NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS

CLASS :- 11th **PAPER CODE :- CWT-14**

CHAPTER :- MECHANICAL WAVES

ANSWER KEY

1.	(C)	**2.**	(A)	**3.**	(D)	**4.**	(A)	**5.**	(A)	**6.**	(D)	**7.**	(C)
8.	(B)	**9.**	(D)	**10.**	(D)	**11.**	(A)	**12.**	(B)	**13.**	(C)	**14.**	(B)
15.	(B)	**16.**	(B)	**17.**	(D)	**18.**	(C)	**19.**	(D)	**20.**	(A)	**21.**	(D)
22.	(C)	**23.**	(A)	**24.**	(C)	**25.**	(D)	**26.**	(C)	**27.**	(D)	**28.**	(C)
29.	(C)	**30.**	(C)	**31.**	(C)	**32.**	(C)	**33.**	(C)	**34.**	(A)	**35.**	(A)
36.	(B)	**37.**	(A)	**38.**	(C)	**39.**	(A)	**40.**	(A)	**41.**	(A)	**42.**	(C)
43.	(A)	**44.**	(A)	**45.**	(A)	**46.**	(A)	**47.**	(B)	**48.**	(B)	**49.**	(A)
50.	(A)												

SOLUTIONS

SECTION-A

1. (C)

2. (A)

Sol. $\omega = 400\pi = 2\pi f$

3. (D)

Sol. $\because\ \omega = \frac{2\pi}{0.01}$, $K = \frac{2\pi}{0.3}$

$\frac{\omega}{v} = k \Rightarrow$ $v =$ SS $= \frac{2\pi}{0.01}\times\frac{0.3}{2\pi}$

$v = 30$ units

4. (A)

Sol. $f_1\,\lambda_1 = f_2\,\lambda_2$

$(300)\,(1) = (f_2)\,(1.5)$

$200\text{ Hz} = f_2$

5. (A)

Sol. $\frac{T}{4} = 0.17$ sec

$T = 0.17 \times 4 = 0.68$ sec.

$f = \frac{1}{T} = \frac{1}{0.68} = \frac{100}{68} = 1.47$ Hz

6. (D)

Sol. The standard wave equation is

$y = a\sin(\omega t - kx)$

The given wave equation is

$y = a\sin\left(100t - \frac{x}{10}\right)$

Compare it with the standard wave equation we obtain

$\omega = 100,\ k = \frac{1}{10}$

Velocity of the wave,

$v = \frac{\omega}{k} = \frac{100}{\frac{1}{10}} = 100 \times 10 = 1000$ m/s

7. (C)

Sol Both tranel same distance

So

$4.5 \times t = 8 \times (t - 4 \times 60)$

$\frac{8}{4.5} = \frac{t}{4t - 240}$

$\frac{8}{3.5} = \frac{t}{240}$

$t = 240 \times \frac{80}{315}$ sec

distance $= 4.5 \times 240 \times \frac{80}{35}$ km

$= \frac{45 \times 24 \times 80}{35}$

$= 2468.57$ km

$= 2500$ km

8. (B)

Sol. $y = 0.0015\sin(316 + 62.8x)$

$\because\ = K\ \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{\lambda} = \frac{2\pi}{62.8} = \frac{3.14 \times 2}{62.8}$

$= \frac{6.28}{628} = \frac{1}{10} = 0.1$

$= 0.1$ unit

Ans (B) is correct

9. (D)

Sol. $y = y_0 \sin\frac{2\pi}{\lambda}(vt - x)$

given

$A\omega = 2 \times v$

$A\,.\ \frac{\omega}{v} = 2$

$A\,.\ \frac{2\pi}{\lambda} = 2$

$\lambda = \pi A$

$\lambda = \pi y_0$

10. (D)

Sol. Speed of sound

$$\upsilon = \sqrt{\left\{\frac{\gamma RT}{M}\right\}} \propto \sqrt{T}$$

$$\therefore \quad \frac{\upsilon_2}{\upsilon_1} = \sqrt{\frac{T_2}{T_1}}$$

Given $\frac{\nu_2}{\nu_1} = 3 \quad \therefore 3 = \sqrt{\frac{T_2}{T_1}}$ or $\frac{T_2}{T_1} = 9$

$\Rightarrow \quad T_2 = 9T_1$

Here : $T_1 = 0°C = 273$ K

$\therefore \quad T_2 = 9 \times 273$ K

= 2457 K

= (2457 – 273)°C

= 2184°C

11. (A)

Sol. $\omega = 2\pi \times f = 2\pi \times \frac{1}{0.04}$

$f = \frac{100}{4} = 25$ Hz

acceleration $= -\omega^2 y$

maximum acceleration $= -\omega^2 A$

$= \left(\frac{2\pi}{0.04}\right)^2 \times 3 = 7.5 \times 10^4 \text{ cm/s}^2$

12. (B)

Sol. Frequency of tuning fork decreases with temperature.

13. (C)

14. (B)

Sol. Speed of sound in a gas is given by :

$$v = \sqrt{\frac{\gamma RT}{M}}$$

$$v \; \mu \; \frac{1}{\sqrt{M}}$$

$$\therefore \quad \frac{v_1}{v_2} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{m_2}{m_1}}$$

Here $\gamma = \frac{C_p}{C_v} = \frac{5}{3}$ for both the gases $\left(\gamma_{monoatomic} = \frac{5}{3}\right)$.

15. (B)

Sol. On increasing the temperature of sound by 1°C, its velocity increases by 0.6 m/s.

16. (B)

17. (D)

Sol. In the interference the energy is redistributed and the distribution remains constant in time

18. (C)

Sol. $V_{max} = A\omega = 5 \quad \Rightarrow \quad A\,\frac{2\pi}{4} = 5$

$\Rightarrow \quad A = \frac{10}{\pi}$ cm.

19. (D)

Sol. Let intensity of sound be I and I' Loudness of sound initially

$$\beta_1 = 10 \log\left(\frac{I}{I_0}\right)$$

Later $\quad \beta_2 = 10 \log\left(\frac{I'}{I_0}\right)$

Given $\quad \beta_2 - \beta_1 = 20$

$\therefore \quad 20 = 10 \log\left(\frac{I'}{I}\right)$

$\therefore \quad I' = 100\, I$

20. (A)

Sol. In transverse waves, particles of the medium vibrate in a direction of perpendiculars of the wave.

21. (D)

Sol. By defination

22. (C)

Sol. $y_1 = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$y_2 = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$\phi = \omega t + \frac{\pi}{2} - \omega t + \frac{\pi}{6} = \frac{\pi}{2} - \frac{\pi}{6}$

$A = \sqrt{a^2 + a^2 + 2a.a.\cos\left(\frac{\pi}{2} - \frac{\pi}{6}\right)}$

$= a\sqrt{1+1+1} = \sqrt{3}a$

23. (A)

Sol. When a sound wave gets reflected from a rigid boundary, the particles at the boundary are unable to vibrate. Thus, a reflected wave is generated which interferes with the oncoming wave to produce zero displacement at the rigid boundary. At these points (zero displacement), the pressure variation is maximum. Thus, a reflected pressure wave has the same phase as the incident wave.

24. (C)
Sol. The frequency and amplitude of the resultant wave will depends upon the phase angle.

25. (D)
Sol. v = dist × time

$2d = \text{dist} = \frac{v}{1}$

$d = \frac{v}{2} = \frac{332}{2} = 166$ M.

ANS . 4

26. (C)
Sol. $v = f\lambda \quad = \frac{54}{60} \times 10$

= 9 m/sec.

27. (D)
Sol. f = 660 Hz , v = 330 m/s

$w = 2\pi f = 1320\ \pi$ radus

particles amplitude will be maximum

M– $d = \frac{\pi}{4} = \frac{330}{660} \times \frac{1}{4}$

$= \frac{1}{8} = 0.125$ m

28. (C)
Sol. $K = 0.025\ \pi = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\text{cm}}{0.025}$

Required length = $\frac{\lambda}{2} = \frac{1}{0.025} = 40$ cm

29. (C)
Sol. $n_1; n_2; n_3 = 1 : 2 : 3$

$\frac{V}{\lambda_1} : \frac{V}{\lambda_2} : \frac{V}{\lambda_3} = 1 : 2 : 3$

$\lambda_1 : \lambda_2 : \lambda_3 = 1 : \frac{1}{2} : \frac{1}{3}$

30. (C)
Sol. $f \propto \sqrt{T}$

⇒ To double the frequency tension should be increased 4 times.

31. (C)
Sol. Now the tube becomes a closed pipe with length $\ell/2$.

fundamental freqeuncy = $\frac{v_{sound}}{4(\ell/2)}$

$= \frac{v_{sound}}{2\ell}$

which is the fundamental frequency of the original open pipe.

32. (C)
Sol. $7I_0 = I_0 + 9I_0 + 2 \times I_0 \times 3 . \cos\Delta\phi$

$-3I_0 = 6I_0 . \cos\Delta\phi$

$\cos\Delta\phi = -\frac{1}{2} = \cos 120°$

33. (C)
Sol. $\lambda = 50\ \lambda/4 \Rightarrow \lambda = 200$ cm.

next vesonatiy lenth = $3 \times \frac{\lambda}{4}$

$= 3 \times \frac{200}{4}$

= 150 cm

34. (A)
Sol. Wave is pulted at 25 cm from one end. this point becomes antinode.

$\frac{\lambda}{4} = 25$ cm

$\Rightarrow \quad \lambda = 1$ m

$V = \sqrt{\frac{T}{\mu}} = 200$ m/s

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

= 200 Hz

35. (A)
Sol. In organ pipes waves produced are longitudinal and stationary.

SECTION-B

36. (B)
Sol. $k = \pi$

$k = \frac{2\pi}{\lambda} = \pi$

$\lambda = 2$ cm

37. (A)
Sol. Avoiding end correction, the length of closed organ pipe is

$\ell_2 = \frac{\lambda_1}{4}$ or $\lambda_1 = 4\ell_1$

The length of open organ pipe is

$\ell_2 = \frac{\lambda_2}{2}$ or $\lambda_2 = 2\ell_2$

Here $n_1 = n_2$

$\Rightarrow \quad \frac{v}{\lambda_1} = \frac{v}{\lambda_2}$

or $\frac{v}{4\ell_1} = \frac{v}{4\ell_2}$

Therefore, $\ell_1 : \ell_2 = 1 : 2$

38. (C)

Sol. $\frac{I_1}{I_2} = \frac{9}{1}$

$\frac{A_1}{A_2} = \frac{3}{1}$

$\frac{I_{max}}{I_{min}} = \frac{4^2}{2^2} = \frac{4}{1}$

39. (A)

Sol. $f_1\ f_2\ f_3 \ldots\ldots\ldots f_{151}, f_{16}$

a, aed , a × 2d . a + 15d

2a = (a+15d)

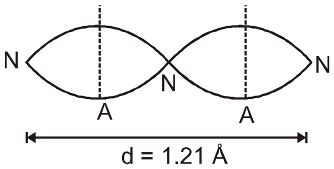
a = 15d ∵ d = 8

a = 15 × 8 =120Hz

40. (A)

Sol. 3 = Nodes , 2 = antinodes ,

distance = 1.21 Å



No. of loops = 2

λ = 1.21 Å

41. (A)

Sol. Beats

Frequency of timing for 512 Hz Frequency of sonomete wire either 512 + 6 or 512 – 6

As tersion increas Frequency of sonometre wire increase n α $\sqrt{T}$

No. of beat reduces. so that Frequency of sonometa wire is = 512 – 6 = 506 Hz

42. (C)

Sol. Energy $\propto A^2\ \omega^2$

$\therefore\ \frac{E_1}{E_2} = \frac{A^2\omega^2}{A^2(2\omega)^2}$

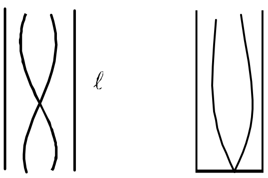
$\therefore\ E_2 = 4E_1$

43. (A)

Sol. 256 + n = 262 – 2n

3n = 6

n = 2



$\eta_1 = \frac{V}{2\ell}$ $\eta_2 = \frac{V}{4\ell}$

no. of beat heard $n_1 - n_2 = \frac{V}{4\ell} = 4$

if length pipes are doubled. no of beats heard $n_1^1 - n_2^1 = \frac{V}{8\ell} = \frac{4}{2} = 2$

44. (A)

Sol. $f = \frac{1}{2\ell}.\sqrt{\frac{T}{\mu}}$

$f \propto \frac{1}{\ell}$ ⇒ %f = –%ℓ

⇒ % change in frequency = 1%

45. (A)

Sol. $f_1 - f_2 = 12 = v1\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)$

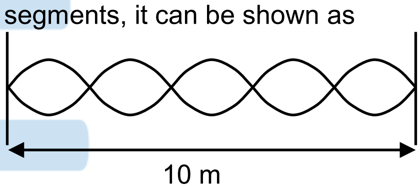
$v = 12 \times \frac{\lambda_1\ \lambda_2}{\lambda_2 - \lambda_1}$

$= 12 \times \frac{50 \times 51}{f} \times 10^{-2}$

= 306 m/s

46. (A)

Sol. As standing waves are produced in the string and the string is vibrating in 5 segments, it can be shown as



$\therefore\ 5\frac{\lambda}{2} = 10$

$\Rightarrow \lambda = 4$ m

Given the velocity of the wave v = 20 m/s

∴ Frequency 1

47. (B)

Sol. Maximum difference in frequencies to hear beats = 15 Hz

48. (B)

49. (A)

Sol. k = 9 ω = 450

$\therefore\ v = \frac{\omega}{k} = 50$ m/s

$v = \sqrt{\frac{T}{\mu}}$

$\therefore\ T = \mu v^2 = 50^2 \times 5 \times 10^{-3} = 12.5$N

50. (A)