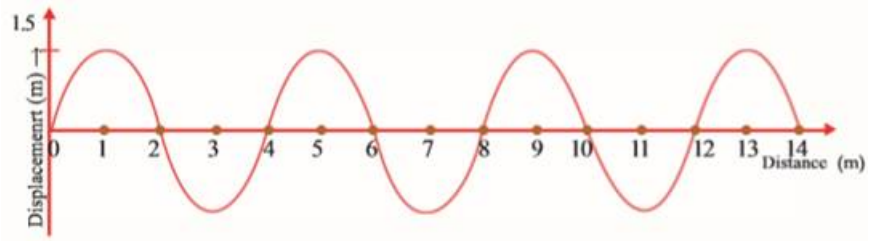
Amplitude: The amplitude of a wave is defined as the maximum displacement or deflection of the particle in the direction perpendicular to the direction of wave motion.



Hence amplitude = 1.5m.

1 B. Question

Observe the graph.



What is the speed of the wave if it travels 800 m in 2 s?

Answer

Speed: The speed is determined as the distance d travelled by an object in time t.

According to question: d = 800 m

t = 2 s

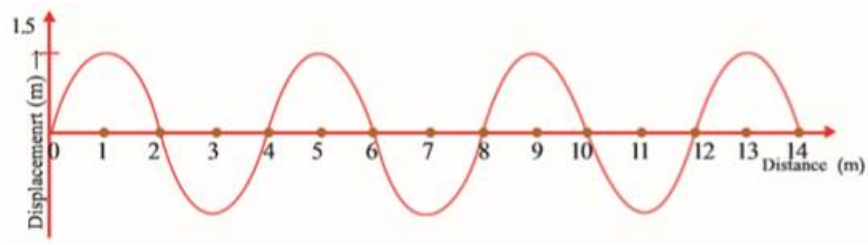
hence, speed $= \frac{\text{distance}}{\text{time}}$

$= \frac{800}{2}$

= 400 m/s

1 C. Question

Observe the graph.



What is the frequency of the wave?

Answer

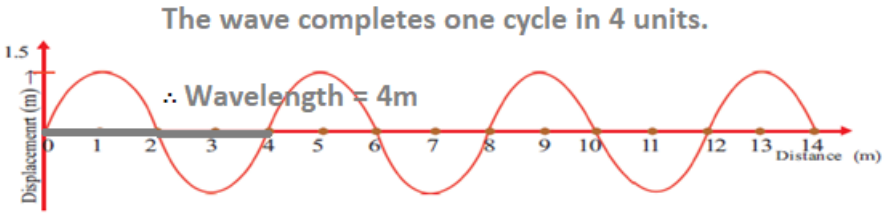
Frequency: It is defined as the rate of vibration constituting a wave or time taken by the number of vibration. That is mathematically it is the reciprocal of the time period of the one complete vibration of the wave.

S.I. unit = hertz

Formula used: $f = \frac{1}{T}$

also, we know that speed = wavelength × frequency

⇒ wavelength = 4 m {from the figure, because one complete cycle = wavelength, as shown below:)



$$\text{frequency} = \frac{400}{4} = 100 \text{ hertz}$$

2. Question

What do you mean by acoustics of buildings? Suggest four steps that can be taken, while constructing buildings, to avoid problems that may occur due to multiple reflection of sound.

Answer

Acoustics of buildings-It is the part of the engineering science which study or deals about problems or factors for the clear audibility of the buildings.

Four steps to avoid problems caused by multiple reflection:-

•Use of sound absorbing material for the construction of the building.

•Tight packing of the building for cancellation of the outer noise.

•Make the floor of the building/hall rough.

•The design of the ceiling matter the most, if one want to increase multiple reflection the ceiling should be curved while for less reflection ceilings should be flat.

3. Question

A sound signal from a ship floating on water, hits a rock at the bottom of the sea and comes back to the ship after 4 s. Calculate the distance of the rock from the surface of water. The speed of sound in water is estimated to be 1500 m/s.

Answer

Info. from the question:

Speed of sound = 1500 m/s

Time taken for to and fro round = 4 s

The time given in the question is of complete round of sound wave that is sending and receiving it back, so if we take distance between ship and rock = d then,

the total distance travelled = 2d

2d = speed× time

2d = 1500× 4

2d = 6000

d = 3000 m.[T1]

Hence, the distance between rock and ship = 3000 m.

Extended Activities

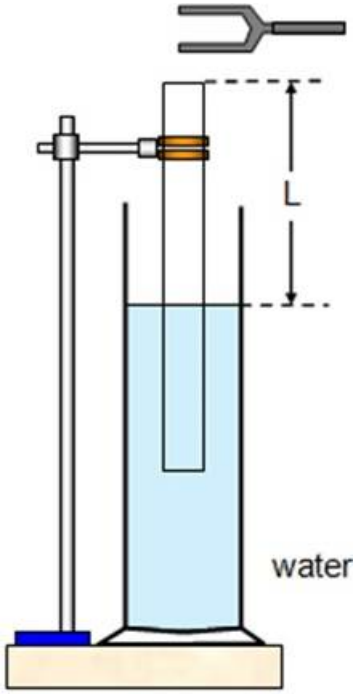
1. Question

Using plastic pipes make a device which resembles a resonance column and exhibit it in the science club.

Answer

Resonance is a stage of forced oscillation when the vibrating body drives another body to oscillate with greater amplitude at specific frequency.

As you excite a tuning fork of frequency 512Hz and raise the inner column simultaneously you will observe increase in the loudness of the sound because when frequency of the air column and fork are equal then there will be maximum sound produced as they will be in resonance.



2. Question

Visit a nearby cinema theatre, find out what has been done there in connection with acoustics of buildings and prepare a short note.

Answer

When I visited a nearby cinema theatre, I observed the following things:

•The ceiling of the theatre was in curved shape for the multiple reflection, so that everyone can hear the sound of the movie. As a curved ceiling results in the multiple reflection.

•The floor of the hall was little rough or the carpet used was not smooth, because after multiple reflection the sound need to be absorbed, if it is not absorbed it will mix up and will create a tragic with the next sound.

•The sound boards behind the screen was curved for multiple reflection so that everyone can hear the

sound.

3. Question

Study the role of the shape of a Veena in utilizing forced vibration and prepare a short note.

Answer

In the veena, the string is attached to the sound box of the veena, the vibrating string is capable of forcing the sound box into vibrating at that same natural frequency. The sound box in turn forces air particles inside the box into vibrational motion at the same natural frequency as the string. The entire system (string, veena, and enclosed air) begins vibrating and forces surrounding air particles into vibrational motion.

Hence the tendency of one object to force another adjoining or interconnected object into vibration motion is referred to as a forced vibration.

In the case of the veena, string is mounted to the sound box, the fact that the surface area of the sound box is greater than the surface area of the string means that more surrounding air particles will be forced into vibration. This causes an increase in the amplitude and thus loudness of the sound.