CBSE

WAVES WS 2

Class 11 - Physics

Section A

1. The ratio of the velocity of sound in hydrogen and oxygen at STP is: **[1]**

   a) 8 : 1 b) 4 : 1

   c) 16 : 1 d) 2 : 1

2. Two sound waves having a phase difference of 60^o have a path difference of: **[1]**

   a) 2λ b) $\frac{\lambda}{2}$

   c) $\frac{\lambda}{3}$ d) $\frac{\lambda}{6}$

3. A wave is expressed by the equation y = 0.5sinπ(0.01x - 3t) where x, y are in metres and t in seconds. The speed of propagation will be **[1]**

   a) 300 m/s b) 350 m/s

   c) 150 m/s d) 50 m/s

4. Sound waves of wavelength λ travelling in a medium with a speed of v m/s enter into another medium where its speed is 2v m/s. The wavelength of sound waves in the second medium is **[1]**

   a) 4λ b) 2λ

   c) $\frac{\lambda}{2}$ d) λ

5. An underwater sonar source operating at a frequency of 60 kHz directs its beam towards the surface. If the velocity of sound in air is 330 m/s, wavelength and frequency of the waves in air are **[1]**

   a) 330 m, 60 kHz b) 5.5 mm, 60 kHz

   c) 5.5 mm, 80 kHz d) 5.5 mm, 30 kHz

6. The equation of a progressive wave can be given by y = 15 $\sin(660\pi t - 0.02\pi x)$ cm. The frequency of the wave is **[1]**

   a) 365 Hz b) 342 Hz

   c) 330 Hz d) 660 Hz

7. Fundamental frequency of sonometer wire is n. If the length, tension and diameter of wire are tripled, the new fundamental frequency is **[1]**

   a) $\frac{n}{\sqrt{3}}$ b) $n\sqrt{3}$

   c) $\frac{n}{3\sqrt{3}}$ d) $\frac{n}{3}$

8. A 5.5 metre length of string has a mass of 0.035 kg. If the tension in the string in 77 N, the speed of a wave on the string is **[1]**

   a) 77 ms^{-1} b) 110 ms^{-1}

c) 165 ms^{-1} d) 102 ms^{-1}

9. A transverse wave is described by the equation y = y_0 sin 2π(ft - $\frac{x}{\lambda}$). The maximum particle velocity is equal to four times the wave velocity if: **[1]**

a) $\lambda = \frac{\pi y_0}{2}$ b) $\lambda = \pi y_0$

c) $\lambda = 2\pi y_0$ d) $\lambda = \frac{\pi y_0}{4}$

10. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is 10° C . If the temperature rises to 30°C the sound wave travels between the same fixed points in **[1]**

a) 2.2 sec b) 2.0 sec

c) 2.1 sec d) 1.9 sec

11. The equation of a simple harmonic wave is given by y = 3sin $\frac{\pi}{2}$(50t - x) where x and y are in metres and t is in seconds. The ratio of maximum particle velocity to the wave velocity is **[1]**

a) $\frac{2}{3}\pi$ b) 2π

c) $\frac{3}{2}\pi$ d) 3π

12. Equation of progressive wave is given by $y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{\pi}{6}\right]$ where y, x are in cm and t is in second. Then which of the following is correct? **[1]**

a) f = 50 Hz b) A = 0.04 cm

c) λ = 18 m d) v = 5 cm/sec

13. A wave equation is given by **[1]**
$y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9} + \frac{1}{6}\right)\right]$
where, x is in cm and t is in second. The wavelength of the wave is

a) 18 cm b) 6 cm

c) 9 cm d) 36 cm

14. The tension in vibrating stretched piano wire is 10 N. To double the frequency, the tension in wire must be **[1]**

a) 80 N b) 5 N

c) 20 N d) 40 N

15. **Assertion (A):** The speed of a wave is the ratio of wavelength and time period. **[1]**
Reason (R): Wavelength is the distance between two nearest particles in phase.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

16. **Assertion (A):** In wave motion, energy is transferred from one position to another in a material medium. **[1]**
Reason (R): In wave motion, particles of a medium move from one position to another.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

17. **Assertion (A):** If two waves of same amplitude, produce a resultant wave of same amplitude, then the phase **[1]**

difference between them will be 120^o.

Reason (R): The resultant amplitude of two waves is equal to sum of amplitude of two waves.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

18. **Assertion (A):** We can recognise our friends by listening to their voices. **[1]**

Reason (R): The quality of sound produced by different persons are different.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

19. **State True or False:** **[1]**

(a) A wave is represented by the equation 0.5sin(10t + x). It is a travelling wave propagating along +x direction with a velocity of $10ms^{-1}$. **[1]**

20. Two wires of the same material are stretched with the same force. Their diameters are 1.2 mm and 1.6 mm, while their lengths are 90 cm and 60 cm respectively. If the frequency of vibrations of first is 256 Hz, find that of the other. **[1]**

21. The displacement of an elastic wave is given by the function $y = 3\sin\omega t + 4\cos\omega t$ where, y is in cm and t is in second. Calculate the resultant amplitude. **[1]**

22. In which medium, do the sound waves travel faster, solids, liquids, or gases? Give reason. **[1]**

23. The phase difference between the vibrations of two medium particles due to the transmission of a wave is $\frac{2\pi}{3}$. The distance between the particles is 15 cm. Determine the wavelength of the wave. **[1]**

24. Sound waves from a point source are propagating in all directions. What will be the ratio of amplitudes at distances of x meter and y meter from the Source? **[1]**

25. If the displacement of two waves at a point is given by:- **[1]**

Y_1 = a sin ωt

$Y_2 = a\sin\left(\omega t + \frac{\pi}{2}\right)$

Calculate the resultant amplitude?

26. An incident wave is represented by y (x, t) = 20 sin (2x - 4t). Write the expression for reflected wave: **[1]**

i. from a rigid boundary.

ii. from an open boundary.

27. Do displacement, particle velocity and pressure variation in a longitudinal wave vary with the same phase? **[1]**

Section B

28. **Fill in the blanks:** **[2]**

(a) The velocity of sound in air increases by _____ cm s^{-1} for every 1°C rise of temperature. **[1]**

(b) The equation y = 0.05 sin2π(0.1π + 2f) represents a wave in which the distances are in metres and time in seconds, the wave speed is _____ ms^{-1}. **[1]**

29. A cord 80 cm long is stretched by a load of 8.0 kg f. The mass per unit length of the cord is 4.0×10^{-5}kg m^{-1}. Find **[2]**

i. speed of the transverse wave in the cord and

ii. frequency of the fundamental and that of the second overtone

30. Equation of a plane progressive wave is given by y =0.6sin2$\pi\left(t-\frac{x}{2}\right)$. On reflection from a denser medium, its amplitude becomes 2/3 of the amplitude of incident wave. What will be the equation of reflected wave? **[2]**

31. Write the equation of a progressive wave propagating along the positive x-direction, whose amplitude is 5 cm, frequency 250 Hz and velocity 500 ms^{-1}. **[2]**

32. A vibrating body with constant frequency sends waves 0.20 m long through the medium A and 0.25 m long through medium B. If velocity of waves in medium A is 280 ms^{-1}, what is the velocity of the waves in medium B? **[2]**

33. The displacement y of a particle in a medium can be expressed as y = 10^{-6} sin (100t + 20x + $\frac{\pi}{2}$). Where t is in second and x in metre. What is the speed of the wave? **[2]**

Section C

34. From the equation y - A sin $\frac{2\pi}{\lambda}(vt-x)$, establish the relation between particle velocity and wave velocity. **[3]**

35. A wave travelling along a string is described by y(x ,t) = 0.005sin(80.0x -3.0t) in which the numerical constants are in SI units (0.005 m, 80.0 rad m^{-1} and 3.0 rad s^{-1}). Calculate **[3]**

    a. the amplitude of particle,
    b. the wavelength and
    c. the period and frequency of the wave. Also, calculate displacement y of the particle at a distance x = 30.0 cm and time t = 20s?

36. The equation of a wave is given by y = 6 sin 10πt + 8 cos 10πt, where y is in centimetre and t in second. Determine the constants involved in the standard equation of the wave. **[3]**

Section D

37. A travelling harmonic wave on a string is described by y(x, t) = 7.5 sin(0.0050x + 12t + $\frac{\pi}{4}$) **[5]**

    a. What are the displacement and velocity of oscillation of a point at *x* = 1 cm, and *t* = 1 s? Is this velocity equal to the velocity of wave propagation?
    b. Locate the points of the string which have the same transverse displacements and velocity as the *x* = 1 cm point at *t* = 2s, 5s and 11s.

38. In the given progressive wave, y = 5 sin (100 πt -0.47 πx) Where y and x are in m, t is in seconds. What is the, **[5]**

    i. amplitude
    ii. wavelength
    iii. frequency
    iv. wave velocity
    v. particle velocity amplitude?

39. For the harmonic travelling wave y = 2 cos 2π (10t - 0.0080x + 3.5) where x and y are in cm and t is in second. What is the phase difference between the oscillatory motion at two points separated by a distance of **[5]**

    a. 4 m
    b. 0.5 m
    c. 2λ
    d. 34λ (at a given instant of time)
    e. What is the phase difference between the oscillation of a particle located at x = 100cm, at t = T s and t = 5 s?