FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – XI
PAPER –1
TEST DATE: 11-05-2025

ANSWERS, HINTS & SOLUTIONS

Physics PART – I

SECTION – A

1. C
Sol. Comparing with radioactive decay

$a = a_0 e^{-\lambda t}$, where $\lambda = \frac{\ell n2}{t_0}$

$\Rightarrow \frac{dv}{dt} = a_0 e^{-\lambda t} \Rightarrow \int_0^v dv = \int_0^t a_0 e^{-\lambda t} dt$

$\Rightarrow v = \frac{a_0}{\lambda}(1 - e^{-\lambda t})$

Terminal velocity $v_T = \frac{a_0}{\lambda} = \frac{a_0 t_0}{\ell n2}$

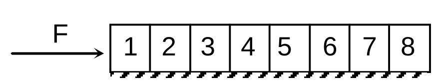
2. C
Sol. If R_0 be the initial activity of the sample, then $R_1 = R_0 e^{-\lambda t_1}$ and $R_2 = R_0 e^{-\lambda t_2}$

Where $\lambda = \frac{1}{T}$ {$\because$ Mean life $T = 1/\lambda$}

$\Rightarrow \frac{R_2}{R_1} = \frac{e^{-\lambda t_2}}{e^{-\lambda t_1}} = e^{\lambda(t_1 - t_2)}$

$\Rightarrow R_2 = R_1 \exp\left(\frac{t_1 - t_2}{T}\right)$

3. D
Sol. $F_{87} = ma$
$F_{21} = 7\ ma$
$\frac{F_{21}}{F_{87}} = 7$



4. B
Sol. Path difference at angular position θ is d sin θ.

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5. B, C, D

Sol. Optical path length = $\int_0^D \mu dy = 2\mu_0 D$, $t = \frac{2\mu_0 D}{c}$

6. B, D

Sol. $a_A = 0$
and $v_A = v_B = u$
By conservation of energy,
$u = \sqrt{gL} = 4$ m/s
Acceleration of centre of mass,
$a_C = a_B/2$

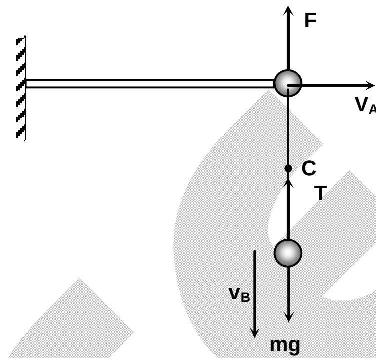
and $a_B = a_C + \frac{(u/2)^2}{L/2}$

$\Rightarrow a_B = \frac{u^2}{L} = g$

Thus, $T - mg = ma_B$
$\Rightarrow T = 2\,mg$

and, $F - 2mg = 2m\left(\frac{a_B}{2}\right)$

$\Rightarrow F = 3mg$
So, $F/T = 3/2$



7. B, C

Sol. $S = \pi(\ell \sin\alpha)^2 \Rightarrow \phi = Bs = \pi B(\ell \sin\alpha)^2$

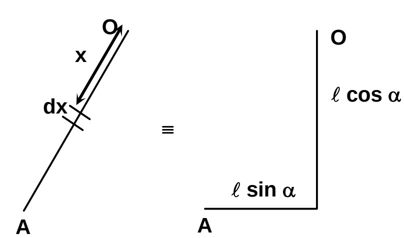
$$e_{in} = \frac{BS}{T} = \frac{BS}{2\pi/\omega} = \frac{B\omega\ell^2 \sin^2\alpha}{2} \quad \text{...(i)}$$

Second Method

$$e_{in} = \int d\vec{x}\cdot(\vec{v}\times\vec{B})$$

$$= \int_0^\ell (\omega x \sin\alpha)(B\cdot\sin\alpha)dx$$

$$= \frac{1}{2}B\omega\ell^2 \sin^2\alpha$$



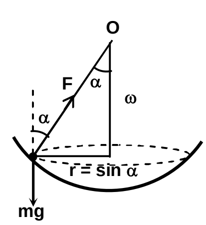
Using FBD of mass m, we can write

$mg = F\cos\alpha$ ...(ii)

$m\omega^2\ell \sin\alpha = F\sin\alpha$

$\Rightarrow m\omega^2\ell = F$ ...(iii)

With the help of (ii) and (iii) we can write



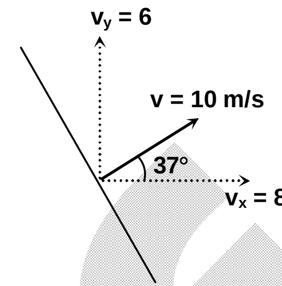
$$\cos\alpha = \frac{g}{\omega^2\ell} \Rightarrow \alpha = \cos^{-1}\left[\frac{g}{\omega^2\ell}\right] = \cos^{-1}\left[\frac{10}{5\times5\times0.8}\right] = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ$$

Since pendulum is rotating with uniform angular speed so no magnetic force or torque is acting on the conducting string because there is no energy loss in resistance, hence no current is flowing in the circuits.

$$V = e_{in} = \frac{B\omega\ell^2}{2}\left[1 - \cos^2\alpha\right] = 0.60\,\text{Volt}$$

8. C
Sol. Use basic concept

9. C
Sol. efflux velocity = $\sqrt{2gH} = \sqrt{2 \times 10 \times 5}$



Time of flight

$-11 = 6t - \frac{1}{2}(10)t^2$

t = 2.2 sec

Horizontal range from B

$R = 8 \times 2.2 - \left(\frac{33}{4}\right)$

R = 9.35 m

$F_x = \rho a v^2 \cos 37°$

$= (10^3)(0.15 \times 10^{-4})(100)\left(\frac{4}{5}\right) = 4$

$F_y = \rho a v^2 \sin 37° = 3$

10. B
Sol. Use basic concept

11. D
Sol. (P) In the process AB,

$PT^{-1/2} = \text{constant} \Rightarrow PV^{-1} = \text{constant}$

$\Delta W_{AB} = \frac{nR\Delta T}{(1-x)} = \frac{2R \times 900}{2} = 900\ R$

$\Delta W_{BC} = 0$

$\Delta W_{CA} = nR\Delta T = 2R(-300) = -600\ R$

$\Delta W_{cycle} = 900\ R + 0 - 600\ R = 300\ R$

(Q) $\Delta Q_{AB} = nC_P\Delta T = 2 \times \frac{5R}{2} \times 400 = 2000R$

In the process BC, $PT^{-2} = \text{constant} \Rightarrow PV^2 = \text{constant}$

$C = C_V + \frac{R}{(1-x)} = \frac{3R}{2} + \frac{R}{(1-2)} = \frac{R}{2}$

$\Delta Q_{BC} = nC\Delta T = 2 \times \frac{R}{2} \times (400 - 800) = -400R$

$\Delta Q_{CA} = \Delta W_{CA} = nRT_0 \ell n\left(\frac{P_0}{4P_0}\right) = 2R \times 400(-2\ell n2) = -1120R$

$\Delta W_{cycle} = \Delta Q_{cycle} = 2000R - 400R - 1120R = 480R$

(R) $\Delta Q_{AB} = nC_P\Delta T = 2 \times \frac{5R}{2} \times 300 = 1500R$

In the process BC, $VT^2 = \text{constant} \Rightarrow PV^{3/2} = \text{constant}$

$C = C_V + \frac{R}{(1-x)} = \frac{3R}{2} + \frac{R}{\left(1 - \frac{3}{2}\right)} = \frac{3R}{2} - 2R = -\frac{R}{2}$

$$\Delta Q_{BC} = nC\Delta T = 2\times\left(-\frac{R}{2}\right)\times(-300) = 300R$$

$$\Delta Q_{CA} = \Delta W_{CA} = nRT_0\ell n\left(\frac{V_0}{8V_0}\right) = 2R\times 300(-3\ell n2) = -1260R$$

$$\Delta W_{cycle} = \Delta Q_{cycle} = 1500R + 300R - 1260R = 540R$$

(S) $\Delta Q_{AB} = nC_P\Delta T = 2\times\frac{5R}{2}\times 300 = 1500R$

$$\Delta Q_{BC} = \Delta W_{BC} = nRT\ell n2 = 2R\times 600\times 0.7 = 840R$$

In the process CA, VT^{-2} = constant $\Rightarrow PV^{1/2}$ = constant

$$C = C_V + \frac{R}{(1-x)} = \frac{3R}{2} + 2R = \frac{7R}{2}$$

$$\Delta Q_{CA} = nC\Delta T = 2\times\frac{7R}{2}\times(-300) = -2100R$$

$$\Delta W_{cycle} = \Delta Q_{cycle} = 1500R + 840R - 2100R = 240R$$

SECTION – B

12. 9

Sol. $F - \mu N = ma$

$80 - \frac{1}{3}\times 6g = ma$

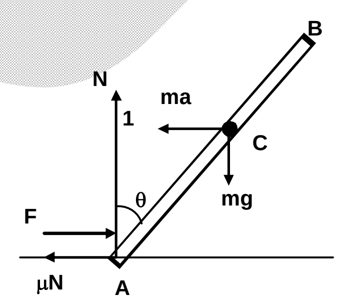
Ma =60

$\tau_A = 0$

$ma\frac{\ell}{2}\cos\theta - mg\frac{\ell}{2}\sin\theta = 0$

$\Rightarrow \tan\theta = 1$

$\theta = 45°$



13. 5

Sol. Initial potential difference between shells = $\frac{kq}{R} - \frac{kq}{2R} = \frac{kq}{2R}$ = 10 volt

Let q′ be the change on the outer shell after switch S_1 is closed

Then $k\left(\frac{q}{2R} + \frac{q'}{2R}\right) = 0 \Rightarrow q' = -q$

If q_1 be the charge on inner shell after switch S_1 is opened and S_2 is closed

$k\left(\frac{q_1}{R} + \frac{-q}{2R}\right) = 0 \Rightarrow q_1 = +\frac{q}{2}$

After S_1 and S_2 are closed alternatively n time charge on the inner shell

$q_n = \frac{q}{2^n}$

So, potential difference between the shells

$v = kq_n\left(\frac{1}{R} - \frac{1}{2R}\right) = \frac{k}{2R}\frac{q}{2^n} = \frac{kq}{2^{n+1}R}$

When n = 3, $V = \frac{1}{8}\left(\frac{kq}{2R}\right) = \frac{5}{4}$ volt

14. 9

Sol. $\frac{2}{3}\ell_1 = \frac{3}{4}\ell_2 \Rightarrow \frac{\ell_1}{\ell_2} = \frac{9}{8}$.

$M_1 = 3M$, $M_2 = 4M$.

$$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{\ell_1}{\ell_2}\right)^3 \times \frac{M_2}{M_1} = \left(\frac{9}{8}\right)^3 \times \frac{4}{3}$$

$$\Rightarrow \frac{T_1}{T_2} = \frac{9}{8}\sqrt{\frac{3}{2}}$$

15. 8

Sol. $F = 2m\eta A\left[(v_0+v)^2 - (v_0-v)^2\right]$

$= 2(10^{-26})(10^{25})(1)\left[(5+2)^2 - (5-2)^2\right]$

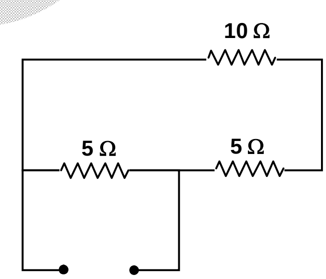
$= 0.2 \times 40 = 8$ N

16. 4

Sol. $$P = \frac{B^2}{2\mu_0} = \frac{1}{2\mu_0}\left(\frac{\mu_0 I}{2\pi R}\right)^2 = \frac{\mu_0 I^2}{8\pi^2 R^2}$$

17. 4

Sol. $x = \frac{15\times 5}{15+5} = \frac{15}{4}\Omega$



Chemistry

PART – II

SECTION – A

18. C

Sol. Let the maximum limiting labelling of oleum is (100 + x)%
In 100 gram of oleum the maximum mass of free SO_3 should be tending to 100 gram and hence, the mass of water needed x gram, should be exactly that mass which combine completely with all the free SO_3 present

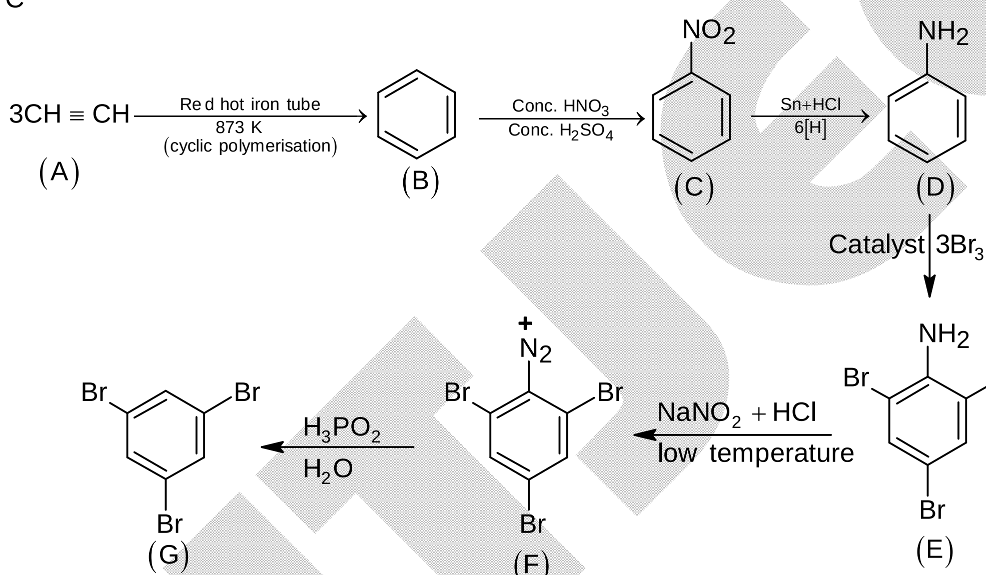
$H_2O + SO_3 \longrightarrow H_2SO_4$

$x = \frac{100}{80} \times 18$

= 22.5

19. C

Sol.



20. C

21. B

Sol. As $P_{ext} = 0$ $\quad W = -P_{ex}\Delta V = 0$

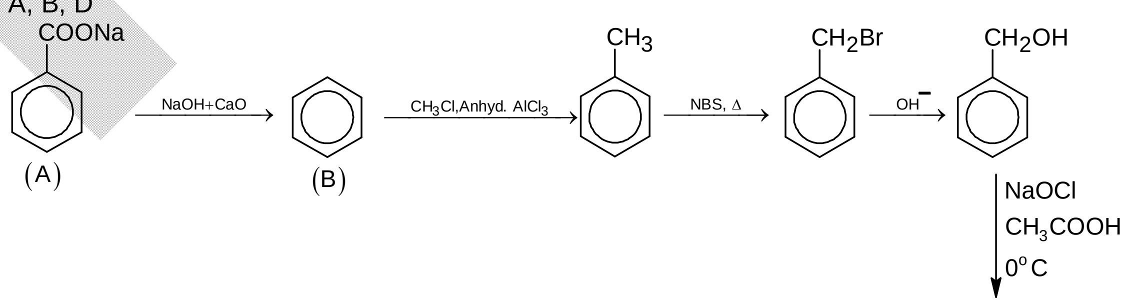
As $\Delta T = 0$ $\quad \Delta E = nC_V\Delta T = 0$

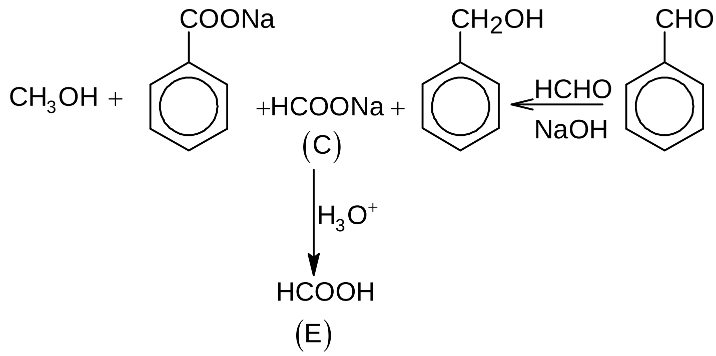
But $\Delta S = nR\ell n\frac{V_2}{V_1}$

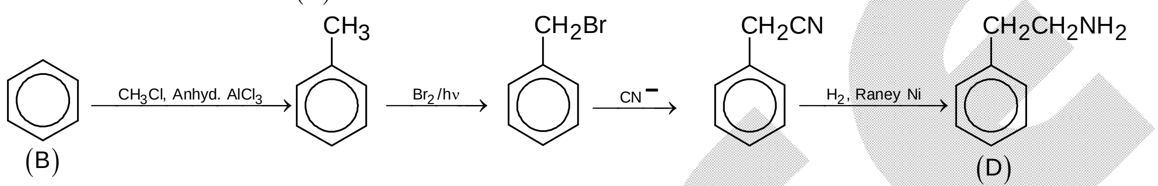
22. B, D

23. A, B, D

Sol.







24. A, B, C, D

25. B

Sol. $[FeF_6]^{3-}$ - sp^3d^2, Paramagnetic

$[NiCl_4]^{2-}$ - sp^3, Paramagnetic

$[Ni(CN)_4]^{2-}$ - dsp^2, Diamagnetic

$[COF_6]^{3-}$ - sp^3d^2, Paramagnetic

26. D

Sol. $P_4O_{10} + 4HNO_3 \longrightarrow 4HPO_3 + 2N_2O_5$

$Pb(NO_3)_2 \xrightarrow{\Delta} 4NO_2 + 2PbO + O_2$

$2NaNO_2 + 2FeSO_4 + 3H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 2NaHSO_4 + 2H_2O + 2NO$

$NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$

27. D

Sol. $2Cu(NO_3)_2 + K_4[Fe(CN)_6] \longrightarrow Cu_2[Fe(CN)_6]\downarrow + 4KNO_3$

Chocolate brown ppt.

$Pb(NO_3)_2 + K_2CrO_4 \longrightarrow PbCrO_4\downarrow + 2KNO_3$

Yellow ppt.

$BiCl_3 + H_2O \longrightarrow BiOCl\downarrow + 2HCl$

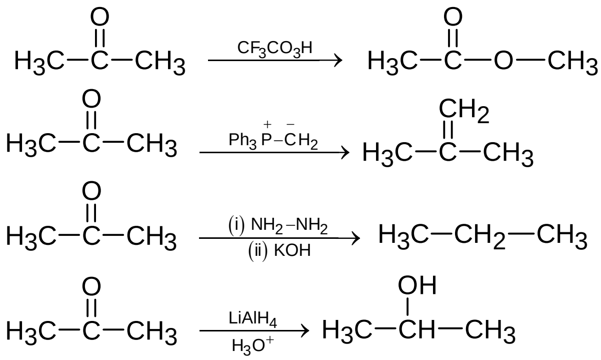
White ppt.

$Pb(CH_3COO)_2 + H_2S \longrightarrow PbS\downarrow + 2CH_3COOH$

Black ppt.

28. B

Sol.



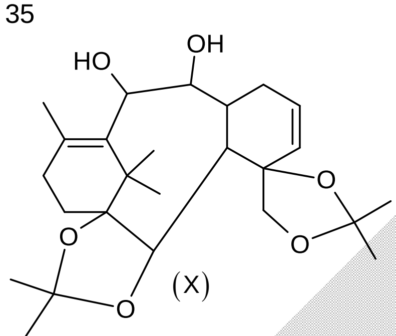
SECTION – B

29. 5

Sol. Pb^{2+}, Bi^{3+}, Cd^{2+}, Sb^{3+}, Mn^{2+}

30. 35

Sol.



a = 7

$b = \frac{7 \times 10}{2} = 35$

31. 7

Sol. Methylene blue and TiO_2 are positively charged sol.

32. 1500

Sol. $\frac{[B]}{[C]} = \frac{5}{4}$ $\qquad \frac{[C]}{[D]} = \frac{4}{1}$ $\qquad \frac{[B]}{[D]} = \frac{5}{1}$

$[B]:[C]:[D] = 5:4:1$

$k_1 = 5x \;\; k_2 = 4x \;\; k_3 = x$

$k = \frac{0.693}{150} = 0.00462$

$k = k_1 + k_2 + k_3$

0.00462 = 5x + 4x + x

$x = \frac{0.00462}{10} = 0.000462$

$t_{1/2}\,(\text{partial half life}) = \frac{0.693}{k_3} = \frac{0.693}{0.000462}$

= 1500 hrs.

33. 180

Sol. $\Delta S_{lake} = \frac{q_{irr}}{T} = \frac{mS\Delta T}{T} = \frac{566 \times 90}{283}$

= 180

34. 2

Sol. $KCl + AgNO_3 \longrightarrow AgCl + KNO_3$

$M_1V_1 = M_2V_2$

$M_1 = \frac{M_2V_2}{V_1}$, $M_1 = \frac{1 \times 20}{36} = \frac{20}{36}$

$M_1 = \text{molality} = \frac{20}{36}$

$i = 1 + \alpha(n-1)$

$i = 1 + \alpha$

$= 1 + 0.8$

= 1.8

$\Delta T_f = iK_fm$

$= 1.8 \times 2 \times \frac{20}{36}$

= 2

Mathematics

PART – III

SECTION – A

35. B

Sol. $f^2(x) + xf(x) = 3 \Rightarrow f'(x) = \dfrac{-f(x)}{x+2f(x)}$

$$\Rightarrow \int \frac{3x^3+6x^2f(x)+2f(x)}{(x+2f(x))(x^3-2f(x))^2}dx = \int \frac{3x^2(x+2f(x))+2f(x)}{(x+2f(x))(x^3-2f(x))^2}dx$$

$$\Rightarrow \int \frac{3x^2-2f'(x)}{(x^3-2f(x))^2}dx = \frac{1}{2f(x)-x^3}+c$$

36. D

Sol. Required probability = $\dfrac{1}{2}+\dfrac{1}{2}\left(\dfrac{1}{2}\cdot\dfrac{1}{2}+\dfrac{1}{2}\cdot\dfrac{1}{2}\cdot\dfrac{1}{2}\cdot\dfrac{1}{2}+\dfrac{1}{2}\cdot\dfrac{1}{2}\cdot\dfrac{1}{2}\cdot\dfrac{1}{2}\right)=\dfrac{22}{32}$

37. B

Sol. $D = (2n + 1)^2 – 4(2m + 1)(2p + 1)$

$\Rightarrow$ Roots are rational if D is perfect square.

$\Rightarrow (2n + 1)^2 – 4(2m + 1)(2p + 1) = I^2$ (I = Integer)

$\Rightarrow (2n + 1)^2 – (2r + 1)^2 = 4(2m + 1)(2p + 1)$, I = 2r + 1, r = Integer

$\Rightarrow 4(n + r + 1)(n – r) = 4(2m + 1)(2p + 1)$

$\Rightarrow (n + r + 1)(n – r)$ = odd (not possible)

Hence, roots are irrational.

38. A

Sol. Let $I(t) = \displaystyle\int_0^1 \frac{\sin(\ln x t)}{\ln x}dx$

$$I'(t) = \int_0^1 \frac{\ln x}{\ln x}\cos(t\ln x)dx = \int_0^1 \mathrm{Re}\left(e^{it\ln|x|}\right)dx$$

$$I'(t) = \mathrm{Re}\left(\frac{1-it}{1+t^2}\right) = \frac{1}{1+t^2}$$

$$\int_0^1 I'(t)dt = \frac{\pi}{4}$$

39. B, C, D

Sol. Consider $\Delta A'B'C'$, where $\angle A' = \dfrac{2\pi}{3}-\angle A$, $\angle B' = \dfrac{2\pi}{3}-\angle B$, $\angle C' = \dfrac{2\pi}{3}-\angle C$

Now apply triangle inequality to get $S > -\dfrac{1}{\sqrt{3}}$

40. A, B, C

Sol. Take base as the x – y plane with one vertex as origin. A, B be vertices along the x, y-axes respectively

$\overrightarrow{OA} = 2\hat{i}$, $\overrightarrow{OB} = 2\hat{j}$, $\overrightarrow{OC} = \hat{i}+\hat{j}+2\hat{k}$, where C is the apex

$\therefore\ \overrightarrow{OA}\times\overrightarrow{OB} = 4\hat{k}$; $\overrightarrow{OA}\times\overrightarrow{OC} = 2\hat{k}-4\hat{j}$; $\overrightarrow{OB}\times\overrightarrow{OC} = -2\hat{k}+4\hat{i}$

Volume is $\frac{1}{3} \times$ parallelopiped = $\frac{8}{3}$

Tetrahedron with half of pyramid's base and the pyramid's apex has volume = $\frac{4}{3}$

41. C, D

Sol. $F(x) = \int_1^n \frac{x^u}{u} du$; $u \in [1, n] \Rightarrow \frac{x^u}{u}$ is strictly monotonic in x

$\Rightarrow$ F(x) is strictly monotonic

$x\int_1^n \frac{du}{u} \le \int_1^n \frac{x^u}{u} du \le x^n \int_1^n \frac{du}{u}$ as $x \to 1^+$ and $x\int_1^n \frac{du}{u} \ge \int_1^n \frac{x^u}{u} du \ge x^n \int_1^n \frac{du}{u}$ as $x \to 1^-$

$\Rightarrow \lim_{x \to 1} F(x) = \ln n$

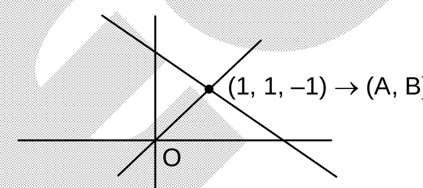
42. B

Sol. (P) $d = 2\sqrt{3}$

(Q) These lines are skew and O lies on shortest distance

(R) Lines are parallel and O lies mid way between them

(S) Lines are coplanar and perpendicular



43. D

Sol. We can consider 9 cells as 9 different boxes and we have to fill these boxes by 3 identical balls (2 written on them), 4 identical balls (3 written on them) and 7 identical balls (5 written on them) as per given conditions

44. A

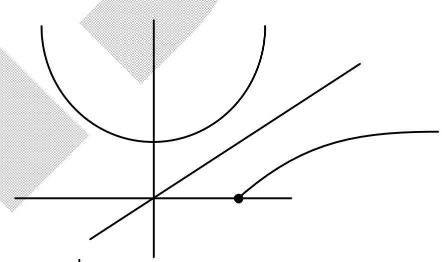
Sol. (P) $x^2 - a = x$

$x^2 - x - a = 0$

$D < 0$

$1 + 4a < 0$

$a < -\frac{1}{4}$



(Q) $-\sqrt{a} < -a$

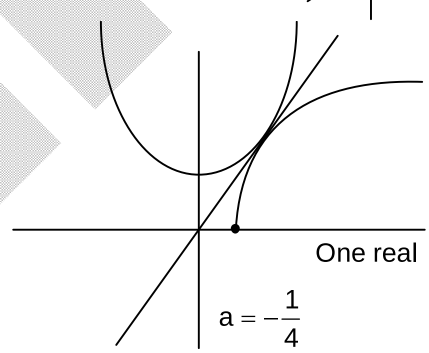
$\sqrt{a} > a$

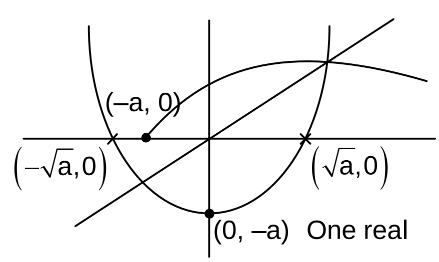
$a > a^2$

$a^2 - a < 0$

$a(a - 1) < 0$

$0 < a < 1$





(R) $x^2 - x - a = 0$

$1 + 4a > 0, -a > 0$

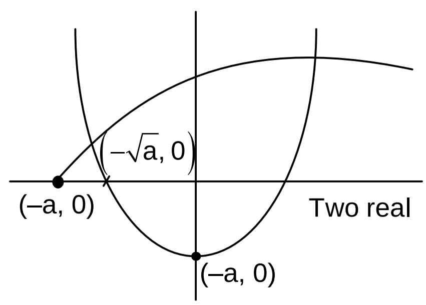
$a > -\frac{1}{4}, a < 0$

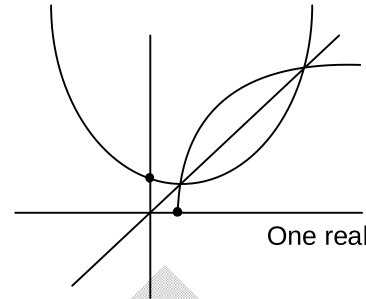
$-\frac{1}{4} < a \le 0$

$-a < -\sqrt{a}$

$a > \sqrt{a}$, $a^2 > a$

$a(a - 1) > 0, a \ge 1$





45. B

Sol. (P) Use ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$

SECTION – B

46. 2

Sol. Let $a = 2^x$, $b = -3^{x-1}$ and $c = -1$

So, $2^x = 3^{x-1}$

$\Rightarrow 3^{x-1} - 2^{x-1} = 2^{x-1} - 1$

Let $f(t) = t^{x-1}$

So, $f'(t_1) = f'(t_2)$ from LMVT on (1, 2) and (2, 3) and $t_1 \in (1, 2)$, $t_2 \in (2, 3)$

$(x-1)t_1^{x-2} = (x-1)t_2^{x-2}$

Clearly, there are only 2 solutions x = 1 and x = 2

47. 2

Sol. $|\text{adj } \lambda A| = |\lambda A|^2 = \lambda^6|A|^2 = \lambda^6$ (as A is orthogonal)

$|\text{Adj}(\text{adj } \lambda A)| = |\text{adj } \lambda A|^2 = \lambda^{12}$

$\therefore \frac{\lambda^{12}}{\lambda^6} = \lambda^6 = 16 \Rightarrow [\lambda^2] = \left[\sqrt[3]{16}\right] = 2$

48. 3

Sol. $\int_0^1 \lim_{n\to\infty} \sum_{k=0}^{n} \frac{x^{k+1}3^k}{k!}dx = \int_0^1 x \lim_{n\to\infty} \sum_{k=0}^{n} \frac{x^k 3^k}{k!}dx = \int_0^1 xe^{3x}dx = \frac{xe^{3x}}{3}\Big|_0^1 - \frac{e^{3x}}{9}\Big|_0^1 = \frac{2e^3+1}{9}$

49. 1

Sol. $(56x+33y)i = \frac{-iy}{x^2+y^2}$, $33x - 56y = \frac{x}{x^2+y^2}$ (z = x + iy)

$56iz + 33z = \frac{x-iy}{x^2+y^2}$

$56iz + 33z = \frac{1}{z} \Rightarrow z^2 = \frac{1}{33+56i} \Rightarrow z = \pm\frac{1}{7+4i} = \pm\frac{7-4i}{65}$

$|x| + |y| = \frac{11}{65} = \frac{p}{q} \Rightarrow 6p - q = 66 - 65 = 1$

50. 41

Sol. $\Rightarrow x^2 + \frac{1}{x^2} + b + a\left(x + \frac{1}{x}\right) = 0 \Rightarrow x + \frac{1}{x} = t$

t^2 + at + b – 2 = 0 $\Rightarrow$ at + b + t^2 – 2 = 0, $t^2 \in [4, \infty)$

This represents equation of line in a-b plane and $a^2 + b^2$ represent square of distance of a point on this line from O (origin)

$d = \frac{t^2 - 2}{\sqrt{1+t^2}} \Rightarrow t^2 \in [4, \infty),\ d_{min} = \frac{2}{\sqrt{5}}$ at $t^2 = 4$

$d_{min}^2 = \frac{4}{5} = \frac{p}{q} \Rightarrow p^2 + q^2 = 41$

51. 8

Sol. Let $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$

$\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$

$\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$

$\vec{a} \times \vec{b} = D_1\hat{i} + D_2\hat{j} + D_3\hat{k}$

$|\vec{a} \times \vec{b}| = \sqrt{D_1^2 + D_2^2 + D_3^2} = 4$

$|c| = \sqrt{c_1^2 + c_2^2 + c_3^2} = 2$

Maximum value of $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = |\vec{a} \times \vec{b}|\,|\vec{c}| = 4 \times 2 = 8$