FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – XI
PAPER –2
TEST DATE: 11-05-2025

ANSWERS, HINTS & SOLUTIONS

Physics

PART – I

SECTION – A

1. B

Sol. Given $m_1 = 12$ g

$m_2 = 36$ g

$-n_1CdT = n_2CdT$

$$C = -\frac{n_2}{n_1}C_v = -\frac{3}{2}\frac{m_2}{m_1}R$$

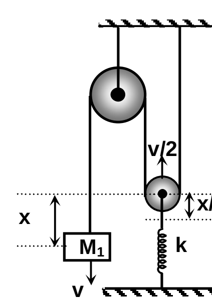
$$= -\frac{3}{2}\times\frac{36}{12}\times R = -\frac{9R}{2}$$

2. C

Sol. A spherical non-conducting sphere with uniform charge density σ, behaves as a conductor.

3. C

Sol. If the mass is displaced by x and has speed v spring will extend by x/2 & M_2 will have speed v/2



Energy of this system can be written as

$$-M_1gx + \frac{1}{2}M_1v^2 + M_2g\frac{x}{2} + \frac{1}{2}M_2\left(\frac{v}{2}\right)^2 + \frac{1}{2}K\left(\frac{x}{2}\right)^2 = \text{constant}$$

$$-M_1gx + \frac{1}{2}M_1v^2 + M_2g\frac{x}{2} + \frac{1}{8}M_2v^2 + \frac{1}{8}Kx^2 = \text{constant}$$

Differentiate w.r.t. time

$$-M_1gv + M_1v\frac{dv}{dt} + \frac{M_2g}{2}v + \frac{1}{4}M_2v\frac{dv}{dt} + \frac{1}{4}Kx.v = 0$$

$$\Rightarrow -M_1g + M_1\frac{dv}{dt} + \frac{M_2g}{2} + \frac{M_2}{4}\frac{dv}{dt} + \frac{1}{4}Kx = 0$$

$$\left(M_1 + \frac{M_2}{4}\right)\frac{dv}{dt} = -\frac{K}{4}x + M_1g - \frac{M_2g}{2}$$

$$a = \frac{dv}{dt} = -\left(\frac{K}{4M_1 + M_2}\right)x + \frac{2(2M_1 - M_2)g}{4M_1 + M_2}$$

Here $\omega^2 = \frac{K}{4M_1 + M_2}$

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{4M_1 + M_2}{K}}$$

4. C
Sol. An induced current will be developed in the loop due to change in flux.

5. B, C, D
Sol. $I_1 = \frac{I_0 R_2}{R_1 + R_2}$

$$\frac{P_1}{P_2} = \frac{I_0^2 R_2^2 R_1}{I_0^2 R_1^2 R_2}$$

6. A, B, C, D
Sol. Use Basic concept

7. A, D
Sol. Least count = $\frac{P}{N} = \frac{1\text{ mm}}{50} = 0.02\text{ mm}$
The instrument has +ve zero error.
e = +n(L.C) = (3 × 0.02) = 0.06 mm
Linear scale reading = 2 × (1 mm) = 2 mm
Circular scale reading = 31 × (0.02 mm) = 0.62 mm
∴ True reading = 2 + 0.62 – 0.06 = 2.56 mm

SECTION – B

8. 31
Sol. $I \propto h^5$

9. 8
Sol. $v_y = u_y + a_y t$

$0 = 6 - \frac{qE_0}{m} t_1$

t_1 = 3 sec

$v_x^2 + v_y^2 + v_z^2 = (5\sqrt{5})^2$

$4^2 + v_y^2 + 3^2 = 125$

$v_y = 10$ m/sec

$v_y = u_y + a_y t$

$10 = 0 + \frac{qE_0}{m} t_2$

$\Rightarrow t_2$ = 5 sec
So, t = $t_1 + t_2$ = 8 sec

10. 6
Sol. $S = \frac{R_1 R_2}{R_1 + R_2}$ (from equivalent cell)
So, S = 6 Ω

11. 4

Sol. $m_1g - T = m_1a_1$

$T = ma$

$$T\left(\frac{\ell}{2}\right) = \frac{m\ell^2}{12}\alpha$$

$$a_1 = a + \frac{\alpha\ell}{2}$$

On solving; $a = \left(\frac{m_1}{m + 4m_1}\right)g$

Clearly a is maximum when $\frac{m}{m_1} \to 0$. Thus, $a_{max} = \frac{g}{4}$

$\Rightarrow$ n = 4

12. 9

Sol. The optical path difference between the two beams arriving at P result from the path difference $\ell_2 - \ell_1$ and the path difference d sin θ (L >> d). Therefore

$\delta = (\ell_2 - \ell_1) + d \sin\theta$ …(i)

The condition for constructive interference is:

$\delta = m\lambda$, m = 0, $\pm$1, …… …(ii)

Thus, $\sin\theta = \frac{1}{d}[m\lambda - (\ell_2 - \ell_1)]$ …(iii)

Using the obvious condition, $|\sin\theta| \le 1$, and substitution of sin θ in equation yields.

$$\frac{1}{d}[m\lambda - (\ell_2 - \ell_1)] \le 0$$

Solving the inequality for the extreme case, we find

$$\begin{cases} m_{max} = \frac{d + (\ell_2 - \ell_1)}{\lambda} \\ m_{min} = \frac{-d + (\ell_2 - \ell_1)}{\lambda} \end{cases}$$

Therefore, the number of orders will be:

$$n = m_{max} - m_{min} + 1 = \frac{2d}{\lambda} + 1 = \frac{2 \times 2000}{500} + 1 = 9$$

Note that the addition of '1' is due to m = 0, which does not appear in m_{max} and m_{min}.

13. 150

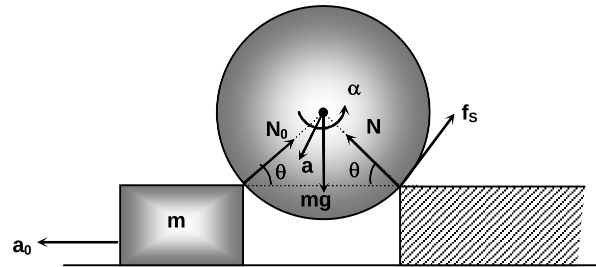
Sol. $$v_3 = \frac{s_1 + s_2}{\frac{s_1}{v_1} + \frac{s_2}{v_2}} = \sqrt{v_1v_2}$$

After solving $\frac{s_1}{s_2} = \sqrt{\frac{v_1}{v_2}} = 1.50$

SECTION – C

14. 8.00

15. 20.00



Sol. **(Q. 14 to 15):**
$v_0 \cos\theta = v \sin 2\theta$
$v_0 = 2v \sin\theta$
$$a_0 = 2\left[a\sin\theta - \frac{v^2}{R}\cos\theta\right]$$
just after release, v = 0, $v_0 = 0$
$a_0 = 2a \sin\theta$
$a_0 = 6a/5$ …(i) (since, θ = 37°)
$N_0 \cos\theta = ma_0$
$$\Rightarrow \frac{4N_0}{5} = ma_0$$
$$\therefore N_0 = \frac{5}{4}ma_0 = \frac{3}{2}ma \quad \text{…(ii)}$$
$$f_S R = \frac{mR^2}{2}\alpha\ f \Rightarrow f_S = \frac{ma}{2} \quad \text{…(iii)}$$
$mg\cos\theta - N_0 \sin 2\theta - f_S = ma$
$$\frac{4}{5}mg - \frac{24}{25}N_0 - \frac{ma}{2} = ma$$
$$\frac{4}{5}mg - \frac{24}{25}\times\frac{3}{2}ma = \frac{3ma}{2}$$
$$\frac{4mg}{5} = \frac{3ma}{2}\times\frac{49}{25}$$
$$\therefore a = \frac{8}{3}\,m/s^2$$
$$\therefore N_0 = \frac{3ma}{2} = \frac{3}{2}\times 5\times\frac{8}{3} = 20\,N$$
$\therefore N_0 = 20$ Newton

16. 1.00
Sol. The reading will be equal to ε.

17. 2.00
Sol. The total amount of heat which will be dissipated on each of the resistors after opening the switch, and until a new equilibrium state is achieved will be $\frac{C\varepsilon^2}{2} + \frac{L\varepsilon^2}{2R^2} = 2J$

Chemistry

PART – II

SECTION – A

18. D
Sol. Hydroboration - Reduction

19. D
Sol. $Na_2S + Na_2[Fe(CN)_5 NO] \longrightarrow Na_4[Fe(CN)_5 NOS]$

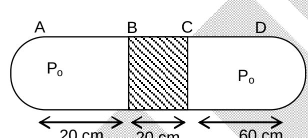
20. A
Sol. Neoprene is a polymer of chloroprene.

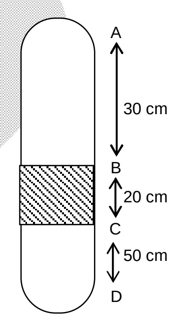
21. A
Sol.
1. PH_3 when passed through $CuSO_4$ solution black ppt. (Cu_3P_2) is formed.
2. PCl_3 on hydrolysis produces H_3PO_3.

22. A, B, C, D

23. A, B, D
Sol.
(1) Lactose on hydrolysis produces D-Glucose and D-Galactose.
(2) Sucrose does not undergo mutarotation.
(3) D-Glucose and D-Mannose are C-2 epimers

24. A, D
Sol.





For column AB

$P_1V_1 = P_2V_2$

$P_o \times 20A = P_2 \times 30A$

$P_2 = \dfrac{P_o \times 20A}{30A} = \dfrac{2P_o}{3}$

For column CD

$P_1V_1 = P_2'V_2$

$P_o \times 60A = P_2 \times 50A$

$P_2' = \dfrac{6P_o}{5}$

$P_2' = P_2 + 20$

$\dfrac{6P_o}{5} = \dfrac{2P_o}{3} + 20$

$P_o = 37.5$ cm Hg

SECTION – B

25. 8

Sol. Meq. of $KMnO_4$ = Meq. of H_2O_2

$$320 \times \frac{1}{10} \times 5 = 112 \times N$$

$$N = \frac{32 \times 5}{112}$$

Volume strength $N \times 5.6$

$$= \frac{32 \times 5}{112} \times 5.6 = 8$$

26. 5

Sol. $PCl_3 + 3H_2O \longrightarrow H_3PO_3 + 3HCl$

Number of moles required to neutralize

1 mole of $H_3PO_3 = 2$

Number of moles NaOH required to neutralize 3 moles of HCl = 3

Total mole of NaOH required = 2 + 3 = 5

27. 8

Sol. $KE = \frac{3}{2}nRT$

$$\frac{KE_{CH_4}}{KE_{SO_2}} = \frac{n_{CH_4}}{n_{SO_2}} \times \frac{T_{CH_4}}{T_{SO_2}}$$

$$= \frac{4}{1} \times \frac{800}{400} = 8$$

28. 6

Sol. $\Delta T_f = i \times K_f \times m$

$$0.744 = i \times 1.86 \times \frac{2.73}{273} \times \frac{1000}{100}$$

$i = 4$

$\therefore$ Formula of the compound is $\left[Co\left(H_2O\right)_6\right]Cl_3$ number of H_2O molecules in coordination sphere is 6.

29. 3

Sol. $6NaOH + 3Cl_2 \longrightarrow 5NaCl + NaClO_3 + 3H_2O$

(Hot and conc.)

30. 4

Sol. $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

$P_{NH_3} = 2 \times P_{CO_2}$

$P_{Total} = 2P + P = 3P = 3$ bar

$\therefore P_{NH_3} = 2$ bar and $P_{CO_2} = 1$ bar

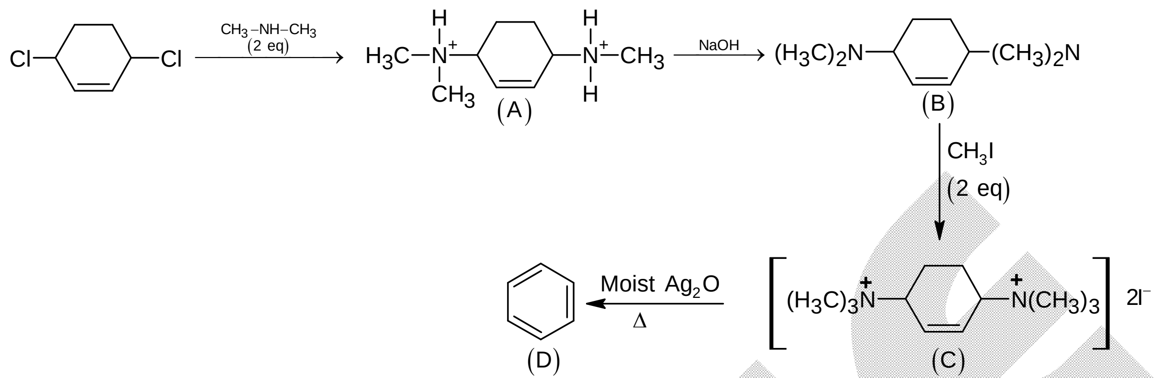
$K_P \left(P_{NH_3}\right)^2 \times \left(P_{CO_2}\right)$

$K_P = (2)^2 \times 1 = 4$

SECTION – C

31. 156.00

Sol.



$$x = \frac{\text{M. wt. of } C_6H_6}{0.5} = \frac{78}{0.5} = 156$$

32. 4.00

Sol. $y = \frac{(2\times 6+2)-6}{2}$

$= \frac{14-6}{2} = \frac{8}{2} = 4$

33. 2.00

Sol. $x = 1\times 2 = 2$

Soil pollutants = DDT

Water pollutant = Pb, $Cl_2C = CCl_2$

34. 0.50

Sol. $y = \frac{1}{2} = 0.5$

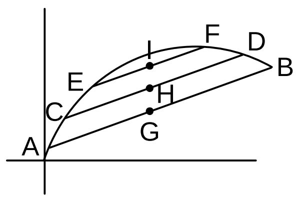
Stratospheric pollutants = 1

Mathematics PART – III

SECTION – A

35. B

Sol. Let $y = x^{1/7} \Rightarrow \frac{d^2y}{dx^2} < 0$ for x > 0 and $\frac{dy}{dx} > 0$ for $x > 0 \Rightarrow$ y is increasing and convex graph



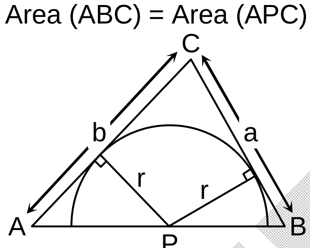
$A\left(2, 2^{1/7}\right)$, $B\left(8, 8^{1/7}\right)$, $E\left(4, 4^{1/7}\right)$, $F\left(6, 6^{1/7}\right)$, $C\left(3, 3^{1/7}\right)$, $D\left(7, 7^{1/7}\right)$

$GI\left(5, \frac{4^{1/7}+6^{1/7}}{2}\right)$, $H\left(5, \frac{3^{1/7}+2^{1/7}}{2}\right)$, $G\left(5, \frac{2^{1/7}+8^{1/7}}{2}\right)$

$\Rightarrow I(5, 2x_3), H(5, 2x_2), G(5, 2x_1) \Rightarrow x_1 < x_2 < x_3$

36. C

Sol. Area (ABC) = Area (APC) + Area (BPC)



$\Delta = \frac{1}{2}(br) + \frac{1}{2}a(r) \Rightarrow r = \frac{2\Delta}{a+b}$

37. D

Sol. Put $x = \sqrt{J}\sqrt{t} \Rightarrow dx = \sqrt{J}\cdot\frac{1}{2\sqrt{t}}dt$

$$\int_0^\infty e^{-x^2}dx = a \Rightarrow \int_0^\infty \frac{e^{-Jt}}{2\sqrt{t}}\sqrt{J}\,dt = a \Rightarrow \int_0^\infty \frac{e^{-Jt}}{\sqrt{t}}dt = \frac{2a}{J} \Rightarrow \int_0^\infty \frac{e^{-Jx}}{\sqrt{x}}dx = \frac{2a}{J}$$

38. C

Sol. Given $A^5 = I = BA^5 = B \Rightarrow (BA)A^4 = B \Rightarrow AB^2A^4 = B$

$\Rightarrow ABAB^2A^3 = B \Rightarrow AAB^2B^2A^3 = B \Rightarrow A^2B^4AA^2 = B \Rightarrow A^2B^3(BA)A^2 = B$

$\Rightarrow A^2B^3AB^2A^2 = B \Rightarrow A^2AB^8A^2 = B \Rightarrow A^3AB^{16}A = B = A^4AB^{32} = B$

$IB^{32} = B \Rightarrow B^{31} = I$

39. A, B

Sol. $$\int_0^{n+1} f(x)dx - \int_0^n f(x)dx = \int_n^{n+1} n^{x-n}dx = \frac{1}{n^n}\left[\frac{n^x}{\ln n}\right]_n^{n+1} = \frac{n-1}{\ln n}$$

$$\int_0^{n+1} g(x)dx - \int_0^{n} g(x)dx = \int_n^{n+1} (x-n)^n dx = \left.\frac{(x-n)^{n+1}}{n+1}\right]_n^{n+1} = \frac{1}{n+1}$$

$$t \in (0, 1) \Rightarrow \int_0^t f(x)dx = 0,\ t \in \left[1, \frac{\pi}{2}\right) \Rightarrow \int_0^t f(x)dx < \frac{\pi}{2} - 1$$

$$t = 1 \Rightarrow \int_0^t g(x)dx = 1$$

$$\lim_{n\to\infty} \int_0^n g(x)dx = \lim_{n\to\infty} \sum_{i=0}^{n} \frac{1}{i+1} \to \text{Divergent series}$$

40. A, B, D

Sol. For $x \in \left(0, \frac{\pi}{2}\right)$, f(x) = 0

For $x \in \left(\frac{\pi}{2}, \pi\right)$, $f(x) = \pi - x - x = \pi - 2x < 0$

For $x \in \left(\pi, \frac{3\pi}{2}\right)$, $f(x) = \pi - x - (2\pi - x) = -\pi < 0$

for $x \in \left(-\pi, \frac{-\pi}{2}\right)$, $f(x) = -(\pi + x) - (-x) = -\pi < 0$

41. A, B, C

Sol. Let the foot of the perpendicular from origin to the line be $P(2\lambda + 3, 3\lambda + 2, \lambda + 2)$
$2(2\lambda + 3) + 3(3\lambda + 2) + (\lambda + 2) = 14\lambda + 14 = 0$
$\Rightarrow \lambda = -1$
$\Rightarrow P(1, -1, 1)$
$\therefore$ length of perpendicular is $\sqrt{3}$

$\Rightarrow$ side (a) = $\sqrt{3} \cdot \frac{2}{\sqrt{3}} = 2$

Area = $\frac{\sqrt{3}}{4}a^2 = \sqrt{3}$

Circum radius = $\frac{2}{3} \cdot \sqrt{3} = \frac{2}{\sqrt{3}}$, inradius = $\frac{1}{3} \cdot \sqrt{3} = \frac{1}{\sqrt{3}}$, Centroid is $\left(\frac{2}{3}, \frac{-2}{3}, \frac{2}{3}\right)$

SECTION – B

42. 2

Sol. $f(n, m) = n + 2m$, each chord defines one segment, with each point of intersection creating 2 additional segments

43. 8

Sol. The curve is symmetric in all 4 quadrants. Confining to first quadrant, curve is $r^2 = 4\cos\theta$

$$A = 4\int_0^{\pi/2} \frac{1}{2} r^2 d\theta = 8\int_0^{\pi/2} \cos\theta d\theta = 8$$

44. 8

Sol. $|z|_{max} = \sqrt{3} + 1$ and $|z|_{min} = \sqrt{3} - 1$

45. 4

Sol. $I_{n+1} = \int_0^{\pi/2} \cos^n x\left[\cos nx - \sin(n+1)x \sin x\right]dx$

$= I_n + \frac{\cos^{n+1} x}{n+1}\sin(n+1)x\Big|_0^{\pi/2} - \int_0^{\pi/2} \cos^{n+1} x \cos(n+1)x dx$

$\Rightarrow 2I_{n+1} = I_n$

46. 4

Sol. Curve is one arm of hyperbola with foci (2, 4) and (2, –4)

47. 5

Sol. $P = \prod_{k=1}^{n} \frac{4(2k-1)^4 + 1}{4(2k^4)+1}$

$4a^4 + b^4 = ((a + b)^2 + a^2)((a - b)^2 + a^2)$

$P = \prod_{k=1}^{n} \frac{\left(4k^2 + (2k-1)^2\right)\cdot\left((2k-2)^2 + (2k-1)^2\right)}{\left((2k)^2 + (2k+1)^2\right)\cdot\left(4k^2 + (2k-1)^2\right)}$

$P = \prod_{k=1}^{n} \frac{(2k-2)^2 + (2k-1)^2}{(2k)^2 + (2k+1)^2}$

$P = \frac{0^2+1^2}{2^2+3^2}\cdot\frac{2^2+3^2}{4^2+5^2}\cdot\frac{4^2+5^2}{6^2+7^2}\cdots\cdots\frac{(2n-2)^2+(2n-1)^2}{(2n)^2+(2n+1)^2}$

$P = \frac{1}{4n^2 + (2n+1)^2} = \frac{1}{8n^2+4n+1} \Rightarrow k_1 = 8,\ k_2 = 4,\ k_3 = 1$

$\therefore k_1 + k_3 - k_2 = 5$

SECTION – C

48. 12.00

Sol. $(x^2 + x + 1)\,P(x - 1) = (x^2 - x + 1)\,P(x)$ ….. (1)

Since, $x^2 + x + 1$ and $x^2 - x + 1$ have no factor

Let $p(x) = (x^2 + x + 1)\,\phi(x)$

From (1), $\phi(x - 1) = \phi(x)$

$\Rightarrow \phi(x) = \phi(x + 1) \Rightarrow$ periodic

A polynomial is periodic if it is constant

$\Rightarrow P(x) = k(x^2 + x + 1)$, $P(1) = 3$

$\Rightarrow P(x) = x^2 + x + 1$

Now, $\int_0^1 \tan^{-1}\left(\frac{2x}{1+P(x^2)}\right)dx = \int_0^1 \tan^{-1}\left(\frac{2x}{1+x^4+x^2+1}\right)dx$

$= \int_0^1 \left\{\tan^{-1}(x^2+x+1) - \tan^{-1}(x^2-x+1)\right\}dx = \int_0^1 \left\{\tan^{-1}\left(\frac{1}{1+x^2-x}\right) - \tan^{-1}\left(\frac{1}{1+x^2+x}\right)\right\}dx$

$= \int_0^1 \left\{\tan^{-1}x - \tan^{-1}(x-1) - \tan^{-1}(1+x) + \tan^{-1}x\right\}dx$

$\int_0^1 \tan^{-1}\left(\frac{2x}{1+P(x^2)}\right)dx + \int_0^1 \tan^{-1}(1+x)dx = 3\left[\frac{\pi}{4} - \frac{1}{2}\ln 2\right] = \frac{3}{4}[\pi - \ln 4] \Rightarrow k = 12$

49. 2.00

Sol. $I_n = 2^n \int_0^1 (1+x^4)^n dx$

$\Rightarrow I_n = 2^n \left[x\cdot(1+x^4)^n \Big|_0^1 - \int_0^1 x\cdot n\cdot 4x^3 (1+x^4)^{n-1} dx \right]$

$\Rightarrow I_n = 2^n \cdot 2^n - 2^n \cdot 4n \int_0^1 (1+x^4-1)(1+x^4)^{n-1} dx$

$\Rightarrow I_n = 4^n - 4n\cdot 2^n \int_0^1 \left\{(1+x^4)^n - (1+x^4)^{n-1}\right\} dx$

$\Rightarrow I_n = 4^n - 4n\cdot I_n + 8n\cdot I_{n-1}$

$\Rightarrow (1+4n)I_n = 4^n + 8nI_{n-1}$

By comparison, $4^n = 8n$

$\Rightarrow n = 2$

50. 8.00

51. 17.00

Sol. **(Q. 50 to 51):**

Angle bisector passes through focus in first question, angle bisector will be same in second question thus B will be (–1, 4)