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Simple pendulum · JEE Main 2022 · Shift-II View Solution on Crucible ↗

1. The motion of a simple pendulum executing S.H.M. is represented by the following equation $y = A\sin(\pi t + \phi)$, where time is measured in second. The length of pendulum is

(A) 97.23 cm
(B) 25.3 cm
(C) 99.4 cm
(D) 406.1 cm

Constructive and Destructive Interference · JEE Main 2022 · Shift-II View Solution on Crucible ↗

2. Two light beams of intensities in the ratio of $9:4$ are allowed to interfere. The ratio of the intensity of maxima and minima will be :

(A) $9:4$
(B) $16:81$
(C) $25:169$
(D) $25:1$

Properties of EM Waves · JEE Main 2023 · Shift-I View Solution on Crucible ↗

3. The energy of an electromagnetic wave contained in a small volume oscillates with

(A) Double the frequency of the wave
(B) The frequency of the wave
(C) Half the frequency of the wave
(D) Zero frequency

Light emitting diode · JEE Main 2024 · Shift-I View Solution on Crucible ↗

4. A light emitting diode (LED) is fabricated using GaAs semiconducting material whose band gap is $1.42\,\text{eV}$. The wavelength of light emitted from the LED is:

(A) $1400\,\text{nm}$
(B) $650\,\text{nm}$
(C) $875\,\text{nm}$
(D) $1243\,\text{nm}$

Displacement of S.H.M. and Phase · JEE Main 2025 · Shift-I View Solution on Crucible ↗

5. A particle is executing simple harmonic motion with time period 2 s and amplitude 1 cm. If D and d are the total distance and displacement covered by the particle in 12.5 s, then $\frac{D}{d}$ is

(A) $\frac{16}{5}$
(B) 10
(C) $\frac{15}{4}$
(D) 25

Time period · JEE Main 2025 · Shift-II View Solution on Crucible ↗

6. Displacement of a wave is expressed as $x(t) = 5\cos\left(628t + \frac{\pi}{2}\right)$ m. The wavelength of the wave when its velocity is $300\,\mathrm{m/s}$ is :

(A) 5 m
(B) 3 m
(C) 0.5 m
(D) 0.33 m

Properties of EM Waves · JEE Main 2023 · Shift-II View Solution on Crucible ↗

7. The amplitude of magnetic field in an electromagnetic wave propagating along y-axis is $6.0 \times 10^{-7}\,\mathrm{T}$. The maximum value of electric field in the electromagnetic wave is

(A) $2 \times 10^{15}\,\mathrm{V\,m^{-1}}$
(B) $180\,\mathrm{V\,m^{-1}}$
(C) $6.0 \times 10^{-7}\,\mathrm{V\,m^{-1}}$
(D) $5 \times 10^{14}\,\mathrm{V\,m^{-1}}$

Forbidden energy gap · JEE Main 2024 · Shift-II View Solution on Crucible ↗

8. The acceptor level of a p-type semiconductor is $6\,\mathrm{eV}$. The maximum wavelength of light which can create a hole would be : Given $hc = 1242\,\mathrm{eVnm}$.

(A) $414\,\mathrm{nm}$
(B) $103.5\,\mathrm{nm}$
(C) $207\,\mathrm{nm}$
(D) $407\,\mathrm{nm}$

Rules while adding two SHM · JEE Main 2023 · Shift-II View Solution on Crucible ↗

9. For a periodic motion represented by the equation $y = \sin\omega t + \cos\omega t$ the amplitude of the motion is

(A) 1
(B) 0.5
(C) 2
(D) $\sqrt{2}$

Beats · JEE Main 2021 · Shift-II View Solution on Crucible ↗

10. A tuning fork A of unknown frequency produces $5\,\mathrm{beats\,s^{-1}}$ with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to $2\,\mathrm{beats\,s^{-1}}$. What is the frequency of fork A ?

(A) 335 Hz
(B) 338 Hz
(C) 345 Hz
(D) 342 Hz

Properties of EM Waves · JEE Main 2025 · Shift-II View Solution on Crucible ↗

11. A plane electromagnetic wave propagates along the $+x$ direction in free space. The components of the electric field, $\vec{E}$ and magnetic field, $\vec{B}$ vectors associated with the wave in Cartesian frame are

(A) $E_x,\ B_y$ **(B)** $E_y,\ B_z$

(C) $E_z,\ B_y$ **(D)** $E_y,\ B_x$

Displacement of S.H.M. and Phase · JEE Main 2023 · Shift-II View Solution on Crucible ↗

12. A particle executes simple harmonic motion between $x = -A$ and $x = +A$. If time taken by particle to go from $x = 0$ to $\frac{A}{2}$ is 2 s; then time taken by particle in going from $x = \frac{A}{2}$ to A is:

(A) 3 s **(B)** 2 s

(C) 1.5 s **(D)** 4 s

Travelling Waves · JEE Main 2021 · Shift-II View Solution on Crucible ↗

13. A sound wave of frequency 245 Hz travels with the speed of $300\ \mathrm{m\ s^{-1}}$ along the positive x-axis. Each point of the wave moves to and fro through a total distance of 6 cm. What will be the mathematical expression of this travelling wave?

(A) $Y(x,t) = 0.03\left[\sin 5.1x - (0.2\times 10^3)t\right]$ **(B)** $Y(x,t) = 0.06\left[\sin 5.1x - (1.5\times 10^3)t\right]$

(C) $Y(x,t) = 0.06\left[\sin 0.8x - (0.5\times 10^3)t\right]$ **(D)** $Y(x,t) = 0.03\left[\sin 5.1x - (1.5\times 10^3)t\right]$

Properties of EM Waves · JEE Main 2024 · Shift-II View Solution on Crucible ↗

14. In the given electromagnetic wave $E_y = 600\sin(\omega t - kx)\ \mathrm{V\ m^{-1}}$, intensity of the associated light beam is (in $\mathrm{W/m^2}$): (Given $\epsilon_0 = 9\times 10^{-12}\ \mathrm{C^2\ N^{-1}\ m^{-2}}$)

(A) 243 **(B)** 729

(C) 972 **(D)** 486

Simple pendulum · JEE Main 2022 · Shift-II View Solution on Crucible ↗

15. Time period of a simple pendulum in a stationary lift is T. If the lift accelerates with $\frac{g}{6}$ vertically upwards then the time period will be (Where $g =$ acceleration due to gravity)

(A) $\sqrt{\frac{6}{5}}T$ **(B)** $\sqrt{\frac{5}{6}}T$

(C) $\sqrt{\frac{6}{7}}T$ **(D)** $\sqrt{\frac{7}{6}}T$

Factors affecting speed of sound · JEE Main 2023 · Shift-II View Solution on Crucible ↗

16. The ratio of speed of sound in hydrogen gas to the speed of sound in oxygen gas at the same temperature is:

(A) $1:2$ **(B)** $4:1$

(C) $1:4$ **(D)** $1:1$

Properties of EM Waves · JEE Main 2024 · Shift-I View Solution on Crucible ↗

17. A plane electromagnetic wave propagating in x-direction is described by $E_y = (200\,\text{V m}^{-1})\sin[1.5\times10^{7}t - 0.05x]$; The intensity of the wave is: (Use $\epsilon_0 = 8.85\times10^{-12}\,\text{C}^2\,\text{N}^{-1}\,\text{m}^{-2}$)

(A) $35.4\,\text{W m}^{-2}$ **(B)** $53.1\,\text{W m}^{-2}$

(C) $26.6\,\text{W m}^{-2}$ **(D)** $106.2\,\text{W m}^{-2}$

Velocity of Simple Harmonic Motion · JEE Main 2022 · Shift-I View Solution on Crucible ↗

18. When a particle executes simple Harmonic motion, the nature of graph of velocity as function of displacement will be

(A) Circular **(B)** Elliptical

(C) Sinusoidal **(D)** Straight line

Laplace correction · JEE Main 2024 · Shift-II View Solution on Crucible ↗

19. The speed of sound in oxygen at S.T.P. will be approximately: (Given, $R = 8.3\,\text{J K}^{-1}$, $\gamma = 1.4$)

(A) $310\,\text{m s}^{-1}$ **(B)** $333\,\text{m s}^{-1}$

(C) $341\,\text{m s}^{-1}$ **(D)** $325\,\text{m s}^{-1}$

Properties of EM Waves · JEE Main 2024 · Shift-II View Solution on Crucible ↗

20. A plane electromagnetic wave of frequency $35\,\text{MHz}$ travels in free space along the X-direction. At a particular point (in space and time) $\vec{E} = 9.6\hat{j}\,\text{V m}^{-1}$. The value of magnetic field at this point is:

(A) $3.2\times10^{-8}\hat{k}\,\text{T}$ **(B)** $3.2\times10^{-8}\hat{i}\,\text{T}$

(C) $9.6\hat{j}\,\text{T}$ **(D)** $9.6\times10^{-8}\hat{k}\,\text{T}$

Conservation of Energy in SHM · JEE Main 2023 · Shift-II View Solution on Crucible ↗

21. A particle executes SHM of amplitude A. The distance from the mean position when its kinetic energy becomes equal to its potential energy is:

(A) $\frac{1}{\sqrt{2}}A$ **(B)** $2A$

(C) $\sqrt{2A}$ **(D)** $\frac{1}{2}A$

Travelling Waves · JEE Main 2021 · Shift-II View Solution on Crucible ↗

22. Which of the following equations represents a travelling wave?

(A) $y = A\sin(15x - 2t)$ **(B)** $y = Ae^{x}\cos(\omega t - \theta)$

(C) $y = Ae^{-x^2}(vt + \theta)$ **(D)** $y = A\sin x\ \cos\omega t$

Properties of EM Waves · JEE Main 2024 · Shift-II View Solution on Crucible ↗

23. If frequency of electromagnetic wave is $60\,\mathrm{MHz}$ and it travels in air along z direction then the corresponding electric and magnetic field vectors will be mutually perpendicular to each other and the wavelength of the wave (in m) is:

(A) 2.5 **(B)** 10

(C) 5 **(D)** 2

Kinetic Energy in SHM · JEE Main 2023 · Shift-I View Solution on Crucible ↗

24. The maximum potential energy of a block executing simple harmonic motion is 25 J. A is amplitude of oscillation. At $\frac{A}{2}$, the kinetic energy of the block is

(A) 37.5 J **(B)** 9.75 J

(C) 18.75 J **(D)** 12.5 J

Frequency of a Travelling Waves · JEE Main 2024 · Shift-II View Solution on Crucible ↗

25. A plane progressive wave is given by $y = 2\cos 2\pi(330t - x)$ m. The frequency of the wave is :

(A) 330 Hz **(B)** 660 Hz

(C) 340 Hz **(D)** 165 Hz

Properties of EM Waves · JEE Main 2023 · Shift-II View Solution on Crucible ↗

26. In an electromagnetic wave, at an instant and at a particular position, the electric field is along the negative z-axis and magnetic field is along the positive x-axis. Then the direction of propagation of electromagnetic wave is:

(A) positive z-axis
(B) positive y-axis
(C) at 45° angle from positive y-axis
(D) negative y-axis

Time Period of SHM · JEE Main 2021 · Shift-II View Solution on Crucible ↗

27. A particle is making simple harmonic motion along the X-axis. If at a distances x_1 and x_2 from the mean position the velocities of the particle are v_1 and v_2, respectively. The time period of its oscillation is given as:

(A) $T = 2\pi\sqrt{\frac{x_2^2+x_1^2}{v_2^2-v_1^2}}$
(B) $T = 2\pi\sqrt{\frac{x_2^2+x_1^2}{v_1^2+v_2^2}}$
(C) $T = 2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2+v_2^2}}$
(D) $T = 2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2-v_2^2}}$

Superposition of waves · JEE Main 2020 · Shift-I View Solution on Crucible ↗

28. Three harmonic waves having equal frequency v and same intensity I_0, have phase angles 0, $\frac{\pi}{4}$ and $-\frac{\pi}{4}$ respectively. When they are superimposed the intensity of the resultant wave is close to:

(A) $5.8I_0$
(B) $0.2I_0$
(C) $3I_0$
(D) I_0

Properties of EM Waves · JEE Main 2022 · Shift-II View Solution on Crucible ↗

29. The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = 5 \times 10^{-6} \sin 1000\pi(5x - 4 \times 10^8 t)$ T. The amplitude of electric field will be

(A) $15 \times 10^2\ \mathrm{Vm}^{-1}$
(B) $5 \times 10^{-6}\ \mathrm{Vm}^{-1}$
(C) $16 \times 10^{12}\ \mathrm{Vm}^{-1}$
(D) $4 \times 10^2\ \mathrm{Vm}^{-1}$

Damped Oscillations · JEE Main 2021 · Shift-II View Solution on Crucible ↗

30. A block of mass 1 kg attached to a spring is made to oscillate with an initial amplitude of 12 cm. After 2 minutes the amplitude decreases to 6 cm. Determine the value of the damping constant for this motion. (take $\ln 2 = 0.693$)

(A) $1.16 \times 10^{-2}\ \mathrm{kg\ s}^{-1}$
(B) $3.3 \times 10^2\ \mathrm{kg\ s}^{-1}$
(C) $1.16 \times 10^2\ \mathrm{kg\ s}^{-1}$
(D) $5.7 \times 10^{-3}\ \mathrm{kg\ s}^{-1}$

Answer Key (Q1 to Q30)

Click any question number below to open its exact step-by-step solution on The Crucible ↗

1: (C)	2: (D)	3: (A)	4: (C)	5: (D)	6: (B)	7: (B)	8: (C)	9: (D)	10: (A)
11: (B)	12: (D)	13: (D)	14: (D)	15: (C)	16: (B)	17: (B)	18: (B)	19: (A)	20: (A)
21: (A)	22: (A)	23: (C)	24: (C)	25: (A)	26: (D)	27: (D)	28: (A)	29: (D)	30: (A)

Sample Solution — Question 7 (Correct Option: B)

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Q7. The amplitude of magnetic field in an electromagnetic wave propagating along y-axis is $6.0 \times 10^{-7}\,\mathrm{T}$. The maximum value of electric field in the electromagnetic wave is

The electric and magnetic fields of an electromagnetic wave are locked together by $E_0 = cB_0$. Once you see that, this is a 15-second question.

$E_0 = cB_0$

$E_0 = 3 \times 10^8 \times 6.0 \times 10^{-7}$

$E_0 = 180\,\mathrm{V\,m^{-1}}$

• **Watch out:** the words "propagating along y-axis" are only there to confuse you. The ratio $E_0/B_0 = c$ holds for every EM wave in vacuum, no matter which way it travels.

Answer: (b) $180\,\mathrm{V\,m^{-1}}$

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