

# FIITJEE

## ALL INDIA TEST SERIES

### FULL TEST – II

JEE (Main)-2025

TEST DATE: 05-01-2025

### *Physics*

### PART – A

### SECTION – A

1. B

Sol.

$$v_y = u_y - gt$$

$$x = u_x t$$

... (i)

... (ii)

$$v_y = u_y - g \frac{x}{u_x}$$

$$\Rightarrow \frac{g}{u_x} = \tan 45^\circ \Rightarrow u_x = 10 \text{ m/s}$$

$$\text{Also, Range } R = \frac{2u_x u_y}{g}$$

$$40 = \frac{2 \times 10 \times u_y}{g} \Rightarrow u_y = 20 \text{ m/s}$$

$$\tan \theta = \frac{u_y}{u_x} = 2$$

$$\Rightarrow \theta = \tan^{-1}(2)$$

2. B

Sol.

Maximum loss in kinetic energy

$$\Delta K.E_{\max} = \frac{1}{2} \frac{Mm}{(M+m)} u^2$$

$$\Delta K.E_{\max} \leq \frac{3}{4} \left( \frac{1}{2} m u^2 \right)$$

$$\frac{1}{2} \frac{Mm}{(M+m)} u^2 \leq \frac{3}{4} \left( \frac{1}{2} m u^2 \right)$$

$$\Rightarrow \frac{M}{m} \leq 3$$

3. D

Sol.  $-\frac{GMm}{R} + \frac{1}{2}mv^2 = 0$

$$\frac{GMm}{R} = \frac{1}{2}mv^2$$

$$v = \sqrt{\frac{2GM}{R}}$$

$$\Delta v = (\sqrt{2} - 1)\sqrt{\frac{GM}{R}}$$

4. B

Sol.  $R = \frac{\sqrt{2mk}}{Bq}$

$$m \propto R^2 q^2$$

$$\frac{m_1}{m_2} = \left(\frac{R_1 q_1}{R_2 q_2}\right)^2$$

$$\left(\frac{6}{5} \times \frac{1}{2}\right)^2 = \frac{9}{25}$$

5. C

Sol.  $V_A = \frac{KP \cos 37^\circ}{\left(\frac{5R}{3}\right)^2} = \frac{9KP}{25R^2} \times \frac{4}{5}$

$$V_A = \frac{36KP}{125R^2}$$

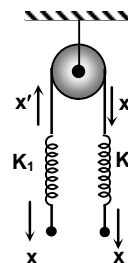
6. B

Sol.  $F_R = 2K_2(x - x')$

$$F_R = \frac{4K_1 K_2 x}{(K_1 + K_2)}$$

$$K_2(x - x') = k_1(x + x')$$

$$x' = \frac{(K_2 - K_1)x}{(K_1 + K_2)}$$



7. B

Sol.  $\phi_{AFC} = \phi_{cube} = \frac{\lambda a}{4\epsilon_0}$

8. C

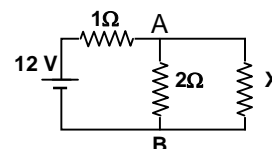
Sol. Let equivalent resistance across battery be x

$$\frac{2x}{2+x} + 1 = x$$

$$\Rightarrow x = 2 \Omega$$

$$V_{AB} = 6V$$

$$I_{AB} = 3A$$



9. B

Sol.  $T2\pi r \cos \theta = Mg$

$$\Rightarrow M \propto r$$

$$\frac{M_1}{M_2} = \frac{r_1}{r_2} = \frac{r}{4r}$$

$$M_2 = 4M_1$$

$$M_2 = 4M$$

10. D

Sol.  $U_i + W_B = U_f + \text{Heat}$

$$\frac{CV^2}{4} + \frac{CV^2}{2} = \frac{CV^2}{2} + \text{Heat}$$

$$\text{Heat} = \frac{CV^2}{4}$$

11. D

Sol.  $I_D = \epsilon_0 \frac{d\phi_E}{dt} = \epsilon_0 (\text{slope})$

12. B

Sol.  $\vec{v}_{OG} = 9\hat{i} + 12\hat{j}$ ,  $\vec{v}_{MG} = -2\hat{i}$

For x-axis:  $\vec{v}_{IM} = -m^2 \vec{v}_{OM}$

For y-axis:  $\vec{v}_{ly} = -m \vec{v}_{Oy}$

$$\vec{v}_{IG} = -46\hat{i} - 24\hat{j} \text{ m/s}$$

13. A

Sol.  $e = \int \frac{\mu_0 I dx v}{2\pi x} = \frac{\mu_0 I v}{2\pi} \ln 2$

$$q_{\max} = Ce$$

14. C

Sol.  $a = \frac{g \sin \theta}{\left(1 + \frac{I_{cm}}{MR^2}\right)}$

$$\frac{\sin \theta_D}{\left(1 + \frac{1}{2}\right)} = \frac{\sin \theta_H}{\left(1 + \frac{2}{3}\right)}$$

$$\frac{2 \sin \theta_D}{3} = \frac{3 \sin \theta_H}{5}$$

$$\frac{\sin \theta_D}{\sin \theta_H} = \frac{9}{10}$$

15. B

Sol.  $\frac{nR\Delta T}{n\left(R + \frac{C_V}{n}\right)\Delta T}$

$$\Rightarrow \frac{nR}{C_V + nR}$$

16. A

Sol. Conceptual

17. B

Sol.  $2I_0 = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$

$$\frac{1}{\sqrt{2}} = \cos\left(\frac{\phi}{2}\right)$$

$$\frac{\phi}{2} = \frac{\pi}{4}$$

$$\phi = \frac{\pi}{2}$$

$$\Rightarrow \Delta x = \frac{\lambda}{4}$$

$$\frac{yD}{D} = \frac{\lambda}{4}$$

$$y = \frac{\lambda D}{4d}$$

18. B

Sol.  $\Delta E = \frac{hC}{\lambda}$

$$\frac{E}{2} = \frac{hC}{\lambda_2} \quad \dots(i)$$

$$2E = \frac{hC}{\lambda_1} \quad \dots(ii)$$

$$\frac{1}{4} = \frac{\lambda_1}{\lambda_2}$$

19. B

Sol. Conceptual

20. A

Sol.  $-\int_0^x mg \cos \theta kx^2 dx + \int_0^x mg \sin \theta dx = \frac{1}{2}mv^2$

$$-mg \cos \theta \frac{kx^3}{3} + mg \sin \theta x = \text{K.E.}$$

For K.E. to be maximum

$$\frac{d\text{K.E.}}{dx} = -mg \cos \theta kx^2 + mg \sin \theta = 0$$

**SECTION – B**

21. 2

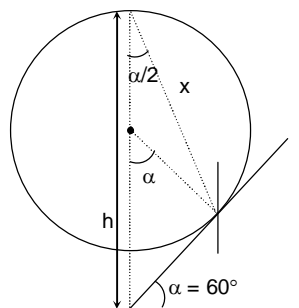
Sol. For time 't' all beads lie on a circle

$$x = \frac{h}{\sqrt{3}}$$

$$x = \frac{1}{2}g \cos\left(\frac{\alpha}{2}\right)t^2, \quad \frac{h}{\sqrt{3}} = \frac{1}{2}g \cos 30^\circ t^2$$

$$\frac{h}{\sqrt{3}} = \frac{1}{2}g \frac{\sqrt{3}}{2} t^2$$

$$t = 2 \text{ sec}$$



22. 2

Sol. Magnetic field due to upper loop ( $B_1$ ) =  $\frac{\mu_0(i)}{4\pi r_1} \left( \frac{2\pi}{3} \right) (-\hat{z})$

Magnetic field due to lower loop ( $B_2$ ) = ( $B_2$ ) =  $\frac{\mu_0(i)}{4\pi r_2} \pi(+\hat{z})$

23. 3

Sol.  $q[v_i - v_f] = k_f - k_i$

$$10^{-6} [4 \times 10^5 - v_f] = \frac{1}{2} \times 2 \times 10^{-3} [200 - 100]$$

$$4 \times 10^5 - v_f = 10^5$$

$$v_f = 3 \times 10^5 \text{ volts}$$

$$n = 3$$

24. 3

Sol. For instantaneous values

$$\text{Let } I = I_0 \sin(\omega t - \phi)$$

$$V_R = IR = I_0 R \sin(\omega t - \phi)$$

$$\Rightarrow I_0 \sin(\omega t - \phi) = 2$$

$$\frac{E_0}{Z} \sin(\omega t - \phi) = 2$$

$$\cos \phi = \frac{R}{Z} = \frac{2Z}{E_0}$$

$$\Rightarrow x_L = \sqrt{3}\Omega$$

$$V_L + V_R = E = 7$$

$$\Rightarrow E = 7V$$

$$E = E_0 \sin(\omega t)$$

$$7 = 7 \sin(\omega t)$$

$$\sin \omega t = 1$$

$$\omega t = \frac{\pi}{2}$$

25. 2

Sol.  $\frac{2\pi}{\lambda} = \frac{\pi}{4}$

$$\lambda = 8 \text{ cm}$$

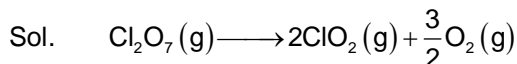
$$1^{\text{st}} \text{ Node: } \frac{\lambda}{4} = 2 \text{ cm}$$

# Chemistry

## PART – B

### SECTION – A

26. C



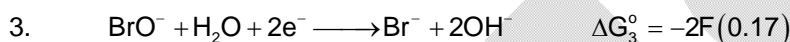
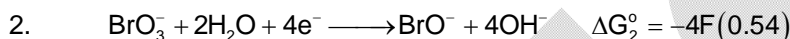
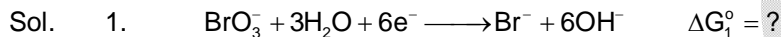
$$\text{Rate} = -\frac{d[\text{Cl}_2\text{O}_7]}{dt} = \frac{1}{2} \frac{d[\text{ClO}_2]}{dt} = \frac{3}{2} \frac{d[\text{O}_2]}{dt}$$

$$\frac{d[\text{O}_2]}{dt} = 50 \times \frac{3}{2} = 75 \text{ mm Hg}$$

$$\text{Rate } k[\text{Cl}_2\text{O}_7]^0 = k = 50$$

$$t_{1/2} = \frac{P_0}{2k} = \frac{600}{2 \times 50} = 6 \text{ sec}$$

27. D



$$\text{Eq. (2) + (3)} = 1, = \Delta G_1^\circ = \Delta G_2^\circ + \Delta G_3^\circ = -F(4 \times 0.54 + 2 \times 0.17) = -2.5 \text{ VF}$$

$$E = \frac{\Delta G_1^\circ}{nF} = -\frac{(2.5) \text{ VF}}{6F} = 0.41 \text{ V}$$

28. C

Sol. Rate is faster when the substituent activates the ring (+I or/and +R, o/p) and the rate is slower when the substituent deactivates the ring (-I, R; m). Halogen deactivates the ring (-I, +R, -I > +R) but the orientation is o/p.

Rate of  $\text{C}_6\text{H}_6 = \text{C}_6\text{D}_6$ , since no kinetic isotope effect is observed when H is replaced by D.

Hence, the order is as given in option (C).

29. D

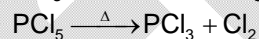
Sol. Hydrolysis of  $\text{SbCl}_3$



$\text{NF}_3$  does not undergo hydrolysis, due to high N – F bond strength.

Pentahalides are thermally less stable than the corresponding trihalides, e.g. thermal stability of

$\text{PCl}_3$  is less than  $\text{PCl}_5$

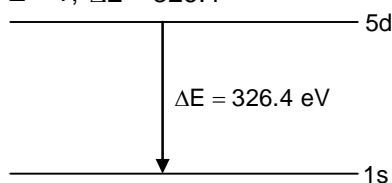


30. A

Sol. The sols obtained in the two cases will be oppositely charged so coagulate each other.

31. D

Sol.  $Z = ?; \Delta E = 326.4$



$$= 13.6 Z^2 \left[ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right] \text{eV}$$

$$\Rightarrow 326.4 = 13.6 \times Z^2 \left[ \frac{1}{(1)^2} - \frac{1}{(5)^2} \right] \Rightarrow Z = 5$$

32. B

Sol.  $W_{\text{total}} = W_{AB} + W_{BC} + W_{CA}$

$$= 1(40 - 20) + 0 + \left( -nRT \ln \frac{20}{40} \right)$$

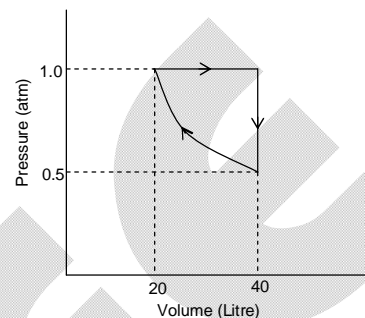
$$= -20 \text{ litre atm} + 2 \times 2.303 \times 0.0821 \log 2 \times 300$$

$$= -20 \text{ litre atm} + 34.15 \text{ litre atm}$$

$$= 14.15 \text{ litre atm}$$

$$= 14.15 \times 100 \text{ J}$$

$$= 1415 \text{ J}$$



33. C

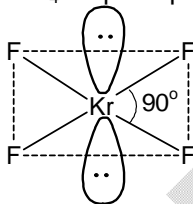
Sol. meq. of  $\text{KMnO}_4 = \text{meq. of } \text{K}_x\text{H}(\text{C}_2\text{O}_4)_y$

$$0.2 \times 5 \times 8 = 10 \times 0.2 \times n\text{-factor}$$

$$n\text{-factor} = 4 \Rightarrow x = 3$$

$$\text{K}_3\text{H}(\text{C}_2\text{O}_4)_2$$

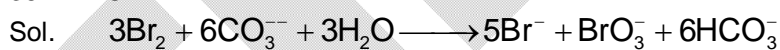
34. A

Sol.  $\text{KrF}_4$  : square planar.

35. D

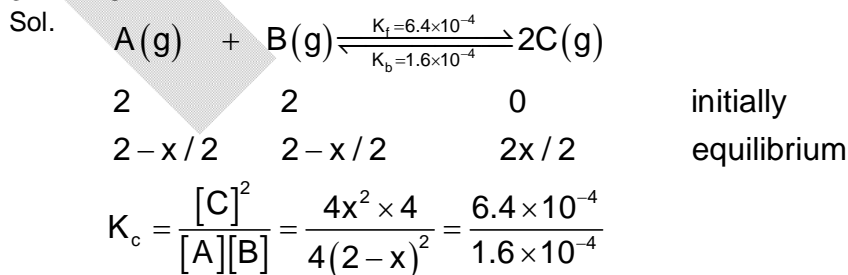
Sol. With bulky base, Hofmann's elimination occur to give the major elimination product.

36. C



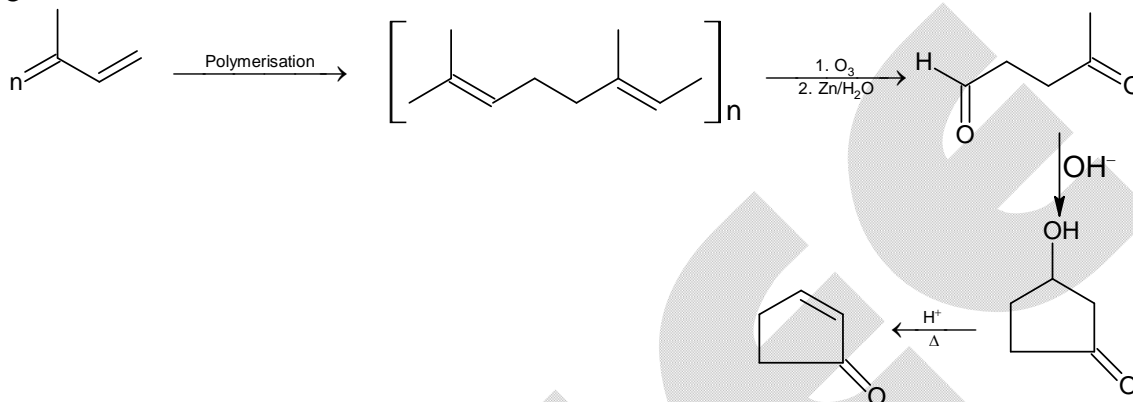
$$\text{EW}(\text{Br}_2) = \frac{M}{2} + \frac{M}{10} = \frac{3M}{5}$$

37. C



$$\begin{aligned} \text{or } \frac{4x}{2-x} &= 4 & \text{or } 4x &= 8 - 4x \\ \text{or } 8x &= 8, & x &= 1 \\ \text{Hence, } \frac{2x}{2} &= \frac{2 \times 1}{2} = 1 \end{aligned}$$

38. C  
Sol.



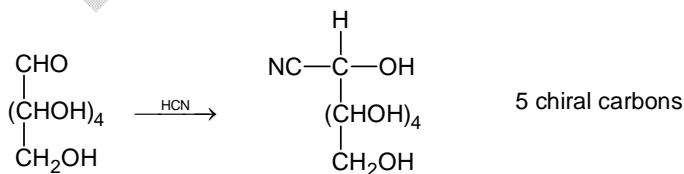
39. C  
Sol.

$$\begin{aligned} 2A &\rightleftharpoons A_2 \\ 1-\alpha & \quad \alpha/2 \\ i &= 1 - \frac{\alpha}{2} \quad \text{or} \quad \alpha = 2(1-i) \\ K_{\text{eq}} &= \frac{m \left( \frac{\alpha}{2} \right)}{m^2 (1-\alpha)^2} = \frac{1-i}{m(2i-1)^2} \quad \text{where } i = \frac{\Delta T_b}{(\Delta T_b)} = \frac{\Delta T_b}{K_b m} \\ K_{\text{eq}} &= \frac{1 - \Delta T_b / K_b m}{m \left[ (2\Delta T_b / K_b m) - 1 \right]^2} = \frac{K_b (K_b m - \Delta T_b)}{(2\Delta T_b - K_b m)^2} \end{aligned}$$

40. D  
Sol.

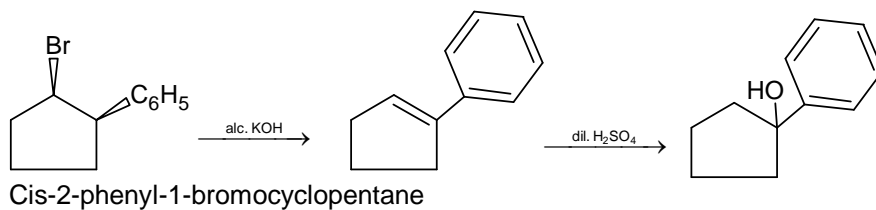
$$\begin{aligned} \text{N}_2\text{H}_5^+ + \text{H}_2\text{O} &\rightleftharpoons \text{N}_2\text{H}_4 + \text{H}_3\text{O}^+ \\ K_h &= \frac{[\text{N}_2\text{H}_4][\text{H}_3\text{O}^+]}{[\text{N}_2\text{H}_5^+]} = \frac{k_w}{k_b} = \frac{10^{-14}}{9.6 \times 10^{-7}} = \frac{x^2}{0.1} = 1.04 \times 10^{-8} \\ \therefore x &= 3.2 \times 10^{-5} \\ \% \text{ hydrolysis} &= \frac{3.2 \times 10^{-5}}{0.1} \times 100 = 0.032 \% \end{aligned}$$

41. A  
Sol.

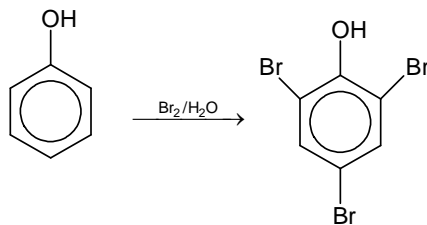




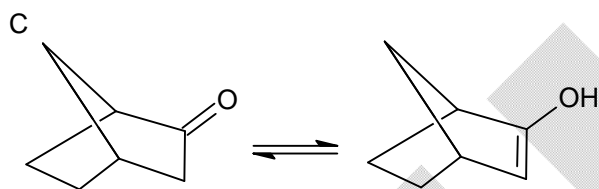
42. A  
Sol. (A) is incorrect.



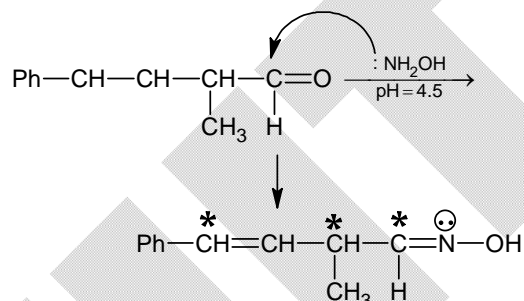
43. D  
Sol.  $\text{KBr(aq)} + \text{KBrO}_3(\text{aq}) \longrightarrow \text{Br}_2(\text{aq})$



44. Sol.

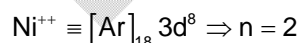
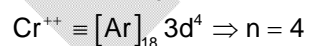
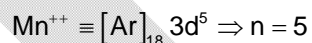


45. Sol.



### SECTION – B

46. 2



Since,  $\mu_s = \sqrt{n(n+2)}\text{BM}$

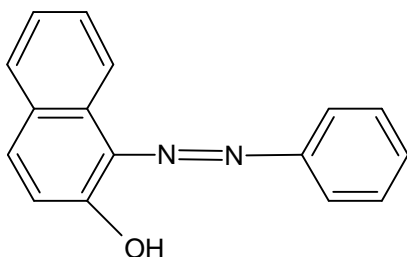
$\text{Fe}^{2+}$  and  $\text{Cr}^{2+}$  will have same  $\mu_s$ .

47. 5

Sol. The correct order in 4<sup>th</sup> period is  
 $K < Ga < Ca < Ge < Se < As < Br < Kr$

48. 9

Sol. Product 'P' is

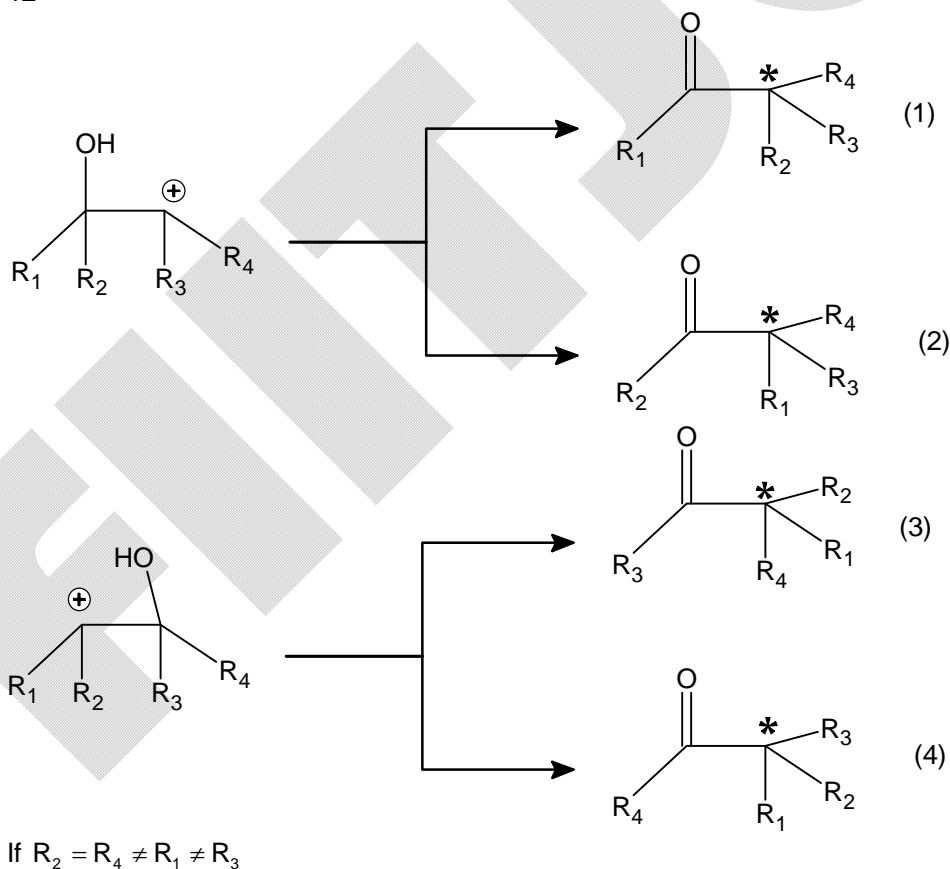


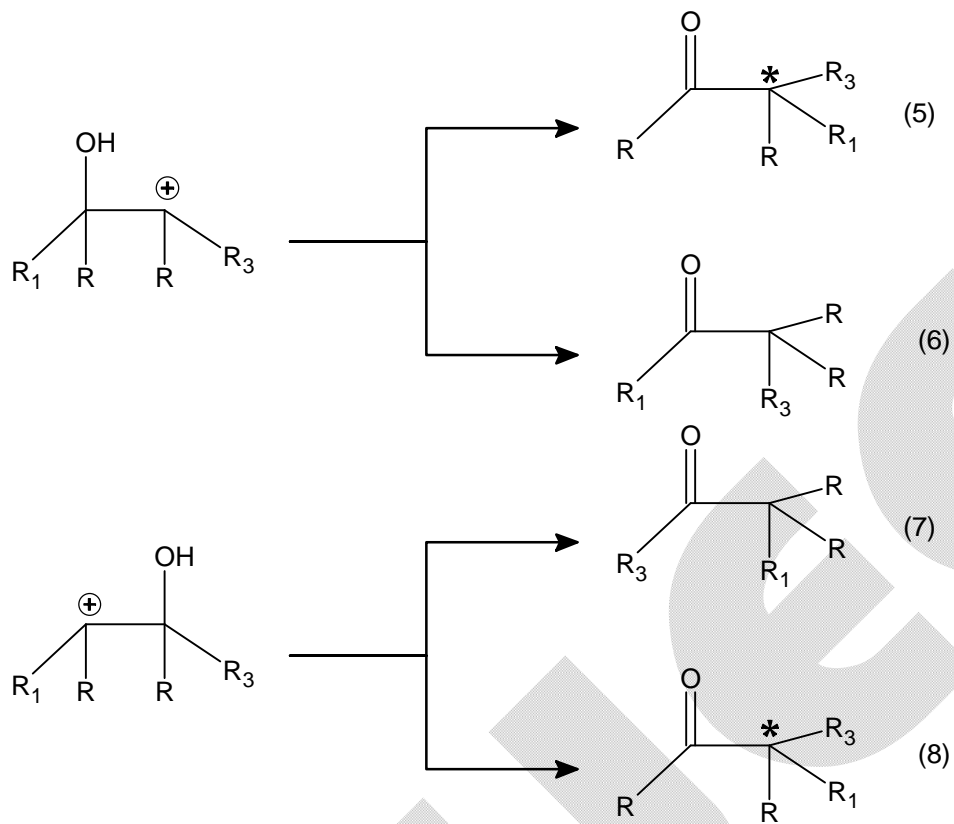
49. 80

Sol. Let fraction of (+) isomer is  $x$   
 $32 = 40 \times x + (1 - x)(-40)$   
 $32 = 80x - 40$   
 $x = 0.9$   
 + isomer is 90%  
 - isomer is 10%  
 Optical purity =  $90 - 10 = 80\%$

50. 12

Sol.





Structure (5) and (8) are identical.

**Mathematics**

**PART – C**

**SECTION – A**

51. C

Sol.  $\therefore M^2 = M.M = MNM = MN = M$   
 sim  $N^2 = N$   
 $\therefore M = M^2 = M^3 = \dots$  and  $N = N^2 = \dots$   
 $(M^{2024} + N^{2024})^{2025} = (M + N)^{2025}$   
 Now,  $(M + N)^2 = M^2 + N^2 + MN + NM = 2(M + N)$   
 $(M + N)^3 = 2(M + N)(M + N) = 2^2(M + N)$   
 $(M + N)^{2025} = \dots = 2^{2024}(M + N)$

52. C

Sol.  $\Rightarrow (x - 1)^{60} = a_0x^{60} + a_1x^{59} + \dots + a_{30}x^{30} + a_{31}x^{29} + \dots + a_{60}$   
 $\therefore a_0 = {}^{60}C_0, a_1 = -{}^{60}C_1, a_2 = {}^{60}C_2, \dots$   
 $\therefore k = a_0 + a_1 + \dots + a_{60} = 0$   
 $k - a_{30} = -{}^{60}C_{30}$

53. B

Sol. We have  
 In  $S_1$  unit place can have 1 or 3 or 5  
 In  $S_2$  it is  ${}^5C_3 \times 3 \times \frac{4!}{2!} + {}^5C_2(9 \times 2 + 6) = 600$

54. C

Sol. Centre of circle is (2, 0) lie on line  $z(1 - i) + \bar{z}(1 + i) = 4$   
 Hence intersection points is two.

55. A

Sol.  $T_{(\theta)} = \frac{1}{2}(1 + \cos(60 - 2\theta)) + \left(\sin^2 \theta - \frac{3}{4}\right) + \frac{1}{2}(1 + \cos(60^\circ + 2\theta))$   
 $= 1 + \frac{1}{2}(2\cos^\circ \cos 2\theta^\circ) + \frac{1}{4}(-1 - 2\cos \theta^\circ) = \frac{3}{4}$   
 $4 \sum \theta T_{(\theta)} = 4 \sum_{\theta=1}^{30} \frac{3\theta}{4} = 3 \sum \theta = 1395$

56. B

Sol. Let the G.P. of three unequal numbers be given by a, ar, ar<sup>2</sup>, r ≠ 1 hence r > 1 for increasing G.P.  
 $ar^2 \leq 100 \Rightarrow a \leq \frac{100}{r^2}$

The number of geometric progression =  $\sum_{r=2}^{100} \left[ \frac{100}{r^2} \right]$  where [.] is G.I.F.

$$= \left[ \frac{100}{4} \right] + \left[ \frac{100}{9} \right] + \left[ \frac{100}{16} \right] + \left[ \frac{100}{25} \right] + \left[ \frac{100}{36} \right] + \left[ \frac{100}{49} \right] + \left[ \frac{100}{64} \right] + \left[ \frac{100}{81} \right] + \left[ \frac{100}{100} \right]$$

$$= 25 + 11 + 6 + 4 + 2 + 2 + 1 + 1 + 1 = 53$$

57. A

Sol.  $\lim_{x \rightarrow 0} \frac{2(a^{x-1} + b^x - 1)}{2} = e^{\ln ab} \Rightarrow ab = 6$   
 (a, b) = (1, 6), (6, 1), (2, 3), (3, 2)  
 $P(E) = \frac{4}{36} = \frac{1}{9}$

58. D

Sol.  $f'(x) = ax(x-1) \Rightarrow f'(2) = 6 \Rightarrow a = 3$

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

$$\therefore f(2) = 2 \Rightarrow c = 0$$

$$\therefore f(x) = x^2 \left( x - \frac{3}{2} \right)$$

59. D

Sol.  $\log_a b = \log_a c \Rightarrow a = b^{1/b} = c^{1/c}$   
from curve  $y = x^{1/x}$ ,  $x > 0$  we find  $1 < a < e^{1/e}$ .

60. B

Sol.  $(2xydx + x^2dy) + x^2ydx + \left( \frac{y^3}{3} dx + y^2dy \right) = 0$

Put  $x^2y = t$  and  $\frac{y^3}{3} = u$

$$(dt + tdx) + (udx + du) = 0$$

$$\int \frac{dt + du}{t + u} = -\int dx$$

$$\Rightarrow \ln(t + u) = -x + c$$

$$\Rightarrow x^2y + \frac{y^3}{3} = k'e^{-x} \text{ at } x = 1, y = 1, k' = \frac{4e}{3}$$

Put  $x = 0$ ,  $\frac{y^3}{3} = \frac{4e}{3} \Rightarrow k = 4$

61. C

Sol.  $\int_{\alpha}^{\beta} f(x) dt + \int_{\alpha}^{\beta} f^{-1}(x) dx = 13$

$$\Rightarrow \beta^2 - \alpha^2 = 13 \Rightarrow \beta = 7, \alpha = 6$$

62. A

Sol. Let point of intersection  $(h, k)$

$$\Rightarrow \frac{h}{a} + \frac{k}{b} = 1 \text{ and } ah + kb = 1, \frac{a}{b} + \frac{b}{a} = 1$$

$$\left( \frac{h}{a} + \frac{k}{b} \right) (ah + kb) = 1$$

$$h^2 + k^2 + hk \left( \frac{b}{a} + \frac{a}{b} \right) = 1$$

63. D

Sol.  $e = \sqrt{\frac{2n+4}{n+1}}$

Put  $n = 48$  then  $e = \frac{10}{7}$  is a rational number

$$\frac{x^2}{49} - \frac{y^2}{51} = 1 \quad \therefore \ell = \frac{2b^2}{a} = \frac{102}{7}$$

64. C  
Sol. PQ will be focal chord and its mid point will be circum centre.

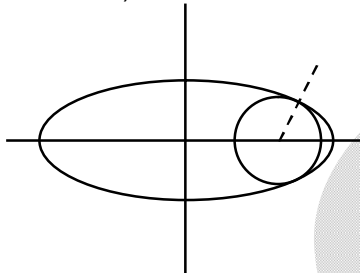
$$2h = a\left(t^2 + \frac{1}{t^2}\right), 2k = 2a\left(t - \frac{1}{t}\right), \text{ where } P \equiv (at^2, 2at)$$

eliminate t, we get locus

$$\text{locus is } y^2 = 2a(x - a), \text{ focus} = \left(\frac{3a}{2}, 0\right)$$

65. C  
Sol. Centre of circle should be on major axis.

If circle touches ellipse at P(2cosθ, sinθ) normal at P



$2x \sec \theta - y \operatorname{cosec} \theta = 3$  cuts major axis at  $\left(\frac{3}{2} \cos \theta, 0\right)$  if r be the radius of circle then

$$r^2 = \left(2 \cos \theta - \frac{3}{2} \cos \theta\right)^2 + (\sin \theta - 0)^2 = 1 - \frac{3}{4} \cos^2 \theta$$

but  $0 \leq \cos^2 \theta < 1$

$$\frac{1}{2} \leq r \leq 1$$

66. A  
Sol. Let angle between  $\vec{a}$  and  $\vec{b}$  is  $\alpha$  and  $\vec{a} \times \vec{b}$  and  $\vec{c}$  is  $\beta$

$$|(\vec{a} \times \vec{b}) \cdot \vec{c}| = 6 \Rightarrow \sin \alpha \cdot \cos \beta = 1$$

so that  $\vec{a}, \vec{b}, \vec{c}$  are mutually perpendicular

$$\therefore \text{req.} = |\vec{a} \times \vec{c}|^2 |\vec{d}|^2 = 9$$

67. C  
Sol.  $\vec{a} = \vec{b} \times \vec{c} + 2\vec{b}$

$$\Rightarrow \vec{a} \cdot \vec{b} = 2|\vec{b}|^2 \Rightarrow |\vec{a}||\vec{b}|\cos \theta = 2|\vec{b}|^2$$

$$\cos \theta = \frac{4}{|\vec{a}|} \Rightarrow |\vec{a}| = 4 \Rightarrow \theta = 0^\circ$$

$$\Rightarrow \vec{a} = 2\vec{b}$$

$$\text{Now } \vec{b} \times \vec{c} = 0 \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{b} = -\vec{c}$$

$$\therefore |2\vec{a} + \vec{b} + \vec{c}| \text{ is either } |3\vec{a}| \text{ or } |2\vec{a}|$$

$$|2\vec{a} + \vec{b} + \vec{c}| \text{ is either } 12 \text{ or } 8$$

$$\text{sum} = 12 + 8 = 20$$

68. C

Sol. Normal vector of plane  $\vec{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 0 & -1 \\ 1 & 2 & -1 \end{vmatrix}$

$$\vec{n} = 2(\hat{i} + \hat{j} + 3\hat{k})$$

Equation of plane :  $x + y + 3z = 1$

$$\therefore a + b + c = 1 + 1 + 3 = 5$$

69. B

Sol. We write the elements A + A

$$1 + 1, 1 + a_1, 1 + a_2, \dots, 1 + a_{18}, 1 + 77, a_1 + 77, \dots, a_{18} + 77, 77 + 77$$

It means all other values are already present in these 39 values, which is only possible in case when all numbers are in A.P. let common diff. be 'd'

$$77 = 1 + 19d \quad \therefore d = 4$$

$$\sum_{i=1}^{18} a_i = \frac{18}{2} [2a_1 + 17d] = 702$$

70. D

Sol.

$x_i$ (observation)	0	2	$2^2$	$2^n$
$f_i$ (frequency)	${}^n C_0$	${}^n C_1$	${}^n C_2$	${}^n C_n$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{0 \times {}^n C_0 + 2 \times {}^n C_1 + 2^2 \times {}^n C_2 + \dots + 2^n \times {}^n C_n}{{}^n C_0 + {}^n C_1 + \dots + {}^n C_n}$$

$$= \frac{3^n - 1}{2^n} = \frac{728}{2^n} \quad (\text{Given})$$

$$\Rightarrow n = 6.$$

## SECTION - B

71. 30

Sol.  $C_1 \equiv (1,1), r_1 = 1, C_2 \equiv (9,6), r_2 = 2$

$$C_1 M_1 \geq r_1, C_2 M_2 \geq r_2$$

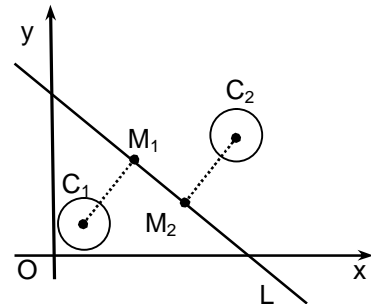
$$|7 - k| \geq 5$$

$$k \geq 12$$

$$\text{and also } k \leq 41$$

$$k \in [12, 41]$$

$$\text{no of integral } k = 30.$$



72. 41

Sol. Let  $P(E_1) = x, P(E_2) = y, P(E_3) = z$

$$\Rightarrow 3x(1-y)(1-z) = (1-x)y(1-z) = 9(1-x)(1-y)z = 3(1-x)(1-y)(1-z)$$

$$\frac{3x}{1-x} = \frac{y}{1-y} = \frac{9z}{1-z} = 3$$

$$\therefore x = \frac{1}{2}, y = \frac{3}{4}, z = \frac{1}{4}$$

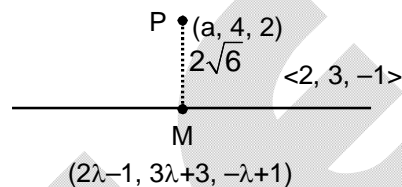
$$\text{Now } \begin{vmatrix} 1/2 & 3/4 & 1/4 \\ 3/4 & 1/4 & 1/2 \\ 1/4 & 1/2 & 3/4 \end{vmatrix} = -\frac{9}{32}$$

$$\therefore \frac{a}{b} = \frac{9}{32}$$

$$\therefore a + b = 41$$

73. 8

Sol.  $(2\lambda - 1 - a)2 + (3\lambda - 1)3 + (-\lambda - 1)(-1) = 0$   
 $\Rightarrow 7\lambda - 2 - a = 0 \dots (i)$   
 And  $(5\lambda - 1)^2 + (3\lambda - 1)^2 + (\lambda + 1)^2 = 24$   
 $\Rightarrow \lambda = 1$   
 $\Rightarrow a = 5$  from (i)  
 $(\alpha_1, \alpha_2, \alpha_3)$  is reflection of P  
 $\Rightarrow \alpha_1 = -3, \alpha_2 = 8, \alpha_3 = -2$   
 $\therefore a + \alpha_1 + \alpha_2 + \alpha_3 = 8.$



74. 9

Sol. Differentiate w.r.t. x  
 $f'(x) - \sin 2x = 0 - f(x) \tan x$   
 or  $y' + y \tan x = \sin 2x$ , where  $y = f(x)$   
 LDE, solution is  $y \sec x = \int 2 \sin x \, dx$   
 or  $y \sec x = -2 \cos x + c$   
 $f(0) = 1 \Rightarrow c = 3 \therefore f(x) = 3 \cos x - 2 \cos^2 x$   
 $f(x) = -2 \left( \cos x - \frac{3}{4} \right)^2 + \frac{9}{8}$   
 $f(x) \text{ max} = 9/8.$

75. 5

Sol. eccentricity of ellipse =  $\frac{1}{2}$   
 $\frac{de}{dt} = -0.1$  (given)  
 eccentricity of auxiliary circle = 0  
 $\int_{1/2}^0 de = -0.1 \int_0^T dt$   
 T is time at which it will become auxiliary circle  
 $-\frac{1}{2} = -0.1 (T - 0)$   
 $\therefore T = 5 \text{ sec.}$