# DPP - Daily Practice Problems

Name : 　　　　　　　　　　　Date :

Start Time : 　　　　　　　　End Time :

# PHYSICS 29

**SYLLABUS :** Waves-1 (Wave motion, longitudinal and transverse waves, speed of a wave, displacement relation for a progressive wave, principle of superposition of waves, reflection of waves)

**Max. Marks : 116** **Time : 60 min.**

**GENERAL INSTRUCTIONS**

- The Daily Practice Problem Sheet contains 29 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

**DIRECTIONS (Q.1-Q.20) :** There are 20 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

**Q.1** A tuning fork makes 256 vibrations per second in air. When the velocity of sound is 330 m/s then wavelength of the tone emitted is

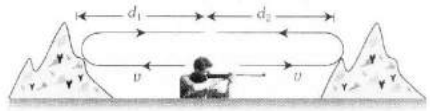
(a) 0.56 m (b) 0.89 m (c) 1.11 m (d) 1.29 m

**Q.2** In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.170 second. The frequency of the wave is

(a) 1.47Hz (b) 0.36 Hz (c) 0.73 Hz (d) 2.94 Hz

**Q.3** A man is standing between two parallel cliffs and fires a gun. If he hears first and second echoes after 1.5 s and 3.5s respectively, the distance between the cliffs is (Velocity of sound in air = 340 $ms^{-1}$)

(a) 1190 m
(b) 850 m
(c) 595 m
(d) 510 m




**Q.4** $v_1$ and $v_2$ are the velocities of sound at the same temperature in two monoatomic gases of densities $\rho_1$ and $\rho_2$ respectively. If $\rho_1/\rho_2 = \frac{1}{4}$ then the ratio of velocities $v_1$ and $v_2$ will be

(a) 1 : 2 (b) 4 : 1 (c) 2 : 1 (d) 1 : 4

**Q.5** A wave of frequency 500 Hz has velocity 360 m/sec. The distance between two nearest points 60° out of phase, is

(a) 0.6 cm (b) 12 cm (c) 60 cm (d) 120 cm

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**Q.6** Two waves are given by $y_1 = a\sin(\omega t - kx)$ and $y_2$ = a cos ($\omega$t – kx). The phase difference between the two waves is

(a) $\frac{\pi}{4}$ (b) $\pi$ (c) $\frac{\pi}{8}$ (d) $\frac{\pi}{2}$

**Q.7** The relation between time and displacement for two particles is given by

$y = 0.06\sin 2\pi(0.04t + \phi_1), y_2 = 0.03\sin 2\pi(1.04t + \phi_2)$

The ratio of the intensities of the waves produced by the vibrations of the two particles will be

(a) 2 : 1 (b) 1 : 2 (c) 4 : 1 (d) 1 : 4

**Q.8** A transverse wave is described by the equation $Y = Y_0 \sin 2\pi\left(ft - \frac{x}{\lambda}\right)$. The maximum particle velocity is four times the wave velocity if

(a) $\lambda = \frac{\pi Y_0}{4}$ (b) $\lambda = \frac{\pi Y_0}{2}$

(c) $\lambda = \pi Y_0$ (d) $\lambda = 2\pi Y_0$

**Q.9** Which one of the following does not represent a travelling wave?

(a) $y = \sin(x - vt)$ (b) $y = y_m \sin k(x + vt)$

(c) $y = y_m \log(x - vt)$ (d) $y = f(x^2 - vt^2)$

**Q.10** The path difference between the two waves $y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$ is

(a) $\frac{\lambda}{2\pi}\phi$ (b) $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

(c) $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$ (d) $\frac{2\pi}{\lambda}\phi$

**Q.11** A transverse wave is represented by the equation

$y = y_0 \sin \frac{2\pi}{\lambda}(vt - x)$, Here $v$ = wave velocity

For what value of $\lambda$, the maximum particle velocity equal to two times the wave velocity

(a) $\lambda = 2\pi y_0$ (b) $\lambda = \pi y_0 / 3$

(c) $\lambda = \pi y_0 / 2$ (d) $\lambda = \pi y_0$

**Q.12** The equation of a plane progressive wave is given by $y = 0.025\sin(100t + 0.25x)$. The frequency of this wave would be

(a) $\frac{50}{\pi}$Hz (b) $\frac{100}{\pi}$Hz (c) 100Hz (d) 50Hz

**Q.13** A wave travelling in positive X-direction with A = 0.2m has a velocity of 360 m/sec. If $\lambda$ = 60m, then correct expression for the wave is

(a) $y = 0.2\sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$ (b) $y = 0.2\sin\left[\pi\left(6t + \frac{x}{60}\right)\right]$

(c) $y = 0.2\sin\left[2\pi\left(6t - \frac{x}{60}\right)\right]$ (d) $y = 0.2\sin\left[\pi\left(6t - \frac{x}{60}\right)\right]$

**Q.14** The equation of a wave is given as $y = 0.07\sin(12\pi x - 3000\pi t)$. where $x$ is in metre and $t$ in sec, then the correct statement is

(a) $\lambda = 1/6\text{m}, v = 250$ m/s (b) $a = 0.07\text{m}, v = 300\text{m/s}$

(c) $n = 1500, v = 200$ m/s (d) None

**Q.15** The equation of a progressive wave is given by $y = 0.5\sin(20x - 400t)$ where $x$ and $y$ are in metre and $t$ is in second. The velocity of the wave is

(a) 10 m/s (b) 20 m/s (c) 200 m/s (d) 400 m/s

**Q.16** There is a destructive interference between the two waves of wavelength $\lambda$ coming from two different paths at a point. To get maximum sound or constructive interference at that point, the path of one wave is to be increased by

(a) $\frac{\lambda}{4}$ (b) $\frac{\lambda}{2}$

(c) $\frac{3\lambda}{4}$ (d) $\lambda$

**Q.17** If two waves of same frequency and same amplitude on superimposition produced a resultant disturbance of the same amplitude, the waves differ in phase by

(a) $\pi$ (b) $2\pi/3$ (c) $\pi/2$ (d) zero

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| | 11. ⓐⓑⓒⓓ | 12. ⓐⓑⓒⓓ | 13. ⓐⓑⓒⓓ | 14. ⓐⓑⓒⓓ | 15. ⓐⓑⓒⓓ |
| | 16. ⓐⓑⓒⓓ | 17. ⓐⓑⓒⓓ | | | |

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**Q.18** Equation of motion in the same direction is given by $y_1 = A\sin(\omega t - kx)$, $y_2 = A\sin(\omega t - kx - \theta)$. The amplitude of the medium particle will be

(a) $2A\cos\frac{\theta}{2}$ (b) $2A\cos\theta$

(c) $\sqrt{2}A\cos\frac{\theta}{2}$ (d) $\sqrt{2}A\cos\theta$

**Q.19** The amplitude of a wave, represented by displacement equation $y = \frac{1}{\sqrt{a}}\sin\omega t \pm \frac{1}{\sqrt{b}}\cos\omega t$ will be

(a) $\frac{a+b}{ab}$ (b) $\frac{\sqrt{a}+\sqrt{b}}{ab}$ (c) $\frac{\sqrt{a}\pm\sqrt{b}}{ab}$ (d) $\sqrt{\frac{a+b}{ab}}$

**Q.20** The displacement due to a wave moving in the positive $x$-direction is given by $y = \frac{1}{(1+x^2)}$ at time $t = 0$ and by $y = \frac{1}{[1+(x-1)^2]}$ at $t = 2$ seconds, where $x$ and $y$ are in metres. The velocity of the wave in *m/s* is

(a) 0.5 (b) 1 (c) 2 (d) 4

**DIRECTIONS (Q.21-Q.23) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:**

**Codes :** **(a)** 1, 2 and 3 are correct
**(b)** 1 and 2 are correct
**(c)** 2 and 4 are correct
**(d)** 1 and 3 are correct

**Q.21** P, Q and R are three particles of a medium which lie on the x-axis. A sine wave of wavelength λ is travelling through the medium in the x-direction. P and Q always have the same speed, while P and R always have the same velocity. The minimum distance between –

(1) P and Q is λ (2) P and Q is λ/2
(3) P and R is λ/2 (4) P and R is λ

**Q.22** A wave represented by the given equation

$Y = A\sin\left(10\pi x + 15\pi t + \frac{\pi}{3}\right)$, where x is in meter and t is in second. The expression represents

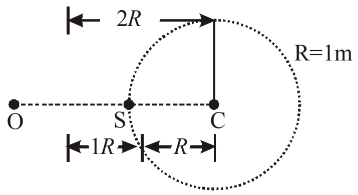
(1) A wave travelling in the negative X direction with a velocity of 1.5 m/sec
(2) A wave travelling in the negative X direction with a wavelength of 0.2 m
(3) A wave travelling in the positive X direction with a velocity of 1.5 m/sec.
(4) A wave travelling in the positive X direction with a wavelength of 0.2 m

**Q.23** It is usually more convenient to describe a sound wave in terms of pressure wave as compared to displacement wave because –

(1) Two waves of same intensity but different frequencies have different displacement amplitude but same pressure amplitude
(2) The human ear responds to the change in pressure and not to the displacement wave.
(3) The electronic detector (microphone) does respond to the change in pressure but not to the displacement.
(4) None of the above

**DIRECTIONS (Q.24-Q.26) : Read the passage given below and answer the questions that follows :**

Sound from a point isotropic source spreads equally in all directions in homogeneous medium. Therefore its intensity decreases with square of distance from the source. When distance between observer and the source changes, apart from changes in intensity, the observer listens sound of pitch higher or lower than actual pitch depending upon the fact that the distance between the observer and source is decreasing or increasing respectively. An observer O is at a distance 2R from centre of a circle of radius R. A point isotropic sound source S moves on the circle with uniform angular velocity ω = π/3 rad/s. Initially observer, source and centre of the circle are in same line.




**RESPONSE GRID**

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23. ⓐⓑⓒⓓ

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**Q.24** Starting from initial moment, the source moves through an angular displacement 180°. Intensity of the sound as observed by the observer decreases by a factor of –
(a) 2 (b) 3
(c) 4 (d) 9

**Q.25** During a complete round trip of star on the circle, the observer listens a sound, whose –
(a) wavelength first decreases to a maximum value then increases to the original value
(b) wavelength first increases to a maximum value then decreases to the original value
(c) During the first half time wavelength increases then decreases to the original value
(d) None of the above is correct because in Doppler's effect, it is the pitch of sound which changes and not its wavelength, irrespective of motion of source or observer.

**Q.26** Sound emitted by the source at two successive instants $t_1$ and $t_2$ has minimum and maximum observed pitch respectively, then –
(a) $t_1 = 1s, t_2 = 5s$
(b) $t_1 = 5s, t_2 = 7s$
(c) $t_1 = 7s, t_2 = 11s$
(d) $t_1 = 5s, t_2 = 11s$

**DIRECTIONS (Q. 27-Q.29) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.**

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement -1 is False, Statement-2 is True.
(d) Statement -1 is True, Statement-2 is False.

**Q.27** **Statement-1 :** Particle velocity and wave velocity both are independent of time.
**Statement-2 :** For the propagation of wave motion, the medium must have the properties of elasticity and inertia.

**Q.28** **Statement-1 :** Speed of wave $= \frac{\text{Wavelength}}{\text{Time period}}$
**Statement-2 :** Wavelength is the distance between two nearest particles vibrating in phase.

**Q.29** **Statement-1 :** Transverse waves are not produced in liquids and gases.
**Statement-2 :** Light waves are transverse waves.

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| DAILY PRACTICE PROBLEM SHEET 29 - PHYSICS | | | |
|---|---|---|---|
| Total Questions | 29 | Total Marks | 116 |
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 28 | Qualifying Score | 44 |
| Success Gap = Net Score – Qualifying Score | | | |
| Net Score = (Correct × 4) – (Incorrect × 1) | | | |

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# DAILY PRACTICE PROBLEMS

# PHYSICS SOLUTIONS 29

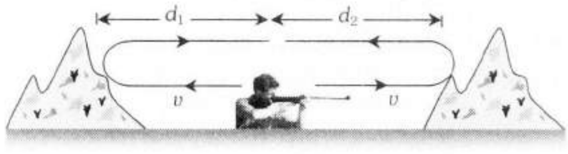
1. **(d)** $v = n\lambda \Rightarrow \lambda = \frac{v}{n} = \frac{330}{256} = 1.29m$

2. **(a)** Time required for a point to move from maximum displacement to zero displacement is

$$t = \frac{T}{4} = \frac{1}{4n}$$

$$\Rightarrow n = \frac{1}{4t} = \frac{1}{4 \times 0.170} = 1.47 Hz$$

3. **(b)**




$$2d_1 + 2d_2 = v \times t_1 + v \times t_2 \Rightarrow 2(d_1 + d_2) = v(t_1 + t_2)$$

$$d_1 + d_2 = \frac{v(t_1 + t_2)}{2} = \frac{340 \times (1.5 + 3.5)}{2} = 850\ m$$

4. **(c)** At given temperature and pressure

$$v \propto \frac{1}{\sqrt{\rho}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{\rho_2}{\rho_1}} = \sqrt{\frac{4}{1}} = 2:1$$

5. **(b)** The distance between two points *i.e.* path difference between them

$$\Delta = \frac{\lambda}{2\pi} \times \phi = \frac{\lambda}{2\pi} \times \frac{\pi}{3} = \frac{\lambda}{6} = \frac{v}{6n} \qquad (\because v = n\lambda)$$

$$\Rightarrow \Delta = \frac{360}{6 \times 500} = 0.12m = 12cm$$

6. **(d)** $y_1 = a\sin(\omega t - kx)$ and

$$y_2 = a\cos(\omega t - kx) = a\sin\left(\omega t - kx + \frac{\pi}{2}\right)$$

Hence phase difference between these two is $\frac{\pi}{2}$.

7. **(c)** $\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} = \left(\frac{0.06}{0.03}\right)^2 = \frac{4}{1}$

8. **(d)** Comparing the given equation with $y = a\sin(\omega t - kx)$,

We get $a = Y_0, \omega = 2\pi f, k = \frac{2\pi}{\lambda}$. Hence maximum particle velocity $(v_{max})_{particle} = a\omega = Y_0 \times 2\pi f$ and wave velocity

$$(v)_{wave} = \frac{\omega}{k} = \frac{2\pi f}{2\pi/\lambda} = f\lambda$$

$$\therefore (v_{max})_{particle} = 4v_{wave} = Y_0 \times 2\pi f = 4f\lambda \Rightarrow \lambda = \frac{\pi Y_0}{2}$$

9. **(d)** $y = f(x^2 - vt^2)$ doesn't follows the standard wave equation.

10. **(a)** $y_1 = a_1\sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and

$$y_2 = a_2\cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right) = a_2\sin\left(\omega t - \frac{2\pi x}{\lambda} + \phi + \frac{\pi}{2}\right)$$

So phase difference $= \phi + \frac{\pi}{2}$ and $\Delta = \frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

11. **(d)** On comparing the given equation with standard equation $y = a\sin\frac{2\pi}{\lambda}(vt - x)$. It is clear that wave speed $(v)_{wave} = v$ and maximum particle velocity

$$(v_{max})_{particle} = a\omega = y_0 \times \text{co-efficient of } t = y_0 \times \frac{2\pi v}{\lambda}$$

$$\therefore (v_{max})_{particle} = 2(\omega)_{wave} \Rightarrow \frac{a \times 2\pi v}{\lambda} = 2v \Rightarrow \lambda = \pi y_0$$

12. **(a)** Compare the given equation with $y = a\sin(\omega t + kx)$

We get $\omega = 2\pi n = 100 \Rightarrow n = \frac{50}{\pi} Hz$

13. **(c)** A wave travelling in positive *x*-direction may be represented as $y = A\sin\frac{2\pi}{\lambda}(vt - x)$. On putting values

$$y = 0.2\sin\frac{2\pi}{60}(360t - x) \Rightarrow y = 0.2\sin 2\pi\left(6t - \frac{x}{60}\right)$$

14. **(a)** Comparing the given equation with $y = a\sin(\omega t - kx)$

We get $\omega = 3000\pi \Rightarrow n = \frac{\omega}{2\pi} = 1500 Hz$

and $k = \frac{2\pi}{\lambda} = 12\pi \Rightarrow \lambda = \frac{1}{6} m$

So, $v = n\lambda \Rightarrow v = 1500 \times \frac{1}{6} = 250\ m/s$

15. **(b)** Given, $y = 0.5\sin(20x - 400t)$

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

Gives velocity of wave $v = \frac{\omega}{k} = \frac{400}{20} = 20\ m/s.$

16. (b) With path difference $\frac{\lambda}{2}$, waves are out of phase at the point of observation.

17. (b) $A^2 = a^2 = a^2 + a^2 + 2a^2\cos\theta \Rightarrow \cos\theta = -\frac{1}{2} \Rightarrow \theta = \frac{2\pi}{3}$

18. (c) For interference, two waves must have a constant phase relationship. Equation '1' and '3' and '2' and '4' have a constant phase relationship of $\frac{\pi}{2}$ out of two choices.

Only one $S_2$ emitting '2' and $S_4$ emitting '4' is given so only (c) option is correct.

19. (a) The resultant amplitude is given by

$$A_R = \sqrt{A^2 + A^2 + 2AA\cos\theta} = \sqrt{2A^2(1+\cos\theta)}$$

$$= 2A\cos\theta/2 \qquad (\because 1+\cos\theta = 2\cos^2\theta/2)$$

20. (d) $y = \frac{1}{\sqrt{a}}\sin\omega t \pm \frac{1}{\sqrt{b}}\sin\left(\omega t + \frac{\pi}{2}\right)$

Here phase difference $= \frac{\pi}{2}$

$\therefore$ The resultant amplitude

$$= \sqrt{\left(\frac{1}{\sqrt{a}}\right)^2 + \left(\frac{1}{\sqrt{b}}\right)^2} = \sqrt{\frac{1}{a} + \frac{1}{b}} = \sqrt{\frac{a+b}{ab}}$$

21. (a) In a wave equation, $x$ and $t$ must be related in the form $(x - vt)$

We rewrite the given equations $y = \frac{1}{1+(x-vt)^2}$

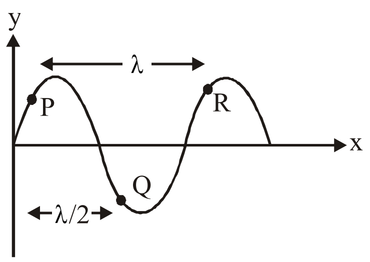
For $t = 0$, this becomes $y = \frac{1}{(1+x^2)}$, as given

For $t = 2$, this becomes

$$y = \frac{1}{[1+(x-2v)^2]} = \frac{1}{[1+(x-1)^2]}$$

$2v = 1$ or $v = 0$ m/s

22. (c)




23. (b)
Standard wave equation which travel in negative x-direction is $y = A\sin(\omega t + kx + \phi_0)$

For the given wave $\omega = 2\pi n = 15\pi,\ k = \frac{2\pi}{\lambda} = 10\pi$

Now $v = \frac{\text{Coefficient of } t}{\text{Coefficient of } x} = \frac{\omega}{k} = \frac{15\pi}{10\pi} = 1.5\text{m/sec}$

and $\lambda = \frac{2\pi}{k} = \frac{2\pi}{10\pi} = 0.2$ m.

24. (a) $p_m = \frac{\omega BA}{v},\ I = \frac{1}{2}\omega p_m A \Rightarrow I = \frac{p_m^2 v}{2B}$

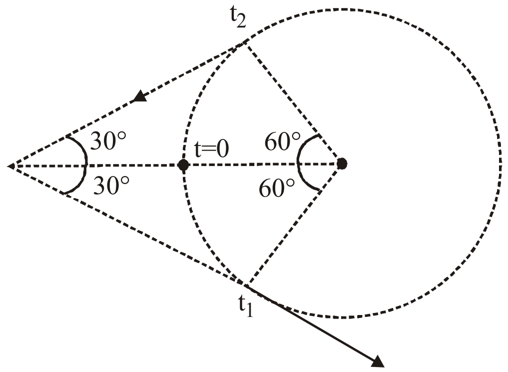
25. (d), 26. (c), 27. (a).

(i) $I \propto \frac{1}{d^2},\ d_{initial} = R,\ d_{final} = 3R,$

$\frac{I_{initial}}{I_{final}} = \frac{9}{1} \Rightarrow I_{final} = \frac{I_{initial}}{9}$

(ii) During the first half time, wavelength first increases as the component of velocity of source increases till it becomes equal to the velocity of source itself, then it decreases till it becomes zeros.

(iii) $t_1 = \frac{\pi/3}{\omega}, \frac{2\pi + \pi/3}{\omega}$ ......., $t_2 = \frac{5\pi/3}{\omega}, \frac{2\pi + 5\pi/3}{\omega}$




when $\omega = \frac{\pi}{3}$ rad/s, $t_1 = 1, 7, 13, .......\ t_2 = 5, 11, 17,$

28. (c) The velocity of every oscillating particle of the medium is different of its different positions in one oscillation but the velocity of wave motion is always constant i.e., particle velocity vary with respect to time, while the wave velocity is independent of time.
Also for wave propagation medium must have the properties of elasticity and inertia.

29. (b) Velocity of wave $= \frac{\text{Distance travelled by wave } (\lambda)}{\text{Time period } (T)}$

Wavelength is also defined as the distance between two nearest points in phase.

30. (b) Transverse waves travel in the form of crests and through involving change in shape of the medium. As liquids and gases do not possess the elasticity of shape, therefore, transverse waves cannot be produced in liquid and gases. Also light wave is one example of transverse wave.