Important Questions for Class 11 Physics Chapter 14: Chapter 14 of Class 11 Physics, titled "Waves," explores the fundamental concepts of wave motion, including types of waves (mechanical and electromagnetic), wave parameters like amplitude, frequency, and wavelength, and the wave equation. The chapter covers sound waves, the speed of waves, and the principle of superposition.

It also introduces important topics such as reflection, refraction, interference, and standing waves. Understanding these concepts is essential for comprehending phenomena like sound propagation and resonance. Key formulas and concepts like the Doppler effect and the energy carried by waves are also discussed in this chapter.

Important Questions for Class 11 Physics Chapter 14 Overview

Chapter 14 of Class 11 Physics, "Waves," is crucial for understanding the behavior and properties of waves in different media. Important questions in this chapter cover topics such as wave motion, types of waves, wave parameters, and phenomena like interference, diffraction, and resonance.

These questions are vital for grasping the concepts of sound waves, Doppler effect, and wave equations. By practicing these questions, students build a solid foundation in wave theory, which is fundamental for higher physics topics, engineering applications, and understanding natural phenomena like sound propagation and light waves.

Important Questions for Class 11 Physics Chapter 14 Waves

Below is the Important Questions for Class 11 Physics Chapter 14 Waves -

1. Explosions on other planets are not heard on earth. Why?

Ans: Explosions on other planets are not heard on earth because there is no material medium between the earth and the planets over a long distance, and without a material medium for propagation, sound waves cannot travel.

2. Why longitudinal waves are called pressure waves?

Ans: Longitudinal waves are called pressure waves because the propagation of longitudinal waves through a medium consists of the variations in the volume and the pressure of the air, these variations in volume and air pressure result in the formation of compressions and rarefactions.

3. Why do tuning forks have two prongs?

Ans: The tuning fork has two prongs because the two prongs of a tuning fork produce resonant vibrations that help to keep the vibrations going for longer.

4. Velocity of sound increases on a cloudy day. Why?

Ans: Velocity of sound increases on a cloudy day, because the air is wet on a cloudy day, it contains a lot of moisture, the density of air is lower, and because velocity is inversely proportional to density, velocity increases.

5. Sound of maximum intensity is heard successively at an interval of 0.2 second on sounding two tuning fork to gather. What is the difference of frequencies of two tuning forks?

Ans: The beat period is 0.2 second so that the beat frequency is $\mathrm{fb} = \frac{1}{0.2} = 5\ \mathrm{Hz}$ Therefore, the difference of frequencies of the two tuning forks is $5\mathrm{HZ}$.

6. If two sound waves have a phase difference of 60^0, then find out the path difference between the two waves?

Ans, Phase difference, $\phi = 60^0 = \frac{\pi}{3}\mathrm{rad}$

Now, in general for any phase difference, (Φ), the path difference (x) :-

$$\phi = \frac{2\pi}{\pi}x$$

Given $\phi = \frac{\pi}{3}, x = ?$

$$\frac{\pi}{3} = \frac{2\pi}{\pi} \times x$$

$$x = \frac{\pi}{3} + \frac{2\pi}{\pi}$$

$$x = \frac{\pi}{3} \times \frac{\pi}{2\pi}$$

$$x = \frac{\pi m}{6}$$

7. If the displacement of two waves at a point is given by: -

$$\mathrm{Y}_1 = asin\mathrm{wt}$$

$$\mathrm{Y}_2 = \mathrm{an}\sin\left(wt + \frac{\pi}{2}\right)$$

Calculate the resultant amplitude?

Ans: Given data **:**

If $\mathbf{a}_1 =$ amplitude of first wave

$a_2 =$ amplitude of second wave

$a_r =$ resultant amplitude

$\phi =$ phase difference between 2 waves

Then,

$$\mathbf{a}_t = \sqrt{{a_1}^2 + {a_1}^2 + 2a_1a_2\cos\phi}$$

In our case,

$$\mathrm{a}_1 = a; \mathrm{a}_2 = a; \phi = \frac{\pi}{2}50$$

$$\mathrm{a}_t = \sqrt{a^2 + a^2 + 2a \times a\,\mathrm{Cos}\left(\frac{\pi}{2}\right)}$$

$$= \sqrt{2a^2} \quad \left(\because \mathrm{Cos}\left(\frac{\pi}{2}\right) = 0\right)$$

$$a_t = \sqrt{2a}$$

8.A hospital uses an ultrasonic scanner to locate tumors in a tissue. What is the wavelength of sound in the tissue in which the speed of sound is $1.7\ \mathrm{km}_5^{-1}$? The operating frequency of the scanner is $4.2\mathrm{MHz}$.

Ans: Given data :

Speed of sound in the tissue, $v = 1.7\ \mathrm{km/s} = 1.7 \times 10^3\ \mathrm{m/s}$

Operating frequency of the scanner, $\mathrm{v} = 4.2\mathrm{MHz} = 4.2 \times 10^5\ \mathrm{Hz}$

Now,

The wavelength of sound in the tissue is given as:

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

$$= \frac{1.7 \times 10^2}{4.2 \times 10^8} = 4.1 \times 10^{-4}\ \mathrm{m}$$

9. Given below are some functions of x and t to represent the displacement (transverse or longitudinal) of an elastic wave. State which of these represent (i) a traveling wave, (ii) a stationary wave or (iii) none at all:

(a) $y = 2\cos(3x)\sin(10t)$

(b) $y = 2\sqrt{x - 13}$

(c) $y = 3\sin(5x - 0.5n) + 4\cos(5x - 0.5t)$

(d) $y = \cos x \sin t + \cos 2x \sin 2t$

Ans: (a) It is a stationary wave because the harmonic terms are present individually in the equation, the preceding equation indicates a stationary wave kx and ωt appear separately in the equation.

(b) There is no harmonic term in the provided equation. As a result, it doesn't represent either a moving or stationary wave.

(c) The harmonic terms in the preceding equation describe a moving wave and are in the combination ofkx and $\omega t$are in the combination of $kx - \omega t$.

(d) The given equation represents a stationary wave because the harmonic terms kx and ωt appear separately in the equation. This equation actually represents the superposition of two stationary waves.

10. A narrow sound pulse (for example, a short pap by a whistle) is sent across a medium. (a) Does the pulse have a definite (i) frequency, (ii) wavelength, (iii) speed of propagation? (b) if the pulse rate is 1 after every $20\ \mathrm{s}$, (that is the whistle is blown for a split of second after every $20\ \mathrm{s}$), is the frequency of the note produced by the whistle equal to $\frac{1}{20}$ or $0.05\mathrm{Hx}$?

Ans: (a) No, the pulse doesn't have a definite .

(ii) No, It doesn't have frequency.

(iii) Yes, It have a wavelength.

(b) No, the frequency of the note produced by the whistle is not equal .

Explanation:

(a) There is no defined wavelength or frequency for the narrow sound pulse. However, the sound pulse's speed remains constant, i.e., it is equal to the speed of sound in that medium.

(b) The short pip produced after every 20 s does not mean that the frequency of the whistle is $\frac{1}{20}$ or $0.05\mathrm{H}$. It means that $0.06\mathrm{H}$ s is the frequency of the repetition of the pip of the whistle.

2 Marks Questions

1. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz source? will this source be in resonance with the pipe if both the ends are open?

Ans: Given data :

Length of pipe $= \mathrm{L} = 20 \text{ cm} = 0.2 \text{ m}$

Frequency of n^{th} node $= v_{\mathrm{n}} = 430 \text{ Hz}$

Velocity of sound $= \mathrm{v} = 340 \text{ m} \mid \mathrm{s}$

Now, v_n of closed pipe is :-

$$v_n = \frac{(2n-1)v}{4L}$$

$$430 = \frac{(2n-1) \times 340}{4 \times 0.2}$$

$$2n - 1 = \frac{430 \times 4 \times 0.2}{340}$$

$$2n - 1 = 1.02$$

$$2n = 1.02 + 1$$

$$2n = 2.02$$

$$n = 1.01$$

Hence, it will be the first normal mode of vibration, In a pipe, open at both ends We have ,

$$v_n = \frac{H \times \mathrm{V}}{2L} = \frac{\mathrm{A} \times 340}{2 \times 0.2} = 430 \quad \mathrm{So}, 430 = \frac{\mathrm{A} \times 340}{2 \times 0.2}$$

$$n = \frac{430 \times 2 \times 0.2}{340}$$

$$w = 0.5$$

As n has to be an integer, open organ pipe cannot be in resonance with the source.

2. Can beats be produced in two light sources of nearly equal frequencies?

Ans: No, because light emission is a random and fast occurrence, and we obtain uniform intensity instead of beats.

3. A person deep inside water cannot hear sound waves produces in air. Why?

Ans: Person deep inside water cannot hear sound produces in air because the speed of sound in water is roughly four times that of sound in air, refractive index is four times that of sound in air.

index $u = \frac{\text{Sin } i}{\sin r} = \frac{Va}{Vw} = \frac{1}{4} = 0.25$

For, refraction $r_{\max} = 90^0$, $i_{\max} = 90^0$, $i_{\max} = 14^0$.

Since $i_{\max} \neq r_{\max}$

Thus, Sounds are only reflected in the air, and people deep in the water are unable to hear them.

4. If the splash is heard 4.23 seconds after a stone is dropped into a well. 78.4 meters deep, find the velocity of sound in air?

Ans: Given data,

depth of$well = s = 78.4m$

Total time after which splash is heard $= 4.23$ s

Assume that,

If t_1 = time taken by stare to hit the water surface is the well

t_2 = time taken be splash of sound to reach the top of well.

then $t_1 + t_2 = 4.23\text{sec}$.

Now, for downward journey of stone;

$u = 0, a = 9.8m \mid s^2, s = 78.4m$

$\text{t} = \text{t1} = 2$

$$As, s = ut + \frac{1}{2}at^2$$

$$\therefore 78.4 = 0 + \frac{1}{2} \times 9.8 \times t_1^2$$

$$78.4 = 4.9t_1^2$$

$$t_1^2 = \frac{78.4}{4.9}$$

$$t_1^2 = 16$$

$$t_1 = \sqrt{16} = 4\text{sec}$$

Now, $t1 + t2 = 4.23$

$$4 + t_2 = 4.23$$

$$t_2 = 4.23 - 4.00$$

$$t_2 = 0.23 \text{ s}$$

If $\text{V} =$ velocity of sound in air.

$$\text{v} = \frac{\text{dis tan}\, ce(t)}{\text{tim}(t)} = \frac{78.4}{0.23} = 340.87 \text{ m} \mid \text{s}$$

5. How roar of a lion can be differentiated from bucking of a mosquito?

Ans: The roaring of a lion produces a low-pitched, high-intensity sound, but the buzzing of mosquitoes produces a high-pitched, low-intensity sound, and therefore the two noises may be distinguished.

6. The length of a sonometer wire between two fixed ends is 110 cm. Where the two bridges should be placed so as to divide the wire into three segments whose fundamental frequencies are in the ratio of 1: 2: 3?

Ans: Assume that,

$Let\ l_1, l_2$ and L_3 be the length of the three parts of the wire and

f_1, f_2 and t_3 be their respective frequencies.

Since,

T and m are fixed quantities, and 2 are constant

$$f = \frac{1}{2t}\sqrt{\frac{T}{m}}$$

$$f = \alpha\frac{1}{l}$$

$or\, f_1 =$ constant

$50, f_1 l_1 =$ Constant $\rightarrow (1)$

$f_2 l_2 =$ Constant $\rightarrow (2)$

$f_3 l_3 =$ Constant $\rightarrow (3)$

Equating equation 1), 2) & 3)

$f_1 l_1 = f_2 l_2 = f_3 l_3$

$$\text{Now}_n \text{l}_2 = \frac{f_1}{f_2} l_\text{I}$$

$$l_2 = \frac{1}{2} l_1 \Rightarrow (4) \left(\frac{f_1}{f_2} = \frac{1}{2} \right) G$$

$$\text{Also, } l_3 = \frac{f_1}{f_i} l_1$$

$$l_1 = \frac{1}{3} l_1 \left(\frac{f_1}{f_1} = \frac{1}{3} (\text{ given }) \right)$$

$$\text{Now, Total length} = 110 \text{ cm}$$

$$\text{1.e } \text{l}_1 + \text{l}_2 + \text{l}_3 = 110 \text{ cm}$$

$$l_1 + \frac{1}{2} l_1 + \frac{1}{3} l_1 = 110$$

$$\frac{11 \, l_1}{6} = 110$$

$$\text{i. e. } \text{l}_1 = 60 \text{ cm}$$

$$l_2 = \frac{l_1}{2}$$

$$l_2 = 30 \text{ cm}$$

$$l_2 = \frac{60}{2}$$

Now_

$$l_1 = \frac{l_1}{3} \quad l_3 = \frac{60}{3}$$

$$l_3 = 20 \text{ cm}$$

7. Why are all stringed instruments provided with hollow boxes?

Ans: The sound box is a hollow box that comes with stringed instruments. Forced vibrations are produced in the sound box when the strings are set into vibration. The enormous surface area of the sound box causes a big amount of air to vibrate. The result is a loud sound with the same frequency as the string.

8. We cannot hear echo in a room. Explain?

Ans: We all know that in order for an echo to be heard, the obstruction must be hard and vast in size. In addition, the obstruction must be at least a distance from the source. The parameters for the generation of Echo are not met since the length of the room is usually less than. As a result, there is no echo in the room.

9. Why do the stages of large auditoriums give curved backs?

Ans: The backs of big auditorium stages are curved because a speaker's voice is rendered parallel following reflection from a concave or parabolic seer face when he stands at or near the focal of a curved surface. As a result, the voice can be heard from afar.

10. Given two cases in which there is no Doppler effect in sound?

Ans: The two circumstances in which there is no Doppler effect in sound (i.e. no change in frequency) are as follows:

1) When both the sound source and the listener are moving in the same direction and at the same speed.

2) When one of the source listeners is in the circle's center and the other is travelling around it at a constant speed.

11. Explain why (or how):

(a) In a sound wave, a displacement node is a pressure antinode and vice versa,

(b) Bats can ascertain distances, directions, nature, and sizes of the obstacles without any "eyes",

(e) A violin note and sitar note may have the same frequency. yet we can distinguish between the two notes.

(d) Solids can support both longitudinal and transverse waves, but only longitudinal waves can propagate in gases, and

(e) The shape of a pulse gets distorted during propagation in a dispersive medium.

(a) A **node** is a point where the vibration is minimal and the pressure is highest, while an **antinode** is a point where the vibration is greatest and the pressure is lowest. So, a **pressure antinode** is essentially a **displacement node**, and vice versa.

(b) Bats produce ultrasonic sound waves at very high frequencies. When these waves hit obstacles, they bounce back. The bat uses its brain sensors to receive the reflected sound and calculate the distance, direction, size, and nature of the obstacle.

(c) The overtones of a sitar and a violin are different, as well as their intensity. This is why you can tell the difference between the sound of a sitar and a violin, even if they play the same note.

(d) **Shear modulus** refers to a property of solids that allows them to resist shearing forces. Fluids, on the other hand, give way to shearing forces because they don't have a fixed shape. **Transverse waves** create shearing stress in a medium and can only travel through solids, not gases. Solids and fluids also have different **bulk moduli**, which measure their ability to resist compressive forces.

Benefits of Using Important Questions for Class 11 Physics Chapter 14 Waves

Using Important Questions for Class 11 Physics Chapter 14 "Waves" offers several key benefits:

Conceptual Clarity: Helps reinforce understanding of fundamental wave concepts like wave motion, sound waves, and the Doppler effect.

Exam Readiness: Prepares you for exams by covering critical topics and frequently asked questions, ensuring you're well-prepared.

Enhanced Problem-Solving: Improves your ability to solve different types of problems related to waves, interference, and resonance.

Time Efficiency: Helps in efficient time management during exams by practicing under timed conditions.

Increased Confidence: Regular practice with these questions builds confidence, reducing exam anxiety and helping you perform better in assessments.