Test Pattern

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

CLASSROOM CONTACT PROGRAMME

(Academic Session : 2024 - 2025)

JEE (Advanced)
FULL SYLLABUS
10-02-2025

JEE(Main + Advanced) : ENTHUSIAST COURSE ALL STAR BATCH (SCORE-II)

ANSWER KEY | PAPER (OPTIONAL)

PART-1 : PHYSICS

SECTION-I (i)	Q.	1	2	3	4	5	6
	A.	A,D	A,C	C	A,D	A,C,D	A,D
SECTION-I (ii)	Q.	7	8	9	10		
	A.	C	C	A	C		
SECTION-II (i)	Q.	1	2	3	4	5	6
	A.	9.00	6.00	0.40	0.40	106.66 to 106.67	933.33
SECTION-II (ii)	Q.	7	8	9			
	A.	1	3	6			

PART-2 : CHEMISTRY

SECTION-I (i)	Q.	1	2	3	4	5	6
	A.	B,C,D	A,B,C,D	A,B,C,D	A,B,D	A,C,D	C,D
SECTION-I (ii)	Q.	7	8	9	10		
	A.	B	D	C	D		
SECTION-II (i)	Q.	1	2	3	4	5	6
	A.	354.00	172.50 to 173.50	6.00	3.00	3.00	5.00
SECTION-II (ii)	Q.	7	8	9			
	A.	7	7	0			

PART-3 : MATHEMATICS

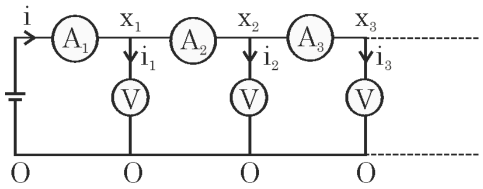
SECTION-I (i)	Q.	1	2	3	4	5	6
	A.	A,B,C,D	A,C,D	A,D	A,D	A,C	A,B,D
SECTION-I (ii)	Q.	7	8	9	10		
	A.	C	A	D	B		
SECTION-II (i)	Q.	1	2	3	4	5	6
	A.	0.80	10.00	5.00	31.00	80.00	101.00
SECTION-II (ii)	Q.	7	8	9			
	A.	2	2	17			

HINT – SHEET

PART-1 : PHYSICS

SECTION-I (i)

1. Ans (A,D)



$$\sum V_i = \sum i_i \cdot R = i \cdot \frac{V_i}{i_1} = 5 \times \frac{9}{5-4.7}$$

$$= 5 \times \frac{9}{0.3} = 150 \text{ volts}$$

$$R = \frac{V_i}{i_1} = \frac{9}{(5-4.7)\times 10^{-3}} = 30 k\Omega$$

2. Ans (A,C)

$$\lambda_k = \frac{\ell n2}{6hr} \approx \frac{0.7}{6} hr^{-1} \approx 0.12 hr^{-1}$$

$$\lambda_\gamma = 0.12 hr^{-1}$$

$$\lambda_\beta \approx 0 \left(\because T_{1/2}\big|_\beta >> T_{1/2}\big|_\gamma\right)$$

$$\lambda_{eq} = \lambda_\gamma + \lambda_k = \frac{2\ell n2}{6hr} = \frac{\ell n2}{3hr}$$

$$A = A_0 e^{-\lambda_{eq}.t}$$

$$A = A_0 e^{-\ln 2} = \frac{A_0}{2}$$

$$A' = \frac{\left(10^{-3} ltr\right) A}{x\, ltr} = \frac{10^{-3} A_0}{2x}$$

$$3.7 = \frac{10^{-3} \times 10^{-6} \times 3.7 \times 10^{10}}{2x}$$

$$x = 5 \text{ ltr}$$

3. Ans (C)

Let ℓ be the distance from the large conducting sphere to each of the small balls, d the separation between the balls and r the radius of each ball. Q be the charge on large sphere and it's potential is V.

$$\frac{1}{4\pi\varepsilon_0}\left[\frac{Q}{\ell} + \frac{q_1}{r}\right] = V \quad ..... (1)$$

$$\frac{1}{4\pi\varepsilon_0}\left[\frac{Q}{\ell} + \frac{q_1}{d} + \frac{q_2}{r}\right] = V \quad ..... (2)$$

$$\frac{1}{4\pi\varepsilon_0}\left[\frac{Q}{\ell} + \frac{q_1}{d} + \frac{q_2}{d} + \frac{q_3}{r}\right] = V \quad ..... (3)$$

On solving we get $q_3 = \dfrac{q_2^2}{q_1}$

$q_3 = 2.25\ \mu C$

4. Ans (A,D)

$$Mg\frac{L}{2} = \frac{1}{2}\left(\frac{ML^2}{3}\right)\omega_0^2$$

$$\omega = \sqrt{\frac{3g}{2L}}$$

$$e = \frac{v - \omega(L-r)}{(L-r)\omega_0} = 1$$

$$\text{COAM, } \frac{ML^2}{3}\omega_0 = \frac{ML^2}{3}\omega + mv(L-r)$$

5. Ans (A,C,D)

- For isothermal process : $Q = W \Rightarrow \tan\theta = 1$
- For adiabatic process : $Q = 0 \Rightarrow \frac{W}{Q} = \infty \Rightarrow \tan\theta = \infty$
- For isobatic process : $Q = nC_P\Delta T$ and

$W = n(C_P - C_V)\Delta T$

$$\Rightarrow \tan\theta = \frac{W}{Q} = \frac{C_P - C_V}{C_P} = 1 - \frac{C_V}{C_P} = 1 - \frac{1}{\gamma}$$

where $\gamma = 1 + \frac{2}{f}$ [where f is degree of freedom]

6. Ans (A,D)

Final image is formed at infinity if the combined focal length of the two lenses (in contact) becomes 30 cm or $\frac{1}{30} = \frac{1}{20} + \frac{1}{f}$

i.e., when another concave lens of focal length 60 cm is kept in contact with the first lens. Similarly, let μ be the refractive index of a liquid in which focal length of the given lens becomes 30 cm. Then

$$\frac{1}{20} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad ---(1)$$

$$\frac{1}{30} = \left(\frac{3/2}{\mu} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad ---(2)$$

From equations, (1) and (2), we get

$$\mu = \frac{9}{8}$$

PART-1 : PHYSICS

SECTION-I (ii)

7. Ans (C)

$$\frac{m_e V^2}{r} = \frac{KZe^2}{r^2} - \frac{Ke^2}{(2r)^2} \quad ..... (1)$$

$$m_e V r = \frac{h}{2\pi} \quad ..... (2)$$

$$m_e v^2 r = Ke^2\left(Z - \frac{1}{4}\right) \text{ and}$$

$$m_e v^2 r = \frac{h^2}{4\pi^2 m_e r}$$

$$r = \frac{h^2}{4\pi^2 K m_e e^2\left(Z - \frac{1}{4}\right)} = \frac{a_0}{Z - \frac{1}{4}}.$$

8. Ans (C)

$$K.E. = m_e V^2 = \frac{Ke^2\left(Z - \frac{1}{4}\right)}{r}$$

$$= \frac{Ke^2\left(Z - \frac{1}{4}\right)^2}{a_0} = 2^2\left(Z - \frac{1}{4}\right)^2 I_H$$

$$P.E. = -\frac{2KZe^2}{r} + \frac{Ke^2}{2r}$$

$$= -\frac{2Ke^2}{r}\left(Z - \frac{1}{4}\right)$$

$$= -\frac{2Ke^2}{a_0}\left(Z - \frac{1}{4}\right)^2$$

$$= -4\left(Z - \frac{1}{4}\right)^2 I_H$$

$$I_2^{th} = \left(Z^2 - Z + \frac{1}{8}\right) I_H$$

9. Ans (A)

$$i_{same} \Rightarrow \frac{1}{\omega C} = \omega L$$

$$\Rightarrow \omega = \frac{1}{\sqrt{LC}}$$

10. Ans (C)

$$i = \frac{v}{z}$$

$$i_t = \frac{v}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}} = \frac{v\omega C}{\sqrt{\omega^2 C^2 R^2 + 1}}$$

PART-1 : PHYSICS

SECTION-II (i)

1. Ans (9.00)

$$F = v_{rel}\frac{dm}{dt} = v_0\left(\rho\frac{dV}{dt}\right)$$

$$= v_0(\rho A_0 v_0) = \rho A_0 v_0^2$$

$$= \rho A_0\left(\frac{2(P - P_0)}{\rho}\right) = 2A_0(P - P_0)$$

2. Ans (6.00)

$$P - P_0 = \frac{1}{2}\rho v_0^2\left[1 - \left(\frac{v}{v_0}\right)^2\right]$$

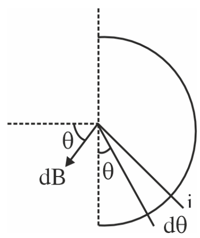
$$= \frac{1}{2}\rho v_0^2\left[1 - \left(\frac{A_0}{A}\right)^2\right] \approx \frac{1}{2}\rho v_0^2$$

$$\Rightarrow v_0 = \sqrt{\frac{2(P - P_0)}{\rho}}$$

3. Ans (0.40)

Magnetic field due to a half ring at it's centre $\frac{\mu_0 i}{4R}$.

Break hemisphere into many half rings connected at junction with external wires.



Current in each half ring $i = \frac{I}{\pi} \times d\theta$

$$\text{so, } B_{net} = \int\left(\frac{\mu_0 i}{4R}\right)\sin\theta$$

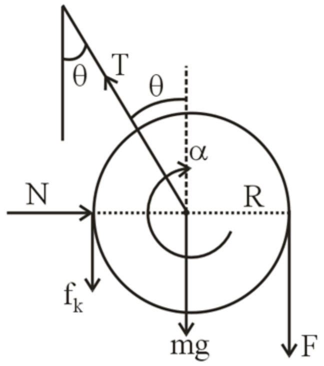
$$= \int_{\theta=0}^{\theta=\pi} \frac{\mu_0 I}{4\pi R} d\theta \sin\theta$$

$$B = \frac{\mu_0 I}{2\pi R}$$

4. **Ans (0.40)**

$F = Bil = 0.1 \times 2 \times 2 = 0.4\ N$

5. **Ans (106.66 to 106.67)**



$N = T \sin \theta$

$f_k = \mu N$

$f_k = \mu(T \sin \theta)$

$F + mg + f_k = T \cos \theta$

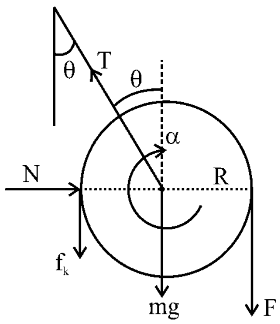
$F + mg + \mu T \sin\theta = T \cos \theta$

$F + mg = T (\cos\theta - \mu \sin\theta)$

$$T = \frac{F + mg}{\cos\theta - \mu \sin\theta}$$

$$\alpha = \frac{\ell_{net}}{1} = \frac{(F - f_k)R}{I} = \frac{320}{3}$$

6. **Ans (933.33)**



$N = T \sin \theta$

$f_k = \mu N$

$f_k = \mu(T \sin \theta)$

$F + mg + f_k = T \cos \theta$

$F + mg + \mu T \sin\theta = T \cos \theta$

$F + mg = T (\cos\theta - \mu \sin\theta)$

$$T = \frac{F + mg}{\cos\theta - \mu \sin\theta}$$

PART-1 : PHYSICS

SECTION-II (ii)

7. **Ans (1)**

$$\frac{d\phi_E}{dt} = \frac{d}{dt}(E \cdot a),\ E = \frac{q}{A\varepsilon_0}$$

$i = i_0 e^{-t/\tau},\ \tau = 100\ \mu s,$

$$a = \pi\left(\frac{R}{2}\right)^2$$

$A = \pi R^2$

8. **Ans (3)**

At O, $Mg = ky_0$

$$OO' = \frac{F}{k} \text{ and } O'A = \frac{F}{k}$$

$$T = 2\pi\sqrt{\frac{m}{k}} = \frac{\pi}{25} \text{ sec.}$$

$$\text{at } t = \frac{\pi}{2} \text{ sec,}$$

$$\text{number of oscillations } N = \frac{\pi/2}{\pi/25}$$

N = 12.5 ; it means when force cases to act, body is at position A.

So amplitude of resulting SHM,

$$OA = \frac{2F}{k} = \frac{2 \times 72}{2000} = 72\ mm$$

PART-2 : CHEMISTRY

SECTION-I (i)

1. **Ans (B,C,D)**

(P) If $FeCl_3$ is added to the excess of hot water, a positively charged sol of hydrated ferric oxide is formed due to adsorption of Fe^{3+} ions. Hence it will more.

(Q) Gas with higher critical temperature is more liquifiable in nature. Hence will get adsorbed to higher extent.

(R) Haemoglobin (Blood) - positively changed sol eosin (acid dye) - negatively charged sol

(S) In electro osmosis, movement of dispersion medium takes place. God sol is negatively charged sol, however dispersion medium is positively charged. Hence it moves towards cathode.

(T) $CH_3(CH_2)_8NH_3^{\oplus}Cl^{\ominus}$ has more non polar part then $CH_3(CH_2)_5COONa$. Hence CMC will be less.

(U) NCERT.

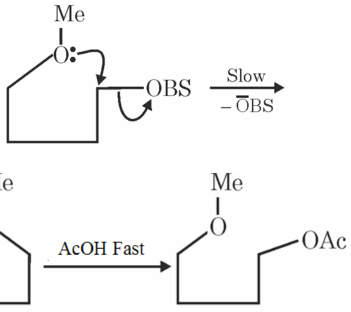
2. Ans (A,B,C,D)

$Pb_3O_4 + 8HCl \longrightarrow 3PbCl_2 + Cl_2 + 4H_2O$

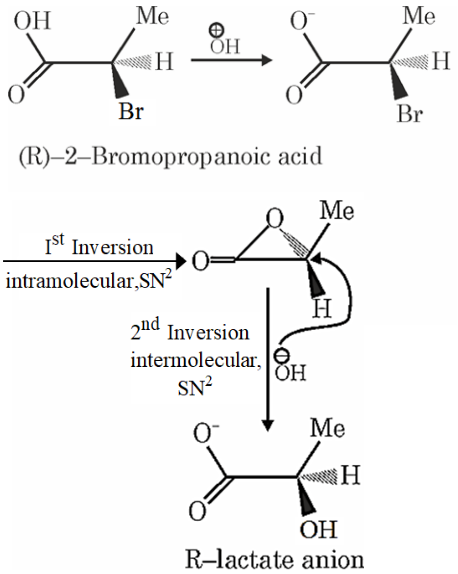
$2AgClO_3 + Cl_2 \xrightarrow{90^\circ C} 2AgCl + 2ClO_2 + O_2$

4. Ans (A,B,D)

(A)

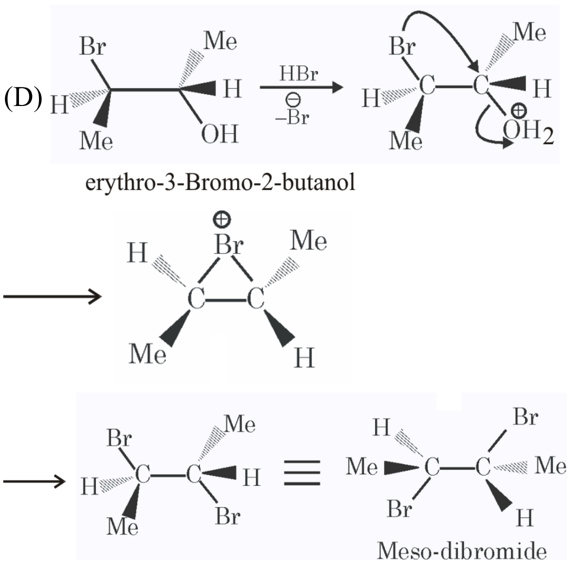


(B)



(C) Trans–2 iodocyclohexyl brosylate involve SN^{NGP} & is 1.7×10^6 times faster than cis.

(D)



5. Ans (A,C,D)

More the negative energy, more is the stability of the ion/molecule.

H_2^+ is more stable than He_2^+

Bond dissociation energy of H_2^+ is more than bond dissociation energy of He_2^+ as more energy is released when H_2^+ is formed.

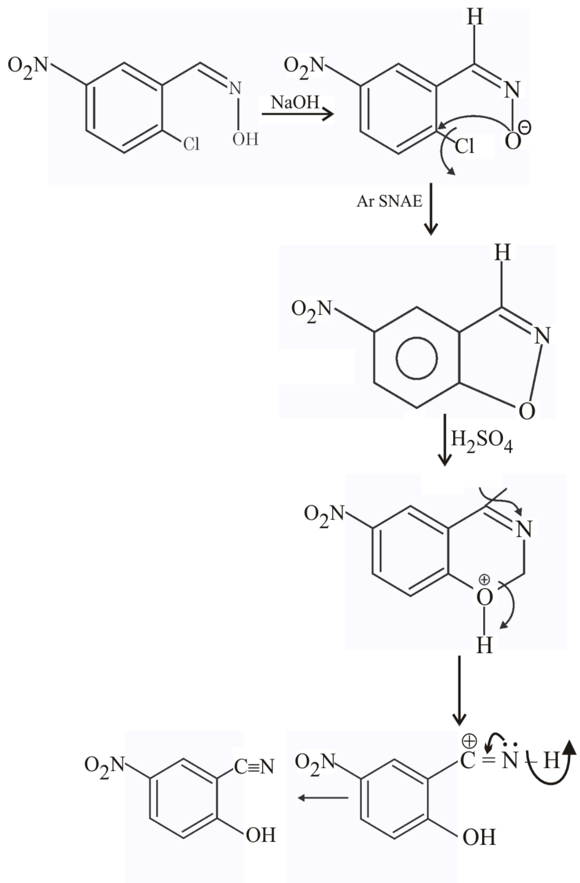
PART-2 : CHEMISTRY

SECTION-I (ii)

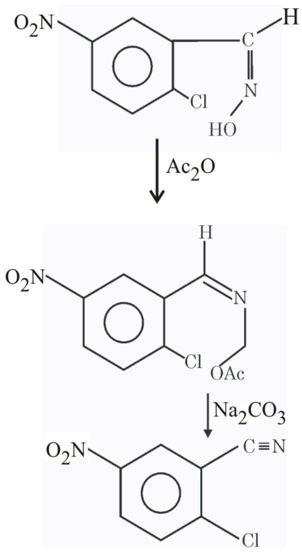
7. Ans (B)

White cast iron content cementite which is a interstitial carbide and represented by Fe_3C.

9. Ans (C)



10. **Ans (D)**



PART-2 : CHEMISTRY

SECTION-II (i)

1. **Ans (354.00)**

$$\varepsilon = \frac{hc}{\lambda} = \Delta_0 = 3.501 \text{ eV}$$

$$\therefore \lambda = \frac{hc}{\Delta_0}$$

$$\lambda = \frac{hc}{\Delta_0} = \frac{(6.626\times10^{-34})(3.00\times10^{8})}{(3.501\text{eV})(1.6022\times10^{-19}\text{J/eV})}$$

$$= 3.54\times10^{-7}$$

$$\lambda = 354\text{nm}$$

2. **Ans (172.50 to 173.50)**

$$\text{CFSE} = 5\left(\frac{2}{5}\Delta_0\right) - 2\left(\frac{3}{5}\Delta\right)$$

$$= \frac{4}{5}\Delta_0 = \frac{4}{5}(2.242\text{ eV})$$

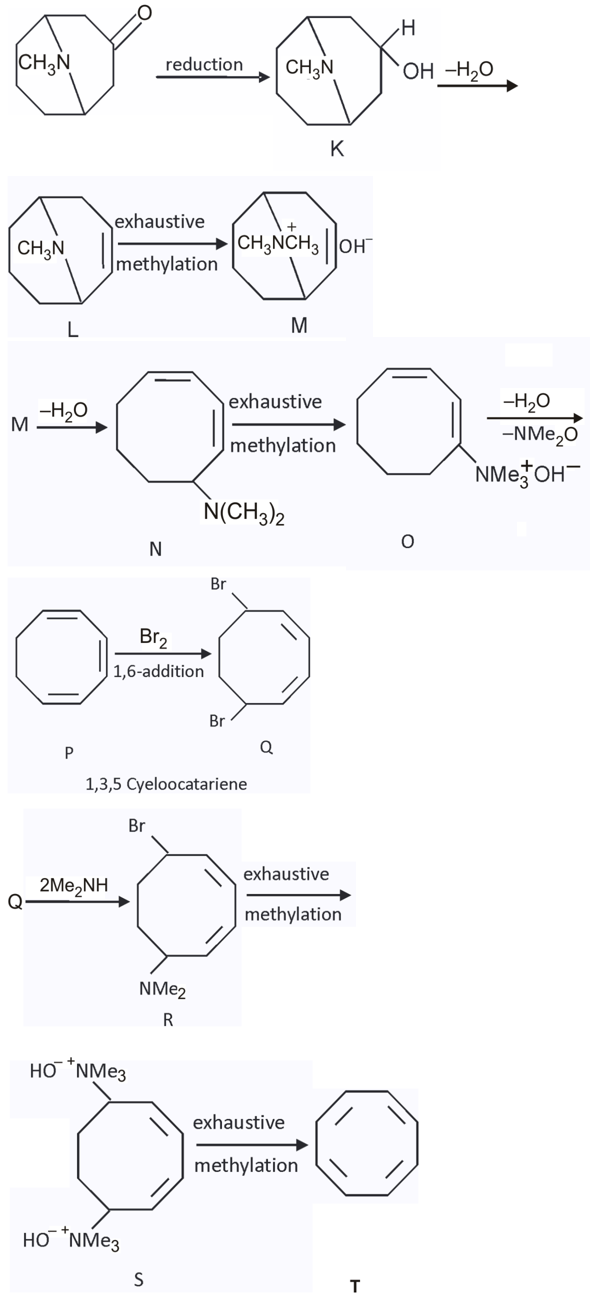
$$\text{CFSE} = 1.794\text{ eV} = \left(1.794\frac{\text{eV}}{\text{ion}}\right)$$

$$\left(1.6022\times10^{-19}\frac{\text{J}}{\text{eV}}\right)\left(6.022\times10^{23}\frac{\text{ion}}{\text{mol}}\right)\left(10^{-3}\frac{\text{kj}}{\text{j}}\right)$$

$$\text{CFSE} = \left(1.794\frac{\text{eV}}{\text{ion}}\right)\left(1.6022\times10^{-19}\frac{\text{J}}{\text{eV}}\right)$$

$$\left(6.022\times10^{23}\frac{\text{ion}}{\text{mol}}\right)\left(10^{-3}\frac{\text{kj}}{\text{j}}\right) = 173.1\frac{\text{kJ}}{\text{mol}}$$

4. **Ans (3.00)**



5. **Ans (3.00)**

(ii), (v), (vii) are correct.

6. **Ans (5.00)**

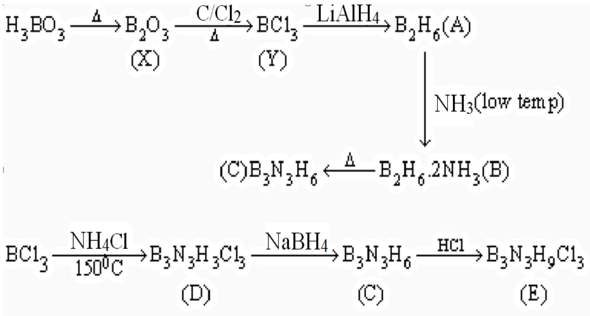
(i), (iii), (iv), (v) & (vi) are correct

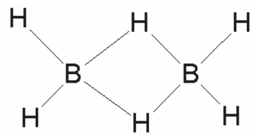
PART-2 : CHEMISTRY

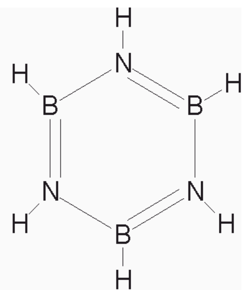
SECTION-II (ii)

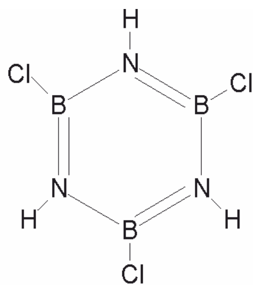
7. **Ans (7)**

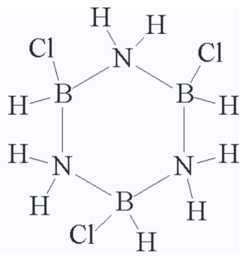
B,C,D,E,G,H,J are correct statements



B_2H_6 ≡


$B_3N_3H_6$ ≡


$B_3N_3H_3Cl_3$ ≡


$B_3N_3H_9Cl_3$ ≡


9. **Ans (0)**

For carnot cycle of the given curve $\frac{v_1}{v_2} = \frac{v_4}{v_3}$

$\Rightarrow \Rightarrow v_2v_4 = v_1v_3$

PART-3 : MATHEMATICS

SECTION-I (i)

1. **Ans (A,B,C,D)**

$A + B = ABAB = A^2 + A$

$\Rightarrow B = A^2$

$BAB = A^5 = A + I \Rightarrow A(A^4 - I) = I$

$B^5 - A^5 = (A^5)^2 - A^5 = (A + I)^2 - (A + I)$

$= A^2 + A = A + B$

2. **Ans (A,C,D)**

$$d(x[0,1]) = \begin{cases} 0 - x & , \quad x < 0 \\ 0 & , \quad 0 \leqslant x \leqslant 1 \\ x - 1 & , \quad 1 < x \end{cases}$$

$$d(x[2,3]) = \begin{cases} 2 - x & , \quad x < 2 \\ 0 & , \quad 2 \leqslant x \leqslant 3 \\ x - 3 & , \quad 3 < x \end{cases}$$

$$f(x) = \begin{cases} \frac{-x}{-x+2-x} & , \quad x < 0 \\ 0 & , \quad 0 \leqslant x \leqslant 1 \\ \frac{x-1}{x-1+2-x} & , \quad 1 < x < 2 \\ 1 & , \quad 2 \leqslant x \leqslant 3 \\ \frac{x-1}{x-1+x-3} & , \quad 3 < x \end{cases}$$

Range $f(x) \in [0, 1]$ onto function.

3. **Ans (A,D)**

Images of (α, β) in the two tangents are $(\alpha, -\beta)$ and (β, α). Slope of axis $= \frac{1}{2}$.

So, $\frac{-\beta}{\alpha - 1} = \frac{\alpha - 1}{\beta - 1} = \frac{1}{2} \Rightarrow (\alpha, \beta) = \left(\frac{3}{5}, \frac{1}{5}\right)$

4. **Ans (A,D)**

$y \cdot (y')^2 + xy' - yy' - x = 0$

$yy'[y' - 1] + x[y' - 1] = 0$

$\frac{dy}{dx} = 1$ or $\frac{dy}{dx} = -\frac{x}{y}$

$y = x + c$ or $y^2 = -x^2 + c$

as curves passing through (3, 4)

$y = x + 1$

and $x^2 + y^2 = 25$

5. **Ans (A,C)**

$x \cdot \frac{10^{2000} - 1}{9} - y \cdot \frac{10^{1000} - 1}{9}$

$= \frac{z^2 \cdot (10^{1000} - 1)^2}{81}$

$10^{1000} = k \Rightarrow x \cdot \frac{(k^2 - 1)}{9} - y \cdot \frac{(k - 1)}{9}$

$= \frac{z^2(k - 1)^2}{81}$

$x(k + 1) - y = \frac{z^2 \cdot (k - 1)}{9}$;

$9x(k + 1) - 9y = z^2k - z^2$

$k(z^2 - 9x) = z^2 + 9x - 9y$

$\{z^2 \neq 9x \Rightarrow k(z^2 - 9x) > z^2 + 9x - 9y\}$

$z^2 = 9x \Rightarrow x = 1, z = 3, y = 2, x = 4, z = 6, y = 8$

6. **Ans (A,B,D)**

Given $(z^2 + 1)(\bar{z}^2 + 1) = \left(1 + \left(\frac{z + \bar{z}}{2}\right)^2\right)^2$

$\Rightarrow (x^2 - y^2 + 1)^2 + 4x^2y^2 = (1 + x^2)^2$

$\Rightarrow 2x^2 + y^2 = 2$

$\Rightarrow \frac{x^2}{1} + \frac{y^2}{2} = 1$

Foci A(0, 1) B(0, –1)

$AB + BC + CA = 2\sqrt{2} + 2$

PART-3 : MATHEMATICS

SECTION-I (ii)

7. **Ans (C)**

$2x^2ydx - 2y^4dx + 2x^3dy + 3xy^3dy = 0$

Dividing by x^3y

$\frac{2dx}{x} - \frac{2y^3}{x^3}dx + 2\frac{dy}{y} + \frac{3y^2}{x^2}dy = 0$

$2d(\ln x) + 2d(\ln y) + d\left(\frac{y^3}{x^2}\right) = 0$

$\Rightarrow 2\ln|x| + 2\ln|y| + \left(\frac{y^3}{x^2}\right) = c$

where $x = 1, y = 1 \Rightarrow c = 1$

$\therefore a = 2, b = 2, c = 1$

So, $a + b + c = 5$

8. **Ans (A)**

$2xydy - x^3dy = 3x^2y\,dx - y^2dx$

$\Rightarrow 2xy\,dy + y^2dx = 3x^2y\,dx + x^3dy$

$\Rightarrow \int d(xy^2) = \int d(x^3y)$

$\Rightarrow xy^2 = x^3y + c$

Put $x = \frac{1}{2}, y = \frac{1}{4} \Rightarrow c = 0$

So equation of curve is $xy^2 = x^3y$

i.e., $y = x^2$

So, length of latus rectum is 1.

9. **Ans (D)**

$a_1 = 2, a_2 = 3, a_3 = 4$

If $P(i) \propto i^2$

$P(R) = \frac{1}{14} \cdot \frac{2}{6} + \frac{4}{14} \cdot \frac{3}{6} + \frac{9}{14} \cdot \frac{4}{6} = \frac{25}{42}$

10. **Ans (B)**

$$\text{Probability} = \frac{1}{3}\left[\frac{{}^2C_1\cdot{}^4C_1+{}^3C_1\cdot{}^3C_1+{}^2C_1\cdot{}^4C_1}{{}^6C_2}\right] = \frac{5}{9}$$

PART-3 : MATHEMATICS

SECTION-II (i)

2. **Ans (10.00)**

Hence $x = e^{i\,2\pi r/10}$ (r = 1, 2, ..., 10)

$A_1 = e^{i2\pi/10} = \alpha_1 \quad A_2 = e^{i4\pi/10} = \alpha_2$

$A_3 = e^{i6\pi/10} = \alpha_3 \quad A_{10} = 1 = \alpha_{10}$

Hence centroid $\Delta\ A_1A_4A_8$ is

$$G_1 = \frac{\alpha_1+\alpha_4+\alpha_8}{3} \quad G_2 = \frac{\alpha_2+\alpha_6+\alpha_9}{3}$$

$$G_3 = \frac{\alpha_3+\alpha_5+\alpha_7}{3}$$

Hence, centroid of $\Delta\ G_1G_2G_3$ is

$$P = \frac{\alpha_1+\alpha_2+\alpha_3+\ldots\alpha_9}{9} = -\frac{1}{9}$$

Hence, $\angle POA_1 = \dfrac{4\pi}{5}$

4. **Ans (31.00)**

$$\lim_{x\to 0}\frac{\sqrt{1+x^2}\tan\left(\frac{x}{\sqrt{1+x^2}}\right)+2\sqrt{1-x^2}\sin\frac{x}{\sqrt{1-x^2}}-3x}{x^p}$$

Using expansion

$$\lim_{x\to 0}\frac{\sqrt{1+x^2}\left(\frac{x}{\sqrt{1+x^2}}+\frac{x^3}{3(1+x^2)^{\frac{3}{2}}}+\frac{2}{15}\frac{x^5}{(1+x^2)^{\frac{5}{2}}}\ldots\right)+2\sqrt{1-x^2}\left(\frac{x}{\sqrt{1-x^2}}-\frac{x^3}{3!(1-x^2)^{\frac{3}{2}}}+\frac{x^5}{5!(1-x^2)^{\frac{5}{2}}}\ldots\right)}{x^p}$$

$$\lim_{x\to 0}\frac{\left(-\frac{2}{3}+\frac{2}{15}+\frac{1}{(1+x^2)^2}+\frac{2}{5!(1-x^2)^2}\right)x^5}{x^p}$$

$$\Rightarrow p = 5 \text{ and limit} = -\frac{2}{3}+\frac{2}{15}+\frac{2}{5!} = \frac{-31}{60}$$

6. **Ans (101.00)**

$$n^2-5(2n-5) \leqslant \frac{393(n-5)}{5} \leqslant n^2-25$$

$\Rightarrow 73.6 \leqslant n \leqslant 83.6$, n = 80 is only possible value

PART-3 : MATHEMATICS

SECTION-II (ii)

7. **Ans (2)**

$f'(x) - \tan x\, f(x) = k$

I.F. = cosx

$\Rightarrow f(x)\cdot\cos x = \int k\cos x\,dx$

$\Rightarrow f(x) = k\tan x + c\sec x$

$f(0) = 1 \Rightarrow C = 1$

$\Rightarrow f(x) = k\tan x + \sec x$

$$\text{Now, } k = \int_{-\pi/6}^{\pi/6} f(x)\,dx = 2\int_0^{\pi/6}\sec x\,dx = \ell n3$$

8. **Ans (2)**

$$\begin{vmatrix} 2 & 1 & 1 \\ 1 & -1 & 1 \\ k & -1 & 3 \end{vmatrix} = 0$$

$\Rightarrow 2(-3+1) - 1(3-k) + 1(-1+k) = 0$

$\Rightarrow k = 4$

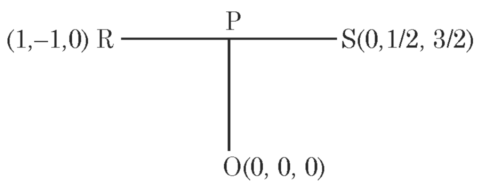
Now put z = 0 in p_1 and p_2 we get

2x + y = 1 and x − y = 2

Solving these we get point R(1, −1, 0)

Again putting x = 0 in p_1 and p_2 we get

y + z = 1, and −y + z = 2



Solving these '2' equation, we get $S\left(0,-\frac{1}{2},\frac{3}{2}\right)$

Now, Equation of the line $\overrightarrow{RS}$ is

$$\frac{x-1}{-1}=\frac{y+1}{1/2}=\frac{z}{3/2}=\lambda$$

$P\left(-\lambda+1,\frac{\lambda}{2}-1,\frac{3\lambda}{2}\right)$ be any point on line

And $OP \perp RS$ So,

$$(-1)(-\lambda+1)+\left(\frac{1}{2}\right)\left(\frac{\lambda-2}{2}\right)+\left(\frac{3}{2}\right)\frac{3\lambda}{2}=0$$

$$\Rightarrow \lambda=\frac{3}{7} \therefore P=\left(\frac{4}{7},\frac{-11}{14},\frac{9}{14}\right)$$

$$\therefore \alpha=\frac{4}{7},\beta=\frac{-11}{14},\gamma=\frac{9}{14} \therefore \frac{\alpha}{2}-180\beta+2k$$

$$=\left(\frac{4}{14}+\frac{1980}{14}+\frac{18}{14}\right)=\frac{2002}{14}=143.$$

Which is equal to three digit number abc then

$a+b-c=2$

9. Ans (17)

$$A^1=\begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}+\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}$$

$$=I+B \Rightarrow A^n=(I+B)^n$$

$$={}^nC_0 I+{}^nC_1 B+\ldots\ldots+{}^nC_n B^n$$

Now, $B^2=2I \Rightarrow B^{2k}=2^k I$ and $B^{2k+1}=2^k B$

$$\text{Now, }\begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}=\left(C_0+C_2\cdot 2+C_4\cdot 2^2+\ldots\ldots\right)I$$

$$+\left(C_1+C_3\cdot 2+\ldots\ldots\right)B$$

$$=XI+YB=\begin{bmatrix}X & 0\\ 0 & X\end{bmatrix}+\begin{bmatrix}Y & Y\\ Y & -Y\end{bmatrix}=\begin{bmatrix}X+Y & Y\\ Y & X-Y\end{bmatrix}$$

$$\Rightarrow a_{12}={}^nC_1+{}^nC_3 2+{}^nC_5 2^2+\ldots\ldots$$

$$=\frac{1}{\sqrt{2}}\left[\frac{\left(1+\sqrt{2}\right)^n-\left(1-\sqrt{2}\right)^n}{2}\right]$$

$$\text{Similarly, } a_{22}=\frac{\left(1+\sqrt{2}\right)^n+\left(1-\sqrt{2}\right)^n}{2}$$

$$-\frac{\left(1+\sqrt{2}\right)^n-\left(1-\sqrt{2}\right)^n}{2\sqrt{2}}$$

$$=\frac{\left(\sqrt{2}-1\right)\left(1+\sqrt{2}\right)^n-\left(\sqrt{2}+1\right)\left(1-\sqrt{2}\right)^n}{2\sqrt{2}}$$

$$\text{Now, }\lim_{n\to\infty}\frac{a_{12}}{a_{22}}=1+\sqrt{2} \Rightarrow \ell^2=\sqrt{9}+\sqrt{8}$$