FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – V
PAPER –2
TEST DATE: 18-02-2025

ANSWERS, HINTS & SOLUTIONS

Physics PART – I

SECTION – A

1. A

Sol. $\omega = \frac{\pi}{3}$, $\frac{2 \times v \times \sin 45}{g} = 1 \Rightarrow v = \frac{g \times 1}{2 \sin 45} = \frac{10}{\sqrt{2}} = 5\sqrt{2} = \sqrt{50}\ m/s$

2. A

Sol. Apply PV = nRT
Also,
Process AB $\to$ Isothermal
Process BC $\to$ Isochoric
Process CA $\to$ Isobaric

3. C

Sol. $F = \frac{k}{v}$

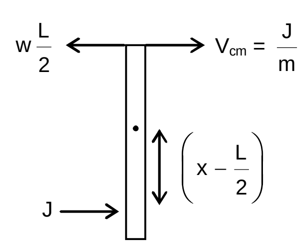
$m\frac{dv}{dt} = \frac{k}{v}$; $\int v dv = \frac{k}{m}\int dt$

$\frac{mv^2}{2} = kt$

Work done by force = change in kinetic energy.

4. C

Sol. $J\left(x - \frac{L}{2}\right) = I\omega$

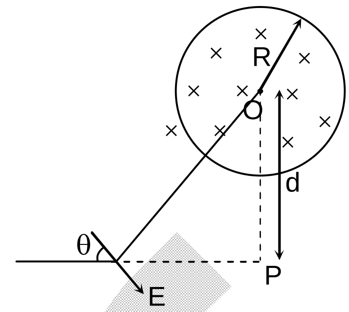


$\omega\frac{L}{2} = V_{cm} = \frac{J}{M}$; $\frac{J\left(x - \frac{L}{2}\right)\frac{L}{2}}{I} = \frac{J}{m}$

$I = \frac{ML^2}{12}$

5. ABD

Sol. $\int \vec{E}\cdot d\vec{l} = A\frac{dB}{dt}$



$E2\pi\sqrt{x^2+d^2} = \pi R^2 k$

$E = \frac{\pi R^2 k}{2\sqrt{x^2+d^2}}$

$W_{ext} = \int_0^\infty q\vec{E}\cdot dx = \frac{q\pi R^2}{4}k$

6. ABCD

Sol. Particle velocity $v_p = -v\left(\frac{dy}{dx}\right)$

v is the wave velocity.

$\frac{dy}{dx}$ is the slope.

At point S, slope is zero, there force V_p at S is zero.
At point T, slope is (+)*ve*, there fore V_p will be along –*ve x* direction

Excess pressure $dP = -B.\frac{dy}{dx}$

At point S, slope is zero

$\Rightarrow$ dP = 0.

At point R, slope is –*ve*

$\Rightarrow$ dP is (+) ve i.e., particles located near C are under compression.

7. AD

Sol. More is optical density, more will be reflected light.

SECTION – B

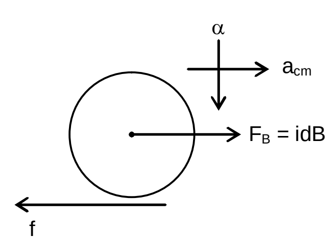
8. 8

Sol. $m\times 2100\times[0-(-5)]+10^{-3}\times 3.36\times 10^5 = 420$

$m = \frac{420-336}{2100\times 5} = 8\times 10^{-3}\text{kg} = 8\text{gm}$

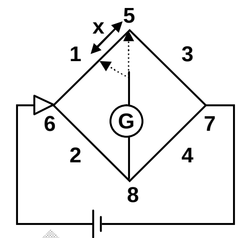
9. 2

Sol. $f = \frac{F}{3} = \frac{idB}{3}$



$\Rightarrow \frac{48\times 0.5\times 0.25}{3} = 2.00$

10. 2
Sol. For getting null point



$\frac{R_1}{R_3} = \frac{R_2}{R_4}$

as R2 = R4

R1 = R3

Let the pointer at point 5 is moved to left by distance x to get nul point as shown in the figure. If resistance per unit length of wire 3 is r then that of wire 1 will be 2r.

$(8 - x)2r = x \times 2r + 8 \times r$

$4x = 8$

$x = 2m$

11. 2
Sol. Velocity of efflux = 16 × 0.25 = 4 m/s^2

Time of fall of the liquid = $\sqrt{\frac{2h}{g}}$ = 0.25 sec.

Thus, range on horizontal surface = velocity of efflux × time of fall = 2 m.

12. 3
Sol. $\Delta T = \left(\frac{\Delta q}{\Delta t}\right)(R)$

Rods connected in series:

$$\Delta T = \left(\frac{\Delta q}{12}\right)(2R) \qquad \ldots(1)$$

Rods connected in parallel:

$$\Delta T' = \left(\frac{\Delta q}{t}\right)\left(\frac{R}{2}\right) \qquad \ldots(2)$$

$$\frac{\Delta T'}{\Delta T} = \frac{1}{4}$$

$\therefore \quad \Delta T' = \frac{\Delta T}{4} = 3$ min.

13. 6
Sol. $\Delta f = f\left(\frac{338+5}{338-5} - 1\right) = 6$

SECTION – C

14. 100.00
Sol. Apply KVL.

15. 160.00
Sol. Apply KVL.

16. 0.97

Sol. $R = \dfrac{mV}{qB} = 1\,m$

Angular deviation = $\sin^{-1}\left(\dfrac{d}{R}\right)$ = 60°.

Time in $\vec{B} = \dfrac{T}{6} = \dfrac{\Delta s}{30}$

In electric field,

$0 = 10 \sin 60° - \dfrac{qEt}{m}$

$t = \dfrac{\sqrt{3}\,s}{2}$

Total time = $\dfrac{\pi}{30} + \dfrac{\sqrt{3}}{2}$ = 0.97 s.

17. 5.00

Sol. $d = 10 \cos 60° \times \dfrac{\sqrt{3}}{2} = \dfrac{5\sqrt{3}\,m}{2}$

Chemistry

PART – II

SECTION – A

18. D
Sol. PO_4^{3-} produces no gas when treated with acids.

19. C
Sol. $\Delta E = 0$ for isothermal process.

20. B
Sol. β-keto acids undergo decarboxylation on heating.

21. D
Sol. $\pi(CaCl_2) = iCRT = 3 \times 0.4 \times RT = 1.2\ RT$
$\pi(KCl) = iCRT = 2 \times 0.6 \times RT = 1.2\ RT$

22. ABD
Sol. Benzylic hydrogen is needed for oxidation of side chain.

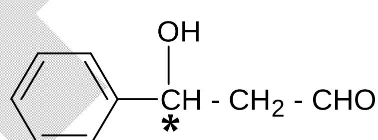
23. ABD
Sol. The products are
(A) $H_3PO_4 + PH_3$, (B) $PH_3 + Na_2HPO_2$, (C) $C + H_2O$, (D) $H_2O + O_2$

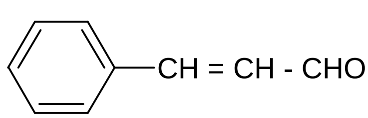
24. BC
Sol. This is due to decrease in lattice energy.

SECTION – B

25. 6
Sol. No. of peptide bonds = 9
Mass of hydrolysed products = $796 + 18 \times 9 = 958$
No. of glycine units = $958 \times \frac{47}{100} \times \frac{1}{75} = 6$

26. 8
Sol. Except (viii) all are correct.

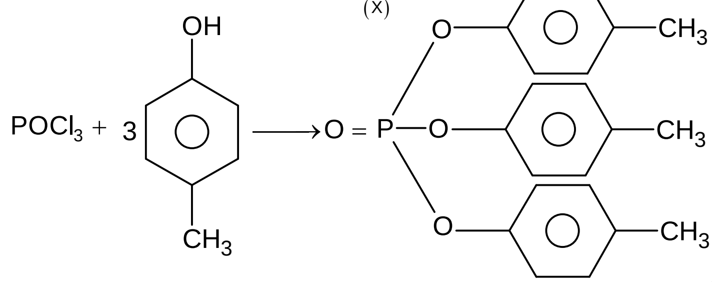
27. 4
Sol.
X is  (2-optical isomers)

Y is  (2-geometrical isomers)

$\therefore$ Total isomers is 4.

28. 16
Sol. P is $BaSO_3$, Q is Na_2SO_4, R is $BaSO_4$
$\therefore$ Mol. mass of (R - P) = 16

29. 47
Sol. $6PCl_3 + P_4O_{10} + 6Cl_2 \longrightarrow \underset{(X)}{10\,POCl_3}$



(Y)

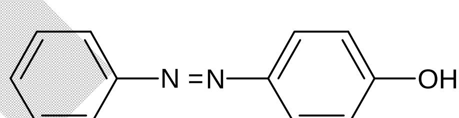
Number of atom in (Y) is 47.

30. 10
Sol. $d = \frac{Z \times A}{N \times a^3} = \frac{2 \times 24}{6 \times 10^{23} \times \left(2 \times 10^{-8}\right)^3} = \frac{2 \times 24}{6 \times 10^{23} \times 8 \times 10^{-24}} = 10\,g/cc$

SECTION – C

31. 0.20
Sol. Moles of $CuSO_4$ before electrolysis = $\frac{25.52}{159.5} = 0.16$
Moles of $CuSO_4$ deposited = 0.06
Moles of $CuSO_4$ after deposited = 0.16 – 0.06 = 0.1
Molarity = $0.1 \times \frac{1000}{500} = 0.2M$

32. 0.96
Sol. $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$
Quantity of charge passed = (193 $\times$ 60) Cou
Number of Faraday passed = $\frac{193 \times 60}{96500} = 0.12$, moles of O_2 evolved $= \frac{0.12}{4}$ = 0.03
Mass of O_2 evolved = 0.03 $\times$ 32 = 0.96 g

33. 3.50
Sol.
R is 

34. 3.30
Sol. x = 26, y = 7

Mathematics PART – III

SECTION – A

35. B

Sol. (A) $a_{ij} = -a_{ji} \Rightarrow a_{ij} + a_{ji} = 0 \Rightarrow$ A is skew symmetric matrix

(C) $A^2 = 2A \Rightarrow A^3 = 2^2A \Rightarrow A^6 = 2^5A$

(D) A^6B^7 is a skew symmetric matrix of odd order

36. D

Sol. Let there be a value of k for which $x^3 - 3x + k = 0$ has two distinct roots between 0 and 1. Let a, b be two distinct roots of $x^3 - 3x + k = 0$ lying between 0 and 1 such that $a < b$. Let $f(x) = x^3 - 3x + k$. Then $f(a) = f(b) = 0$. Since between any two roots of a polynomial f(x) there exist at least one root of its derivative $f'(x)$. Therefore $f'(x) = 3x^2 - 3$ has at least one root between a and b. But $f'(x) = 0$ has two roots equal to ± 1 which do not lie between a and b. Hence $f(x) = 0$ has no real roots lying between 0 and 1 for any value of k.

37. A

Sol. Let $\hat{d}$ be the unit vector along the desired vector then $\hat{d}$ is along $\left(-2\hat{j} + 3\hat{k}\right) \times \left(-\hat{i} - 2\hat{k}\right)$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -2 & 3 \\ -1 & 0 & -2 \end{vmatrix} = 4\hat{i} - 3\hat{j} - 2\hat{k}$$

38. A

Sol. $x^4 + 4x^3 - 8x^2 = -k$

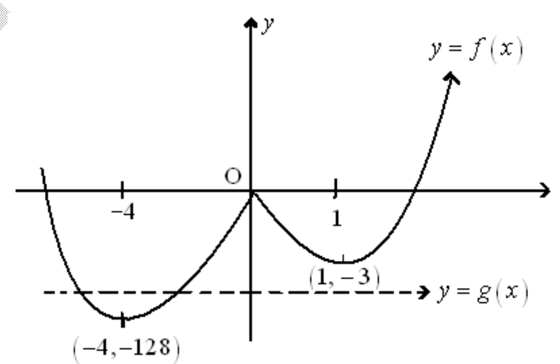
$\Rightarrow \quad f(x) = -k$

Where

$f(x) = x^4 + 4x^3 - 8x^2 = x^2\left(x^2 + 4x - 8\right)$

Let $g(x) = -k$

From the graph the following cases arise :



1. When $-3 \le -k \le 0, \Rightarrow 0 \le k \le 3$
   In this case, $y = -k$ intersect at four points.
2. When $-4 \le -k < -3, \Rightarrow 3 < k \le 4$
   In this case, $y = -k$ intersect at two points, the given equation has two real roots.
3. When $k < 0, \Rightarrow -k > 0$
   In this case, there are two points of intersection. So, the equation has two real roots.

39. AB

Sol. $\det(A+B) = -\det(A)\det(B)\det(A+B)$

$= -\det(A^T)\det(B^T)\det(A+B)$

$= -\det(A^T(A+B)B^T)$

$= -\det(A^T(A+B)B^T)$

$= -\det(A^TAB^T + A^TBB^T)$

$= -\det(B^T + A^T)$

$= -\det(A+B)^T$

$= -\det(A+B)$

$\Rightarrow \det(A+B) = 0$

40. AD

Sol. $\dfrac{2x}{(x-1)(x-4)} = \dfrac{C}{x-1} + \dfrac{D}{x-4}$

$2x = C(x-4) + D(x-1)$

$\therefore \quad C = -2/3,\ D = 8/3$

$\therefore \quad \displaystyle\int \frac{e^{x-1}}{(x-1)(x-4)} 2x\ dx = \int e^{x-1}\left(\frac{-2/3}{x-1} + \frac{8/3}{x-4}\right)dx$

$= -\dfrac{2}{3}F(x-1) + \dfrac{8}{3}e^3F(x-4) + C$

$\therefore \quad A = -2/3,\ B = 8/3\ e^3$

41. AD

Sol. Since $\displaystyle\int_a^b f(x)dx = (b-a)\int_0^1 f\{(b-a)x + a\}dx$,

$\displaystyle\int_1^2 \sin x^2 dx = \int_0^1 \sin(x+1)^2 dx = \int_0^1 \sin(x^2+2x+1)dx$

$\displaystyle\int_{-4}^4 \cos x^2\, dx = 8\int_0^1 \cos(8x-4)^2\, dx$

$= \displaystyle 8\int_1^0 \cos 16(2x-1)^2\, dx.$

SECTION – B

42. 2

Sol. E = even of any one cutting a space in one cut

$n(E) = {}^{13}C_1$

$n(S) = {}^{52}C_1$

$P(E) = 1/4 = p, P(\bar{E}) = q$

Probability of a winning $= p + qqqp + qqqqqqp + \ldots\ldots\ldots\ldots\infty$

$= \frac{P}{1-q^3} = \frac{64}{175} = 128$

$\left[\frac{\lambda}{64}\right] = 2$

43. 7

Sol. $P(A \cap B) = P(A)P(B) \Rightarrow 1/6 = P(A)P(B)$

$P(A \cup B) = P(A) + P(B) \cdot P(A \cap B)$

$\Rightarrow 2/3 = P(A) + \frac{1}{6P(A)} - \frac{1}{6}$

$\Rightarrow 6(P(A))^2 - 5P(A) + 1 = 0 \Rightarrow P(A) = 1/2, P(B) = 1/3$

So, $8P(A) + 9P(B) = 4 + 3 = 7$

44. 7

Sol. $\left({}^{19}c_0(x^3)^{19} + {}^{19}c_1(px^2 + 2x - 5)(x^3)^{18} + \ldots\right)$

$\left({}^{8}c_0x^{16} + {}^{8}c_1(qx - 41)x^{14} + \ldots\right)\left({}^{6}c_0x^{24} + {}^{6}c_1(-x^3 + x - 1)x^{20} + \ldots\right)$

$= x^{97} + 391x^{96} + a_{95}x^{95} + \ldots$

Comparing the coefficient of x^{96} we get

$19p + 8q - 6 = 391$

$\Rightarrow 19p + 8q = 397$ Let $q = 19\lambda + k$, $0 \le k < 19$

$p = \frac{397 - 8(19\lambda + k)}{19} = 21 - 8\lambda - 2\frac{(4k+1)}{19}$

$\frac{4k+1}{19}$ must be integer $\Rightarrow k = 14$, $p = 15 - 8\lambda$

For minimum positive value of p, $\lambda = 1 \Rightarrow p = 7$

45. 30

Sol. $\frac{4000}{a_1a_{4001}} = 10 \Rightarrow a_1a_{4001} = 400$

also $a_1 + a_{4001} = 50$

$\Rightarrow |a_1 - a_{4001}|^2 = 2500 - 1600$

$\Rightarrow |a_1 - a_{4001}| = 30$

46. 61

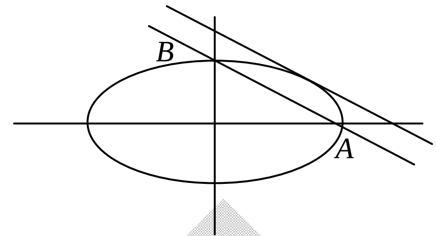
Sol. The number of ways when no student failed in any examination $= (2^3 - 1)^4$

The number of ways when out of above cases atleast one subject was not cleared by any students $= 3C_1(3)^4$

The number of ways when out of above cases atleast any two subjects were not cleared by any student $= 3C_2(1)^4$. So required cases $= (2^3 - 1)^4 - 3C_1 3^4 + 3C_2$ = 2161

47. 3

Sol. Let perpendicular distance of P from the line be h



$\frac{1}{2} \times h \times 5 = 6(\sqrt{2} - 1)$ (as $\Delta PAB = 6(\sqrt{2} - 1)$)

$\Rightarrow h = \frac{12(\sqrt{2} - 1)}{5}$

Now distance of tangent parallel to AB i.e. $4y + 3x = 12\sqrt{2}$, from line AB is $\frac{12(\sqrt{2} - 1)}{5}$.

There are just three such points.

SECTION – C

48. 5.00

Sol. $\left| y \frac{dy}{dx} \right| = 1 \Rightarrow y^2 = \pm 2x + 1$

49. 8.00

Sol. $x + y \frac{dy}{dx} = 3x$; solving we get $2x^2 - y^2 + 2 = 0$.

50. 6.00

Sol. Writing $\sin^2 \theta = x$, we get $2 \sin \theta \cos \theta \, d\theta = dx$, and hence the given integral is equal to

$$\frac{1}{2} \int_0^{\pi/2} \cos^{2m-1} \sin^{2n-1} \theta \, (2 \sin \theta \cos \theta) \, d\theta$$

$$= \frac{1}{2} \int_0^1 \left(\cos^2 \theta\right)^{\frac{2m-1}{2}} \left(\sin^2 \theta\right)^{\frac{2n-1}{2}} dx = \frac{1}{2} \int_0^1 (1 - x)^{m-1/2} x^{n-1/2} dx = \frac{1}{2} \beta\left(m + \frac{1}{2},\ n + \frac{1}{2}\right).$$

51. 1.00

Sol. Writing $\frac{x}{1+x} = z$, we get $x = \frac{z}{1-z}$, $1 + x = \frac{1}{1-z}$ and $dx = \frac{dz}{(1-z)^2}$.

$$\text{L.H.S.} = \int_0^1 \frac{z^{m-1}}{(1-z)^{m-1}} (1-z)^{m+n} \frac{dz}{(1-z)^2} = \int_0^1 z^{m-1} (1-z)^{n-1} dz = \beta(m, n)$$

$$= \int_0^\infty \frac{x^{n-1}}{(1+x)^{m+n}} dx.$$