WBJEE 2025 Question Paper

Time Allowed :3 Hour	**Maximum Marks :**200	**Total Questions :**150

1 Physics

1. A quantity X is given by:

$$X = \frac{\epsilon_0 L \Delta V}{\Delta t}$$

where:

- ϵ_0 is the permittivity of free space,

- L is the length,

- ΔV is the potential difference,

- Δt is the time interval.

The dimension of X is the same as that of:

(A) Resistance

(B) Charge

(C) Voltage

(D) Current

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2. Six vectors $\mathrm{a}, \mathrm{b}, \mathrm{c}, \mathrm{d}, \mathrm{e}, \mathrm{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?

(A) $\mathbf{b} + \mathbf{e} = \mathbf{f}$

(B) $\mathbf{b} + \mathbf{c} = \mathbf{f}$

(C) $\mathbf{d} + \mathbf{c} = \mathbf{f}$

(D) $\mathbf{d} + \mathbf{e} = \mathbf{f}$

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3. The minimum force required to start pushing a body up a rough (having coefficient of friction μ) inclined plane is F_1, while the minimum force needed to prevent it from sliding is F_2. If the inclined plane makes an angle θ with the horizontal such that $\tan\theta = 2\mu$, then the ratio $\frac{F_1}{F_2}$ is:

(A) 4

(B) 1

(C) 2

(D) 3

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4. Acceleration-time (a vs. t) graph of a body is shown in the figure. Corresponding velocity-time (v vs. t) graph is:

(A) A shape resembling a trapezium

(B) A shape resembling a right-angle triangle

(C) A shape resembling an L-shape

(D) A shape resembling a linearly increasing curve

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5. A ball falls from a height h upon a fixed horizontal floor. The coefficient of restitution between the ball and the floor is e. The total distance covered by the ball before it comes to rest is:

(A) $\frac{1-e^2}{1+e^2}h$

(B) $\frac{1+e^2}{1-e^2}h$

(C) $\frac{1-2e^2}{1+e^2}h$

(D) $\frac{1+2e^2}{1-e^2}h$

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6. What are the charges stored in the 1 µF and 2 µF capacitors in the circuit as shown in the figure once the current (I) becomes steady?

(A) 8 µC and 4 µC

(B) 4 µC and 8 µC

(C) 3 µC and 6 µC

(D) 6 µC and 3 µC

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7. A diode is connected in parallel with a resistance as shown in Figure. The most probable current (I) - voltage (V) characteristic is:

(A) A graph with a smooth curve rising steeply for positive voltage

(B) A straight line with a slope for positive voltage

(C) A graph showing a small hump before a steep rise for positive voltage

(D) A sharply increasing graph after a certain voltage threshold

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8. Ruma reached the metro station and found that the escalator was not working. She walked up the stationary escalator with velocity v_1 in time t_1. On another day, if she remains stationary on the escalator moving with velocity v_2, the escalator takes her up in time t_2. The time taken by her to walk up with velocity v_1 on the moving escalator will be:

(A) $\frac{t_1}{t_2}$

(B) $\frac{t_1+t_2}{t_2-t_1}$

(C) $\frac{t_1+t_2}{v_1+v_2}$

(D) $\frac{t_1 t_2}{t_1+t_2}$

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9. The variation of displacement with time of a simple harmonic motion (SHM) for a particle of mass m is represented by:

$$y = 2\sin\left(\frac{\pi}{2} + \phi\right) \text{ cm}$$

The maximum acceleration of the particle is:

(A) $\frac{\pi^2}{2}$ cm/sec^2

(B) $\frac{\pi}{2m}$ cm/sec^2

(C) $\frac{\pi^2}{2m}$ cm/sec^2

(D) $\frac{\pi^2}{2}$ cm/sec^2

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10. A force $\mathrm{F} = ai + bj + ck$ is acting on a body of mass m. The body was initially at rest at the origin. The co-ordinates of the body after time t will be:

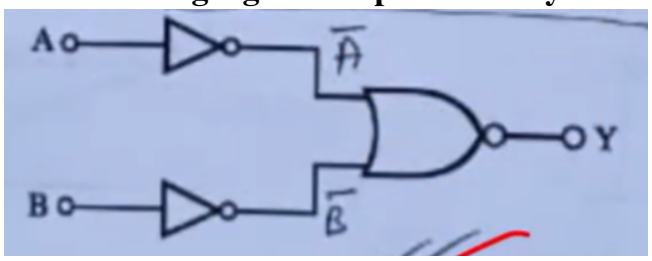
(A) $\frac{ar^2}{2m}i + \frac{br^2}{2m}j + \frac{cr^2}{2m}k$

(B) $\frac{ar^2}{2m}i + \frac{br^2}{2m}j + \frac{cr^2}{2m}k$

(C) $\frac{ar}{m}i + \frac{br}{m}j + \frac{cr}{m}k$

(D) $\frac{ar}{m}i + \frac{br}{m}j + \frac{cr}{m}k$

11. Which logic gate is represented by the following combination of logic gates?



(A) NAND

(B) AND

(C) NOR

(D) OR

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12. The minimum wavelength of Lyman series lines is P, then the maximum wavelength of the Lyman series lines is:

(A) $\frac{4P}{3}$

(B) $2P$

(C) $\frac{2P}{3}$

(D) ∞

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13. The de-Broglie wavelength of a moving bus with speed v is λ. Some passengers left the bus at a stop. Now, when the bus moves with twice of its initial speed, its kinetic energy is found to be twice of its initial value. What is the de-Broglie wavelength of the bus now?

(A) λ

(B) 2λ

(C) $\frac{\lambda}{2}$

(D) $\frac{\lambda}{4}$

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14. A single slit diffraction pattern is obtained using a beam of red light. If red light is replaced by blue light, then:

(A) The diffraction pattern will disappear.

(B) Fringes will become narrower and crowded together.

(C) Fringes will become broader and will be further apart.

(D) There is no change in the diffraction pattern.

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15. A simple pendulum is taken at a place where its distance from the Earth's surface is equal to the radius of the Earth. Calculate the time period of small oscillations if the length of the string is 4.0 m. (Take $g = 9\,\text{m/s}^2$ at the surface of the Earth.)

(A) 4 s

(B) 6 s

(C) 8 s

(D) 2 s

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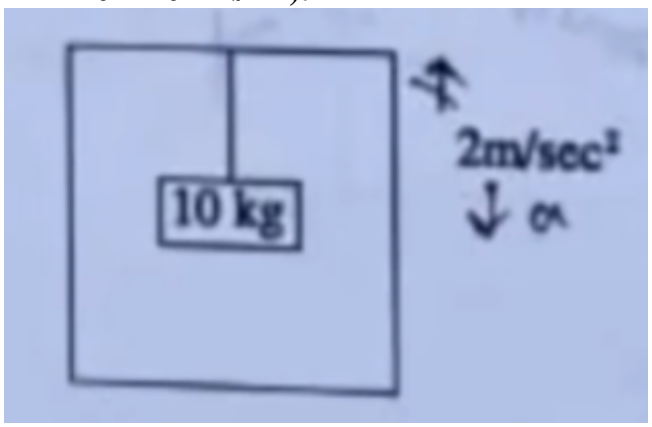
16. One end of a steel wire is fixed to the ceiling of an elevator moving up with an acceleration $2\,\text{m/s}^2$ and a load of 10 kg hangs from the other end. If the cross-section of the wire is $2\,\text{cm}^2$, then the longitudinal strain in the wire will be (Take $g = 10\,\text{m/s}^2$ and $Y = 2.0 \times 10^{11}\,\text{N/m}^2$).



(A) 4×10^{-11}

(B) 6×10^{-11}

(C) 8×10^{-6}

(D) 2×10^{-6}

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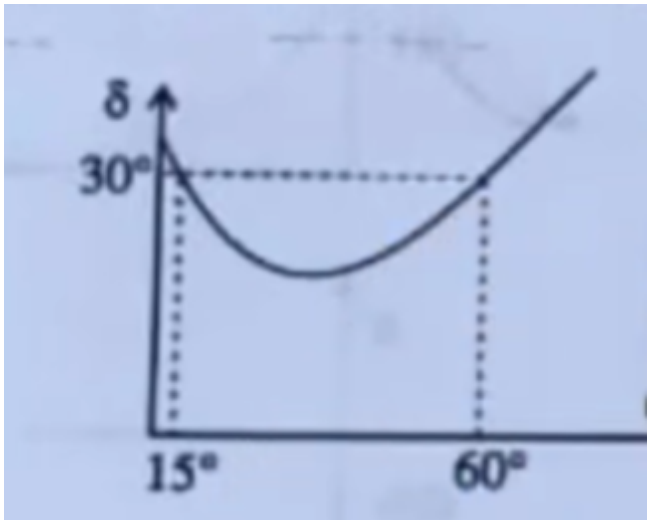
17. Figure shows the graph of angle of deviation δ versus angle of incidence i for a light ray striking a prism. The prism angle is



(A) 30°

(B) 60°

(C) 75°

(D) 90°

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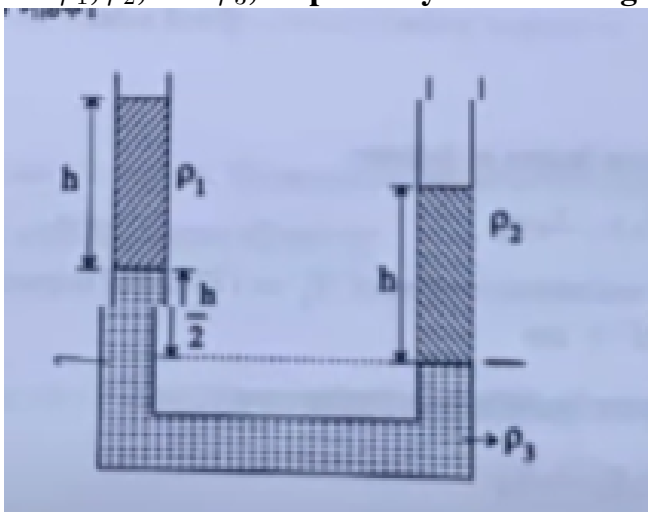
18. Three different liquids are filled in a U-tube as shown in the figure. Their densities are ρ_1, ρ_2, and ρ_3, respectively. From the figure, we may conclude that:



(A) $\rho_3 = 4(\rho_2 - \rho_1)$

(B) $\rho_3 = 4(\rho_1 - \rho_2)$

(C) $\rho_3 = 2(\rho_2 - \rho_1)$

(D) $\rho_3 = \frac{\rho_1 + \rho_2}{2}$

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19. A radioactive nucleus decays as follows:

$$X \to X_1 \to X_2 \to X_3 \to X_4$$

If the mass number and atomic number of X_4 are 172 and 69 respectively, the mass number and atomic number of X are:

(A) 72, 180

(B) 69, 170

(C) 68, 172

(D) 70, 177

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20. Consider a particle of mass 1 gm and charge 1.0 Coulomb at rest. Now, the particle is subjected to an electric field $E(t) = E_0 \sin(\omega t)$ in the x-direction, where $E_0 = 2$ N/C and $\omega = 1000$ rad/sec. The maximum speed attained by the particle is:

(A) 2 m/s

(B) 4 m/s

(C) 6 m/s

(D) 8 m/s

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21. The variation of the density of a solid cylindrical rod of cross-sectional area α and length L is given by:

$$\rho(x) = \rho_0 \frac{x^2}{L^2}$$

Where x is the distance from one end of the rod. The position of its center of mass from one end is:

(A) $\frac{2L}{3}$

(B) $\frac{L}{2}$

(C) $\frac{L}{3}$

(D) $\frac{3L}{4}$

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2 Mathematics

1. Let $f_n(x) = \tan\left(\frac{x}{2}\right)(1+\sec x)(1+\sec 2x)\cdots(1+\sec 2^n x)$, then which of the following is true?

(A) $f_5\left(\frac{\pi}{16}\right) = 1$

(B) $f_4\left(\frac{\pi}{16}\right) = 1$

(C) $f_3\left(\frac{\pi}{16}\right) = 1$

(D) $f_2\left(\frac{\pi}{16}\right) = 1$

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2. Let $f(x)$ be a second degree polynomial. If $f(1) = f(-1)$ and p, q, r are in A.P., then $f'(p), f'(q), f'(r)$ are

(A) in A.P.

(B) in G.P.

(C) in H.P.

(D) neither in A.P. or G.P. or H.P.

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3. Evaluate the integral $\int_{-1}^{1} \frac{x^2+|x|+1}{x^2+2|x|+1}\,dx$:

(1) $\log 2$

(2) $2\log 2$

(3) $\frac{1}{2}\log 2$

(4) $4\log 2$

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4. If the sum of the squares of the roots of the equation $x^2-(a-2)x-(a+1)=0$ is least for an appropriate value of the variable parameter a, then that value of a will be

(A) 3

(B) 2

(C) 1

(D) 0

---

5. Let f be a function which is differentiable for all real x. If $f(2) = -4$ and $f'(x) \geq 6$ for all $x \in [2,4]$, then:

(A) $f(4) < 8$

(B) $f(4) \geq 12$

(C) $f(4) \geq 8$

(D) $f(4) < 12$

---

6. Let $\phi(x) = f(x) + f(2a - x)$, $x \in [0, 2a]$ and $f'(x) > 0$ for all $x \in [0, a]$. Then $\phi(x)$ is:

(A) increasing on $[0, a]$

(B) decreasing on $[0, a]$

(C) increasing on $[0, 2a]$

(D) decreasing on $[0, 2a]$

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7. The number of reflexive relations on a set A of n elements is equal to:

(A) 2^{n^2}

(B) n^2

(C) $2^{n(n-1)}$

(D) n^{2-n}

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8. Let $\vec{a}, \vec{b}, \vec{c}$ be unit vectors. Suppose $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$. Then $\vec{a}$ is:

(A) $\vec{b} \times \vec{c}$

(B) $\vec{c} \times \vec{b}$

(C) $\vec{b} + \vec{c}$

(D) $\pm 2(\vec{b} \times \vec{c})$

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9. Consider three points $P(\cos\alpha, \sin\beta)$, $Q(\sin\alpha, \cos\beta)$ and $R(0, 0)$, where $0 < \alpha, \beta < \frac{\pi}{4}$. Then:

(A) P lies on the line segment RQ.

(B) Q lies on the line segment PR.

(C) R lies on the line segment PQ.

(D) P, Q, R are non-collinear.

10.

If $g(f(x)) = |\sin x|$ and $f(g(x)) = (\sin\sqrt{x})^2$, then:

(A) $f(x) = \sin^2 x,\ g(x) = \sqrt{x}$

(B) $f(x) = \sin x,\ g(x) = |x|$

(C) $f(x) = x^2,\ g(x) = \sin\sqrt{x}$

(D) $f(x) = |x|,\ g(x) = \sin x$

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11. If for a matrix A, $|A| = 6$ and adj $A = \begin{bmatrix} 1 & -2 & 4 \\ 4 & 1 & 1 \\ -1 & k & 0 \end{bmatrix}$, then k is equal to:

(A) -1

(B) 1

(C) 2

(D) 0

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12. Let $\omega(\neq 1)$ be a cubic root of unity. Then the minimum value of the set

$\{|a + b\omega + c\omega^2|^2 : a, b, c$ **are distinct non-zero integers** $\}$ **equals:**

(A) 15

(B) 5

(C) 3

(D) 4

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13. Let $f(x) = |1 - 2x|$, then:

(A) $f(x)$ is continuous but not differentiable at $x = \frac{1}{2}$.

(B) $f(x)$ is differentiable but not continuous at $x = \frac{1}{2}$.

(C) $f(x)$ is both continuous and differentiable at $x = \frac{1}{2}$.

(D) $f(x)$ is neither differentiable nor continuous at $x = \frac{1}{2}$.

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14. The line parallel to the x-axis passing through the intersection of the lines

$ax + 2by + 3b = 0$ **and** $bx - 2ay - 3a = 0$ **where** $(a, b) \neq (0, 0)$ **is:**

(A) above x-axis at a distance $\frac{3}{2}$ from it.

(B) above x-axis at a distance $\frac{2}{3}$ from it.

(C) below x-axis at a distance $\frac{3}{2}$ from it.

(D) below x-axis at a distance $\frac{2}{3}$ from it.

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15. The line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at the points P and Q. If the co-ordinates of the point X are $(\sqrt{3}, 0)$, then the value of $XP \cdot XQ$ is:

(A) $\frac{4(2+\sqrt{3})}{3}$

(B) $\frac{4(2-\sqrt{3})}{2}$

(C) $\frac{5(2+\sqrt{3})}{3}$

(D) $\frac{5(2-\sqrt{3})}{3}$

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16. For what value of $'a'$, the sum of the squares of the roots of the equation $x^2 - (a-2)x - a + 1 = 0$ will have the least value?

(A) 2

(B) 0

(C) 3

(D) 1

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17. If ${}^9P_3 + 5 \cdot {}^9P_4 = {}^{10}P_r$, then the value of $'r'$ is:

(A) 4

(B) 8

(C) 5

(D) 7