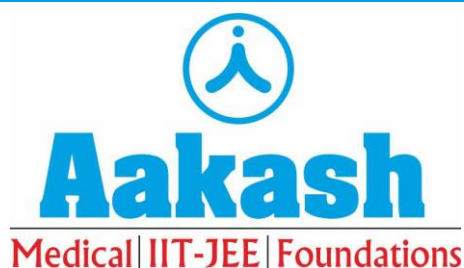


22/01/2025

Evening



Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar,
Gurugram, Haryana-122018

Memory Based Answers & Solutions

Time : 3 hrs.

for

M.M. : 300

JEE (Main)-2025 (Online) Phase-1

(Physics, Chemistry and Mathematics)

IMPORTANT INSTRUCTIONS:

- (1) The test is of **3 hours** duration.
- (2) This test paper consists of 75 questions. Each subject (PCM) has 25 questions. The maximum marks are 300.
- (3) This question paper contains **Three Parts**. **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is **Mathematics**. Each part has only two sections: **Section-A** and **Section-B**.
- (4) **Section - A** : Attempt all questions.
- (5) **Section - B** : Attempt all questions.
- (6) **Section - A (01 – 20)** contains 20 multiple choice questions which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.
- (7) **Section - B (21 – 25)** contains 5 **Numerical value** based questions. The answer to each question should be rounded off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.



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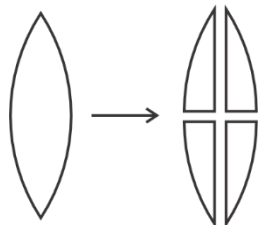
PHYSICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. An equiconvex lens of focal length f , is cut into four parts as shown in the diagram. The focal length of each part is



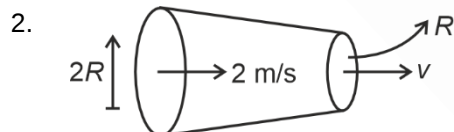
- (1) f (2) $2f$
(3) $f/2$ (4) $4f$

Answer (2)

Sol. $f = \frac{R}{2(\mu - 1)}$ (equiconvex lens)

$f' = \frac{R}{(\mu - 1)}$ (plano convex lens)

$f = 2f'$



Radius of a tube decreases from $2R$ to R in which ideal liquid is flowing at same level.

Speed at one end is 2 m/s as shown, find speed v at other end

- (1) 4 m/s (2) 1 m/s
(3) 2 m/s (4) 8 m/s

Answer (4)

Sol. $A_1 v_1 = A_2 v_2$ equation of continuity

$\pi(2R)^2 \cdot 2 = \pi R^2 v$

$v = 8 \text{ m/s}$

3. The dimensional formula of capacitance is

- (1) $[M^{-1}L^2T^2A^{-3}]$ (2) $[M^{-1}L^{-2}T^4A^3]$
(3) $[M^{-1}L^{-2}T^4A^2]$ (4) $[M^{-1}L^{-2}T^2A^2]$

Answer (3)

Sol. The energy stored in capacitor in term of charge

$E = \frac{Q^2}{2C}$

$C = \frac{Q^2}{2E}$

$[C] = \frac{[A^2T^2]}{[ML^2T^{-2}]}$
 $= [M^{-1}L^{-2}T^4A^2]$

4. A proton is moving with uniform velocity of $2 \times 10^8 \text{ m/s}$ in uniform magnetic and electric fields which are perpendicular to each other. If electric field is switched off then proton moves in circular path of radius $1.6 \times 10^{-5} \text{ m}$. Then magnetic field is B

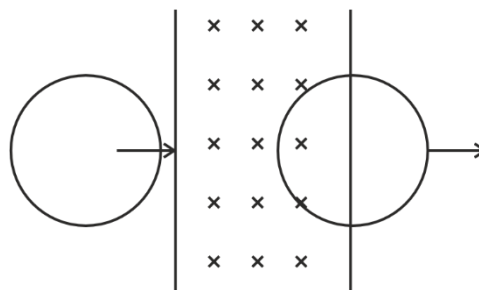
- (1) $5 \times 10^{-5} \text{ T}$ (2) $1.2 \times 10^5 \text{ T}$
(3) $2.5 \times 10^4 \text{ T}$ (4) $2.5 \times 10^2 \text{ T}$

Answer (2)

Sol. $r = \frac{mv}{qB} \Rightarrow 1.6 \times 10^{-5} = \frac{1.6 \times 10^{-27} \times 2 \times 10^8}{1.6 \times 10^{-19} \times B}$

$B = \frac{5}{4} \times 10^5 = 1.25 \times 10^5 \text{ T}$

5. A conducting circular ring is moving with a constant velocity in a uniform magnetic field as shown. Identify the correct graph between induced emf vs time



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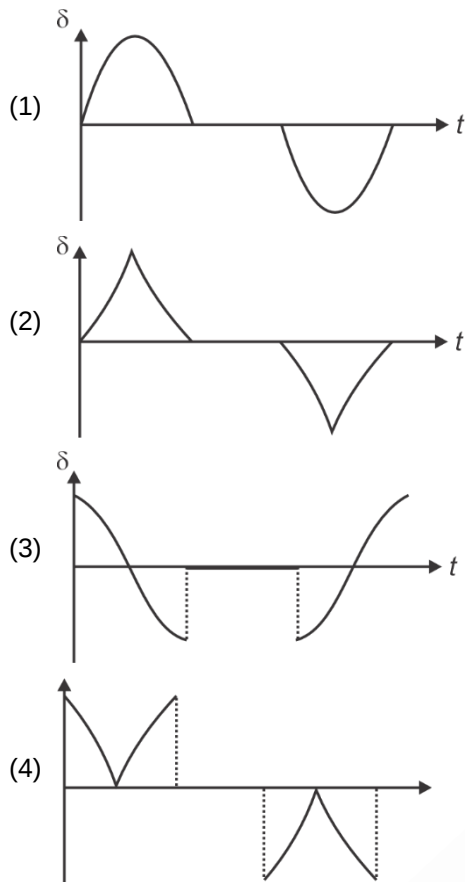
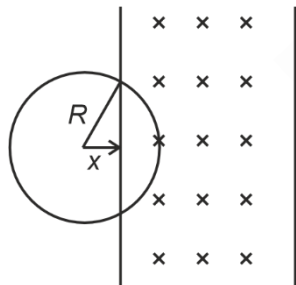


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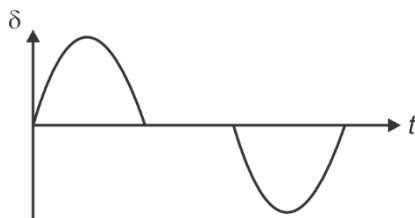
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**Answer (1)****Sol.**

$$\delta = 2Bv\sqrt{R^2 - x^2} \quad (\text{Equation of an ellipse})$$

$$x = R - vt$$



6. The displacement of a particle moving under the action of a force $\vec{F} = 2\hat{i} + b\hat{j} + \hat{k}$ is $\vec{d} = \hat{i} + \hat{j} + \hat{k}$. Find the value of b if the work done by the force is zero.

- (1) 0 (2) +3
(3) -3 (4) -1

Answer (3)

$$\begin{aligned} \text{Sol. Work} &= \vec{F} \cdot \vec{s} = (2\hat{i} + b\hat{j} + \hat{k}) \cdot (\hat{i} + \hat{j} + \hat{k}) \\ &= 2 + 1 + 1 = 3 + b = 0 \end{aligned}$$

$$\Rightarrow b = -3$$

7. In a series LCR circuit the maximum amplitude of current is I_0 when the resistance is R . What is the maximum amplitude of current if the resistor is replaced by a resistor of resistance $\frac{R}{2}$.

- (1) I_0 (2) $2I_0$
(3) $\frac{I_0}{2}$ (4) $\frac{2I_0}{3}$

Answer (2)**Sol.** Current has maximum amplitude at resonance.

$$I_0 = \frac{\xi_0}{R}$$

$$\Rightarrow I_0' = \frac{\xi_0}{R/2} = \frac{2\xi_0}{R} = 2I_0$$

8. **Statement-I** : Fringe width of red light is more than fringe width of violet light.

Statement-II : Fringe width is directly proportional to the wavelength of light used.

Choose the correct option.

- (1) Statement-I is correct and statement-II is incorrect
(2) Both statement-I and statement-II are correct
(3) Statement-I is incorrect and statement-II is correct
(4) Both statement-I and statement-II are incorrect

Answer (2)

$$\text{Sol. Fringe width } (\beta) = \frac{\lambda D}{d}$$



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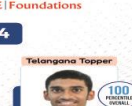
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9. For non-vibrating diatomic gas has adiabatic constant of γ_1 & for vibrating diatomic gas has adiabatic constant of γ_2 then

- (1) $\gamma_1 > \gamma_2$ (2) $\gamma_1 < \gamma_2$
(3) $\gamma_1 = \gamma_2$ (4) None of these

Answer (1)

Sol. $\gamma_1 = 1 + \frac{2}{5} = \frac{7}{5} = 1.4$

$\gamma_2 = 1 + \frac{2}{7} = \frac{9}{7} = 1.28$

Therefore $\gamma_1 > \gamma_2$

10. A force $\vec{F} = (\hat{i} + 2\hat{j} - 3\hat{k})N$ acts on point whose position vector is given as $\vec{r} = (2\hat{i} - 3\hat{j} + 7\hat{k})m$. Find torque about origin.

- (1) $(+5\hat{i} - 12\hat{j} + 7\hat{k})N.m$
(2) $(-5\hat{i} - 12\hat{j} + 8\hat{k})N.m$
(3) $(-5\hat{i} + 13\hat{j} + 7\hat{k})N.m$
(4) $(-5\hat{i} + 13\hat{j} - 7\hat{k})N.m$

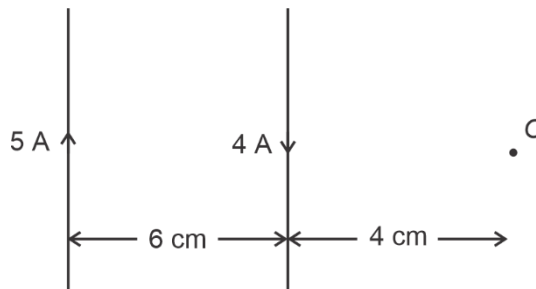
Answer (3)

Sol. $\vec{\tau} = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -3 & 7 \\ 1 & 2 & -3 \end{vmatrix}$

$= \hat{i}(9 - 14) - \hat{j}(-6 - 7) + \hat{k}(4 + 3)$

$= (-5\hat{i} + 13\hat{j} + 7\hat{k}) N.m$

11. The net magnetic field at point O due to the two infinite current carrying wires shown in the figure is



- (1) $1 \times 10^{-5} T$
(2) $1.2 \times 10^{-5} T$
(3) $1.5 \times 10^{-5} T$
(4) $2 \times 10^{-5} T$

Answer (1)

Sol. $B_{\text{net}} = \left| \frac{\mu_0 (5 A)}{2\pi(10 \text{ cm})} - \frac{\mu_0 (4 A)}{2\pi(4 \text{ cm})} \right|$
 $= \frac{25\mu_0}{\pi} = 10^{-5} T$

12. Read the statements and select the correct option.

Statement I : A pendulum is taken from Earth to another planet having mass four times and radius double than earth, then time period of pendulum remain same as on earth.

Statement II : The time period of pendulum only depends on the gravity of the planet.

- (1) Statement I is true but statement II is false.
(2) Statement II is true but statement I is false.
(3) Both statements are false.
(4) Both statements are true.

Answer (1)

Sol. On earth $T = 2\pi\sqrt{\frac{l}{g}}$

On other planet, $g' = \frac{G(4M)}{(2R)^2} = g$

So, time period will remain same and her T depends on g as well as l .

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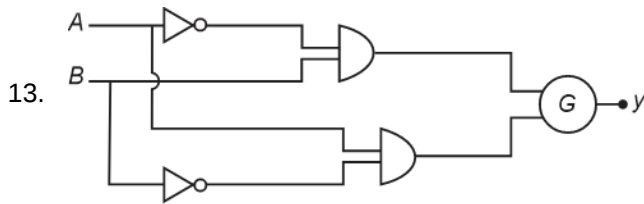
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For a given logic circuit truth table is given identify the gate G.

A	B	y
0	0	1
1	0	0
0	1	0
1	1	1

- (1) AND (2) NOR
(3) NAND (4) OR

Answer (2)

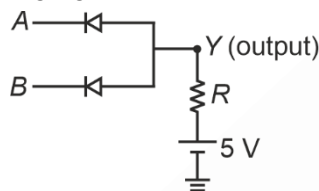
Sol. From truth table

we know its XNOR gate

$$\text{i.e. } y = \overline{AB} + A\overline{B}$$

therefore gate G must be NOR gate.

14. Name the logic gate



- (1) OR (2) AND
(3) NOT (4) NAND

Answer (2)

Sol. If both A and B are high only then Y is high, otherwise Y is low.

$\therefore$ AND Gate.

15. Displacement current in capacitor of area 16 cm^2 is 6 A at an instant. Find displacement current across area 3.2 cm^2



- (1) 1.2 A (2) 1.6 A
(3) 2.1 A (4) 0.5 A

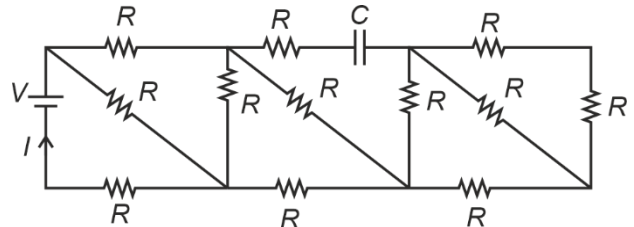
Answer (1)

Sol. $id = \epsilon_0 \frac{d\phi_E}{dt} = \epsilon_0 A \frac{dE}{dt} \Rightarrow id \propto A$

$$\Rightarrow i' = \left(\frac{3.2}{16} \right) id$$

$$= 1.2 \text{ A}$$

16. In the RC circuit shown, find I .



- (1) $\frac{V}{5R}$ (2) $\frac{5V}{3R}$
(3) $\frac{8V}{13R}$ (4) $\frac{3V}{R}$

Answer (3)

Sol. At steady state, C behaves as open-circuit

$$R_{eq} = \frac{13}{8}R$$

$$I = \frac{V}{R_{eq}} = \frac{8V}{13R}$$

17. A glass slab of refractive index $\mu_g = 1.44$ is coated with a thin film of refractive index $\mu_f = 2$. The minimum thickness of the film so that maximum transmission of green light of wavelength $\lambda = 5000 \text{ \AA}$ (incident normally) takes place is

- (1) $0.500 \mu\text{m}$ (2) $0.250 \mu\text{m}$
(3) $0.125 \mu\text{m}$ (4) $1.00 \mu\text{m}$

Answer (3)

Sol. For maximum transmission of light incident normally

$$2\mu_f t = n\lambda \quad (n = 1, 2, 3, \dots)$$

$$t_{\min} = \frac{\lambda}{2\mu_f} = \frac{5000 \times 10^{-10}}{2(2)} \text{ m} = 0.125 \mu\text{m}$$



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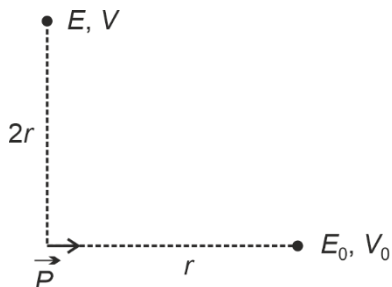
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18. For the electric dipole shown in the figure, the electric field and the electric potential are E_0, V_0 at a distance r on the axis. Then what is the electric field and the electric potential at a point on the equatorial plane at a distance $2r$.



- (1) $\frac{E_0}{16}, 0$
(2) $\frac{E_0}{4}, 0$
(3) E_0, V_0
(4) $\frac{E_0}{8}, 0$

Answer (1)

Sol. $E_{\text{axis}} = \frac{2kP}{r^3} = E_0$

$$E_{\text{equatorial}} = \frac{kP}{(2r)^3} = \frac{kP}{8r^3} = \frac{E_0}{16}$$

$$V = \frac{kP \cos \theta}{r^2}$$

$$V_{\text{axis}} = \frac{kP \cos 0^\circ}{r^2} = \frac{kP}{r^2}$$

$$V_{\text{equatorial}} = \frac{kP \cos 90^\circ}{(2r)^3} = 0$$

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

Choose the correct answer:

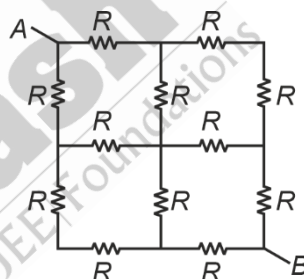
21. A projectile is fired with speed of 20 m/s at angle of 60° with horizontal. The speed at highest point of trajectory is x m/s then x is

Answer (10)

Sol. $V_H = 4 \cos \theta$

$$= 20 \cos 60^\circ = 10 \text{ m/s}$$

22. If equivalent resistance across AB is $\frac{NR}{2}$, find N



Answer (3)

Sol. Line of symmetry problem

$$R_{\text{eq}} = \frac{3R}{4} \times 2 = \frac{3R}{2}$$

23.

24.

25.

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