

24/01/2025

Morning



Aakash

Medical | IIT-JEE | Foundations

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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AIR	Name	Classroom
25	Rishi Shekher Shukla	2 Year Classroom
67	Krishna Sai Shishir	2 Year Classroom
78	Abhishek Jain	2 Year Classroom
93	Hardik Aggarwal	2 Year Classroom
95	Ujjwal Singh	2 Year Classroom
98	Rachit Aggarwal	2 Year Classroom

JEE (Main) 2024

AIR	Name	Classroom	State
1	Sarvvi Jais	2 Year Classroom	Karnataka
15	M Sai Divya Teja Reddy	2 Year Classroom	Telangana
19	Rishi Shekher Shukla	2 Year Classroom	Telangana

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. If $I = I_A \sin \omega t + I_B \cos \omega t$, then find rms value of current

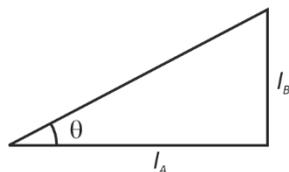
(1) $I_{rms} = I_A + I_B$

(2) $I_{rms} = \sqrt{I_A^2 + I_B^2}$

(3) $I_{rms} = \sqrt{\frac{I_A^2 + I_B^2}{2}}$

(4) $I_{rms} = \frac{1}{2} \sqrt{I_A^2 + I_B^2}$

Answer (3)



Sol.

$$I = \sqrt{I_A^2 + I_B^2} \sin(\omega t + \theta)$$

$$\tan \theta = \left(\frac{I_B}{I_A} \right)$$

$$\text{as } I_{rms} = \frac{I_0}{\sqrt{2}} \Rightarrow I_{rms} = \sqrt{\frac{I_A^2 + I_B^2}{2}}$$

2. What is relative shift of focal length of a lens when optical power is increased from 0.1 D to 2.5 D

(1) $\frac{24}{25}$

(2) $\frac{13}{10}$

(3) $\frac{21}{25}$

(4) $\frac{11}{10}$

Answer (1)

Sol. $f = \frac{1}{p}$

So, $f_1 = 10 \text{ m} = \frac{1}{p_1}$

And $f_2 = \frac{1}{p_2} = \frac{10}{25} \text{ m}$.

So $\frac{|\Delta f|}{f_1} = \frac{24}{25}$

3. Satellite A is launched in a circular orbit of radius R. Satellite B is launched in circular orbit of radius 1.03R. Time period of B is greater than A by approximately

(1) 9% (2) 4.5%

(3) 3% (4) 2.5%

Answer (2)

Sol. $T = 2\pi \sqrt{\frac{r^3}{Gm}}$

$$\frac{\Delta T}{T} = \frac{3 \Delta R}{2 R}$$

$$\frac{\Delta T}{T} \times 100 = \frac{3}{2} \times \frac{0.03R}{R} \times 100 = 4.5\%$$

4. An electron jumps from principle quantum state A to C by releasing photon of wavelength 2000 Å and from state B to C by releasing of photon of wavelength 6000 Å, then final the wavelength of photon for transition from A to B.

(1) 3000 Å (2) 4000 Å

(3) 8000 Å (4) 2000 Å

Answer (1)

Sol. $E_{AC} = E_{AB} + E_{BC}$

$$\frac{hc}{2000 \text{ Å}} = \frac{hc}{\lambda} + \frac{hc}{6000 \text{ Å}} \Rightarrow \frac{3-1}{6000} = \frac{1}{\lambda}$$

$\lambda = 3000 \text{ Å}$

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- Telangana Topper: AIR 15 M Sai Divya Teja Reddy (2 Year Classroom)
- Telangana Topper: AIR 19 Rishi Shekher Shukla (2 Year Classroom)

5. An electron of mass m enters in a region of uniform electric field $\vec{E} = -E_0\hat{k}$ at $t = 0$ with an initial velocity $\vec{V} = V_0\hat{j}$. If the de-Broglie wavelength is λ_0 initially, the de-Broglie wavelength at a time t is

- (1) $\lambda_0 \sqrt{1 + \frac{m^2 V_0^2}{e^2 E_0^2 t^2}}$ (2) $\lambda_0 \sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 V_0^2}}$
- (3) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 V_0^2}}}$ (4) $\frac{\lambda_0}{\sqrt{1 + \frac{m^2 V_0^2}{e^2 E_0^2 t^2}}}$

Answer (3)

Sol. $\lambda_0 = \frac{h}{mV_0}$... (i)

$$\vec{V} = V_0\hat{j} + \frac{(-e)(-E_0\hat{k})t}{m}$$

$$\vec{V} = V_0\hat{j} + \frac{eE_0t\hat{k}}{m}$$

$$|\vec{V}| = \sqrt{V_0^2 + \frac{e^2 E_0^2 t^2}{m^2}}$$

$$|\vec{P}_f| = \frac{h}{\lambda} = m|\vec{V}|$$

$$\lambda = \frac{h}{m|\vec{V}|}$$

$$= \frac{h}{m\sqrt{V_0^2 + \frac{e^2 E_0^2 t^2}{m^2}}}$$

$$= \frac{h}{mV_0\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 V_0^2}}}$$

$$= \frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 V_0^2}}}$$

6. For an ideal mono atomic gas undergoing an isobaric process, the ratio of $\frac{\Delta Q}{\Delta U}$ is

- (1) $\frac{5}{3}$
- (2) $\frac{7}{5}$
- (3) $\frac{4}{3}$
- (4) $\frac{5}{4}$

Answer (1)

Sol. In an isobaric process,

$$\Delta Q = nC_p \Delta T$$

$$\Delta U = nC_v \Delta T$$

$$\frac{\Delta Q}{\Delta U} = \frac{C_p}{C_v} = \gamma = \frac{5}{3} \text{ for a monoatomic}$$

7. In a process pressure of the gas is directly proportional to temperature then choose correct option.

- A : Process is isochoric.
 B : Work done in process is zero.
 C : Internal energy increase with increase in temperature.
- (1) A and B are correct
 (2) A and C are correct
 (3) A, B and C are correct
 (4) B and C are correct

Answer (3)

Sol. $P \propto T$

V is constant

Work = 0

ΔU is positive

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8. If the distance two parallel plate of a capacitor is d , A is the area of each plate, and E is the electric field. Find the energy stored in capacitor

(1) $\frac{1}{2}E^2 A \epsilon_0 d$ (2) $\frac{1}{4}E^2 A \epsilon_0 d$

(3) $\frac{3}{4}E^2 A \epsilon_0 d$ (4) $E^2 A \epsilon_0 d$

Answer (1)

Sol. $\Delta u = \text{Energy density} \times \text{volume} = \frac{1}{2} \epsilon_0 E^2 \cdot Ad$

9. In YDSE, lights of wavelength 600 nm and 480 nm are used. What is the minimum order of bright fringe of 480 nm coincides with bright fringe of 600 nm.

(1) 8 (2) 7

(3) 6 (4) 5

Answer (4)

Sol. For 480 nm $w_1 = \frac{480D}{d}$

For 600 nm = $w_2 = \frac{600D}{d}$

So, 5th order of 480 nm natcher

Clearly $5\Delta w_1 = 4\Delta w_2$

10. A body of mass m is projected with initial velocity v_0 at 45° with horizontal. Find it's angular momentum at highest point about point of projection.

(1) $\frac{mv_0^3}{4g}$ (2) $\frac{mv_0^3}{4\sqrt{2}g}$

(3) $\frac{mv_0^2}{4\sqrt{2}g}$ (4) $\frac{mv_0}{2\sqrt{2}g}$

Answer (2)

Sol.



$$L = \frac{mv_0}{\sqrt{2}} H$$

$$= \frac{mv_0}{\sqrt{2}} \cdot \frac{v_0^2 \cdot \frac{1}{2}}{2g}$$

$$L = \frac{mv_0^3}{4\sqrt{2}g}$$

11. A Plano convex lens of refractive index 1.5 & radius of curvature of curved surface of 20 cm present in air is having focal length of f_1 . There is another Plano convex lens of refractive index of 1.5 & ROC of 30 cm placed in liquid of RI of 1.2 having focal length of f_2 the $\frac{f_1}{f_2}$ is

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

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

Answer (4)

Sol. $\frac{1}{f_1} = (1.5 - 1) \left\{ \frac{1}{R} \right\} = \frac{0.5}{20}$

$$f_1 = \frac{20}{0.5} = 40$$

$$\frac{1}{f_2} = \left(\frac{1.5}{1.2} - 1 \right) \left(\frac{1}{R} \right) = \frac{0.3}{1.2} \times \frac{1}{30} = \frac{1}{120}$$

$$\frac{f_1}{f_2} = \frac{40}{120} = \frac{1}{3}$$

12. Acceleration of solid cylinder purely rolling an inclined plane of inclination of θ is

(1) $\frac{2}{5}g \sin \theta$ (2) $\frac{3}{2}g \sin \theta$

(3) $\frac{2}{3}g \sin \theta$ (4) $\frac{1}{3}g \sin \theta$

Answer (3)

Sol. $a = \frac{g \sin \theta}{1 + \frac{k^2}{r^2}} = \frac{g \sin \theta}{1 + \frac{1}{2}} = \frac{2}{3}g \sin \theta$

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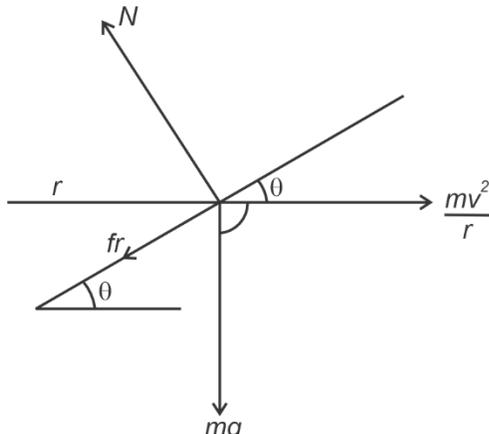
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13. Find the maximum possible speed for the given angle of banking 'θ' on a curved road of radius r having coefficient of friction μ .

(1) $v_{\max} = \sqrt{\frac{gr(\mu + \tan\theta)}{(1 - \mu \tan\theta)}}$ (2) $v_{\max} = \sqrt{\frac{gr(\mu - \tan\theta)}{(1 - \mu \tan\theta)}}$
 (3) $v_{\max} = \sqrt{\frac{gr(1 + \mu \tan\theta)}{(1 - \mu \tan\theta)}}$ (4) $v_{\max} = \sqrt{\frac{gr(\mu - \tan\theta)}{(1 + \mu \tan\theta)}}$

Answer (1)

Sol.



$$\Rightarrow N = \frac{mv^2}{r} \sin\theta + mg \cos\theta$$

$$\text{Also } \frac{mv^2}{r} \cos\theta = \mu N + mg \sin\theta$$

$$\Rightarrow \frac{mv^2}{r} \cos\theta = \mu \frac{mv^2}{r} \sin\theta + \mu mg \cos\theta + mg \sin\theta$$

$$\Rightarrow v^2 \left[\frac{\cos\theta}{r} - \frac{\mu \sin\theta}{r} \right] = g(r \cos\theta + \sin\theta)$$

$$\Rightarrow v = \sqrt{\frac{gr(\sin\theta + \mu \cos\theta)}{(\cos\theta - \mu \sin\theta)}}$$

$$v = \sqrt{\frac{gr(\tan\theta + \mu)}{(1 - \mu \tan\theta)}}$$

14. In a parallel plate capacitor length l and width b are 3 cm and 1 cm respectively. Separation between plates d is 3 μm . By which of the following values capacitance increases by a factor of 10.

- (A) $l = 6 \text{ cm}, b = 5 \text{ cm}, d = 3 \mu\text{m}$
- (B) $l = 5 \text{ cm}, b = 2 \text{ cm}, d = 1 \mu\text{m}$

(C) $l = 5 \text{ cm}, b = 1 \text{ cm}, d = 30 \mu\text{m}$

(D) $l = 1 \text{ cm}, b = 1 \text{ cm}, d = 30 \mu\text{m}$

- (1) A, B
- (2) A, C
- (3) B, C
- (4) B, C, D

Answer (1)

Sol. $C = \frac{A\epsilon_0}{d}$

$$C = \frac{lb\epsilon_0}{d}$$

$$C_i = \frac{3 \times 1}{3} \epsilon_0 \times 10^2 = 10^2 \epsilon_0$$

15. In SHM given by equation $x = A \sin \omega t$ of time period 2 sec and amplitude 1 cm, ratio of $\frac{\text{distance}}{\text{displacement}}$ in first

1.25 sec is

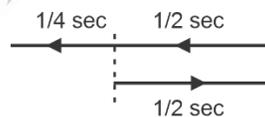
- (1) $2\sqrt{2} + 1$
- (2) $2\sqrt{2} - 1$
- (3) $\frac{1}{\sqrt{2}}$
- (4) $\frac{1}{2\sqrt{2}}$

Answer (1)

Sol. $x = A \sin \frac{2\pi}{2} \times 1.25$

$$x = A \sin \frac{5\pi}{4}$$

$$|s| = \frac{A}{\sqrt{2}}$$



$$d = 2A + \frac{A}{\sqrt{2}}$$

$$\frac{d}{|s|} = (2\sqrt{2} + 1)$$

- 16.
- 17.
- 18.
- 19.
- 20.

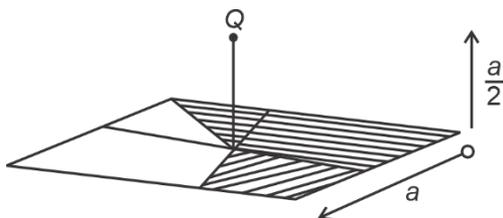
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SECTION - B

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

21. The electric flux through the shaded area of square plate of side a due to point charge placed at distance of $\frac{a}{2}$ from it as shown in figure, is $\frac{NQ}{48\epsilon_0}$. Then N is

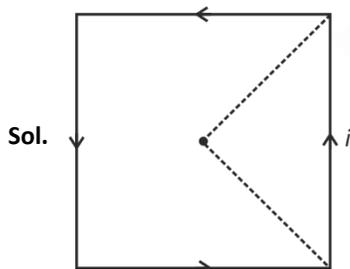


Answer (5)

Sol. $\left(\frac{Q}{6\epsilon_0}\right)\frac{1}{4} + \left(\frac{Q}{6\epsilon_0}\right)\frac{1}{4} + \left(\frac{Q}{6\epsilon_0}\right)\frac{1}{4} \times \frac{1}{2} = \frac{5Q}{48}$

22. In a square loop of side length $\frac{1}{\sqrt{2}}$ m, a current of 5 A is flowing. Find magnetic field at its centre in (μ T).

Answer (8)



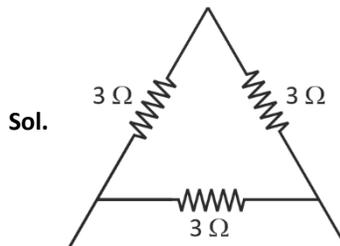
$$B = 4 \left(\frac{\mu_0 i}{4\pi \frac{1}{2\sqrt{2}}} \right) (\sin 45^\circ + \sin 45^\circ)$$

$$= 4 \left(\frac{4\pi \times 10^{-7} \times 5}{4\pi} \cdot 2\sqrt{2}\sqrt{2} \right)$$

$$= 8 \times 10^{-6} \text{ T}$$

23. A wire of resistance 9Ω is bent in form of an equilateral triangle. Find equivalent resistance between two vertices of triangle.

Answer (2)



$$R_{eq} = 3 \parallel 6$$

$$R_{eq} = \frac{3 \times 6}{9} = 2 \Omega$$

24. Work done required to break a drop of radius R to 27 drops of equal radius is 10 J. Then work done to break drop of radius R in 64 drops of equal radii is X J, then X is

Answer (15)

Sol. For 27 $R \rightarrow \frac{R}{3}$; for 64 $R \rightarrow \frac{R}{4}$

$$\frac{S \left(27 \cdot 4\pi \left(\frac{R}{3} \right)^2 - 4\pi R^2 \right)}{S \left(64 \cdot 4\pi \left(\frac{R}{4} \right)^2 - 4\pi R^2 \right)} = \frac{10}{x} = \frac{2}{3}$$

$$X = 15 \text{ J}$$

25. A particle moves on a straight line under the influence of a force $F = \alpha + \beta x^2$ where x is the displacement, and $\beta = -12$ SI units. If the total work done for a displacement $x = 1$ m is 12 J, then α is _____ SI units.

Answer (16)

Sol. $w = \int_0^1 F_x dx$

$$= \int_0^1 (\alpha + \beta x^2) dx$$

$$= \alpha + \frac{\beta}{3}$$

$$12 = \alpha - \frac{12}{3}$$

$$\alpha = 16$$

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