ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

CLASSROOM CONTACT PROGRAMME

JEE(Advanced) FULL SYLLABUS

SAMPLE PAPER-2

ANSWER KEY PAPER-2

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B,D	A,C	C,D	A,C,D	D	A,C	A,C	B,D	C	A
	Q.	11	12								
	A.	D	B								
SECTION-II	Q.	1	2	3	4	5	6				
	A.	1.55 to 1.75	4.90	3.00	0.50	1.80 to 1.90	1.50				

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,B,C	B,D	A,B,C	C,D	A,B,C,D	A,B,D	A,B,C	C,D	D	C
	Q.	11	12								
	A.	B	B								
SECTION-II	Q.	1	2	3	4	5	6				
	A.	0.08 TO 0.09	0.59	6.00	4.00	5.50	4.00				

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,D	A,B,C,D	B,C,D	B,C	A,B,C	C,D	B,C,D	A,C	C	B
	Q.	11	12								
	A.	A	D								
SECTION-II	Q.	1	2	3	4	5	6				
	A.	792.00	44.00	60.00	7.00	34.00	9.00				

SAMPLE PAPER-2

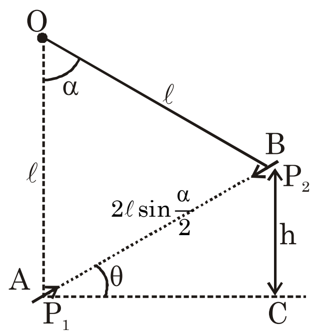
PAPER-2

PART-1 : PHYSICS SOLUTION

SECTION-I

1. Ans. (B,D)

Sol.



$U_i = 0$

$$U_f = \frac{2KP_1P_2}{\left[2\ell\sin\frac{\alpha}{2}\right]^3} + mgh \quad ....(i)$$

Now; form ΔAOB

$\alpha + 90 - \theta + 90 - \theta = 180$

$\alpha = 2\theta$

ΔABC :

$$h = 2\ell\sin\left(\frac{\alpha}{2}\right)\sin\theta$$

$$h = 2\ell\sin^2\frac{\alpha}{2}$$

$$\frac{Mg}{\sin\left(90+\frac{\alpha}{2}\right)} = \frac{Fe}{\sin(180-2\theta)}$$

$$\Rightarrow \quad Fe = 2mg\sin\left(\frac{\alpha}{2}\right)$$

$$\Rightarrow \quad \frac{6KP_1P_2}{\left(2\ell\sin\frac{\alpha}{2}\right)^4} = mg2\sin\left(\frac{\alpha}{2}\right)$$

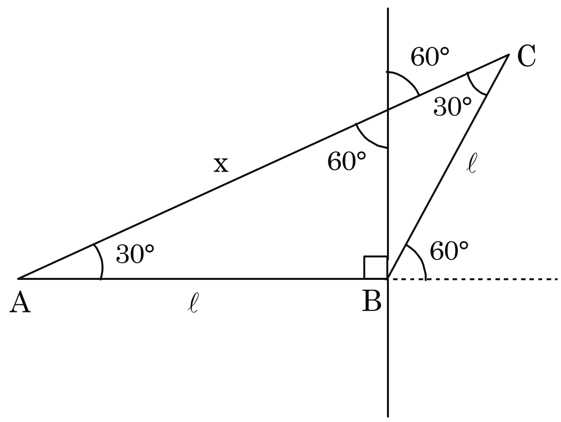
$$\Rightarrow \quad \frac{KP_1P_2}{\left(2\ell\sin\frac{\alpha}{2}\right)^3} = \frac{mg\sin}{3}\left(\frac{\alpha}{2}\right)\times\left(2\ell\sin\frac{\alpha}{2}\right) = \frac{mgh}{3}$$

$$\because \quad U_f = \frac{2}{3}mgh + mgh = \frac{5}{3}mgh$$

2. Ans. (A,C)

Sol. AC = 2ℓ cos 30° = $\ell\sqrt{3}$

$$AD = \frac{\ell}{\cos 30^\circ} = \frac{2\ell}{\sqrt{3}}$$



Distance from COM of AC = $\frac{2\ell}{\sqrt{3}} - \frac{\ell\sqrt{3}}{2}$

Moment of inertia of AB about axis

$$I_{AB} = \frac{M\ell^2}{3}$$

Moment of inertia of BC about axis

$$I_{BC} = \frac{M\ell^2}{3}\sin^2 30^\circ = \frac{M\ell^2}{12}$$

Moment of inertia of AC about axis

$$I_{AC} = \frac{M(\ell\sqrt{3})^2}{12}\times\left(\frac{\sqrt{3}}{2}\right)^2 + M\left(\frac{\ell}{4}\right)^2 = \frac{M\ell^2}{4}$$

Moment of inertia triangular frame about given axis

$$I = I_{AB} + I_{BC} + I_{AC}$$

$$= \frac{M\ell^2}{3} + \frac{M\ell^2}{12} + \frac{1}{4}M\ell^2 = \frac{2}{3}M\ell^2$$

Moment of inertia about an axis passing through A

$$I = \frac{M\ell^2}{3} + \frac{M(\ell\sqrt{3})^2}{3}\sin^2 60° + \left[\frac{M\ell^2}{12}\sin^2 30° + M\left(\frac{5\ell}{4}\right)^2\right]$$

$$= M\ell^2\left[\frac{1}{3} + \frac{3}{4} + \frac{1}{48} + \frac{25}{16}\right]$$

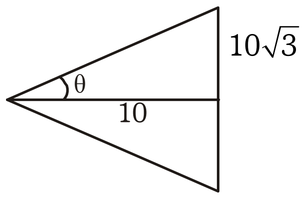
$$= M\ell^2\left[\frac{16+36+1+75}{48}\right] = \frac{8}{3}M\ell^2$$

3. Ans. (C,D)

Sol. (A) $P = \sigma eAT^4 = 141.75$ w

(B) Power reading detation

$$P_0 = P\frac{(1-\cos\theta)}{2} = 35.4375$$



(C) $\lambda mT = b \Rightarrow \lambda m = 1160$ nm

(D) $N = \frac{P_0\lambda}{hc} = 3.1 \times 10^{20}$

4. Ans. (A,C,D)

Sol. $\frac{mv^2}{R} = F$ ...(1)

$$mvR = \frac{nh}{2\pi}$$

$$\frac{n^2h^2}{4\pi^2} = m^2v^2R^2 \quad ...(2)$$

$$v^3 = \frac{Fnh}{m^2 2\pi}$$

$$v = \left(\frac{Fnh}{m^2 2\pi}\right)^{\frac{1}{3}}$$

$$R = \frac{nh}{2\pi m}\left[\frac{m^2 2\pi}{fnh}\right]^{\frac{1}{3}} = \left[\frac{n^2h^2}{4\pi^2 mF}\right]^{\frac{1}{3}}$$

$$T.E. = \frac{1}{2}mv^2 + FR = \frac{3}{2}\left[\frac{n^2h^2F^2}{4\pi^2 m}\right]^{\frac{1}{3}}$$

5. Ans. (D)

Sol. CM will again be at 0 when

$\Delta x_0 = 0$

which is possible when $\mu' = 1$

$\mu - \gamma\Delta\theta = 1$

$$\Delta\theta = \frac{\mu - 1}{\gamma}$$

6. Ans. (A, C)

Sol. In the closed circuit, $\frac{q}{C/\eta} - E = iR$

or, $iR = \frac{\eta q}{C} - E$ ...(1)

We differentiate this equation with respect to time (considering that in our case q decreases). $dq/dt = -i$

$$R\frac{di}{dt} = -\frac{\eta}{C}i \quad \text{or,} \quad \frac{di}{i} = -\frac{\eta}{C}dt$$

Integration of this equation gives

$$\ln\frac{i}{i_0} = -\frac{\eta t}{RC} \quad \text{or, } i = i_0 e^{-\eta t/RC} \quad ...(2)$$

Where i_0 is determined by condition (1). Indeed, we can write $Ri_0 = \eta q_0/C - E$, where $q_0 = CE$ is the charge of the capacitor before its capacitance has changed. Therefore $i_0 = (\eta - 1)E/R$. Hence $i = \frac{(\eta-1)E}{R}e^{-\eta t/RC}$

7. Ans. (B,C,D)

Sol. $\det(M) \neq 0$

$M^{-1} = \text{adj(adj } M)$

$M^{-1} = \det(M).M$

$M^{-1}M = \det(M).M^2$

$I = \det(M).M^2$ .... (i)

$\det(I) = (\det(M))^5$

$1 = \det(M)$ .... (ii)

From (i) $I = M^2$

$(\text{adj } M)^2 = \text{adj } (M^2) = \text{adj } I = I$

8. Ans. (B, D)

Sol. $\delta = 1 + e - A$

$\delta_{min} = 2i - A$

$60° = 120° - A \Rightarrow A = 60°$

$63 = i_1 + 2i_1 - 60°$

$$i_1 = \frac{123}{3} = 41$$

$$\mu = \frac{\sin\left(\frac{60° + 60°}{2}\right)}{\sin\frac{60°}{2}} = \sqrt{3}$$

9. Ans. (C)

10. Ans. (A)

Sol. Case - I :

$$v = \sqrt{\frac{2g\left[\left(\frac{dH}{2}\right) + 3d\left(\frac{H}{2} - h\right)\right]}{3d}}$$

$$\text{Range } R = vT = \sqrt{\frac{2g}{3d}\left(\frac{dH}{2} + 3d\left(\frac{H}{2} - h\right)\right)}\sqrt{\frac{2h}{g}}$$

For $R_{max} \Rightarrow \frac{dR}{dh} = 0$

$$\frac{d}{dh}\left[3\left(\frac{H}{2} - h\right)h + \frac{H}{2}h\right] = 0$$

$$\Rightarrow \quad h = \frac{H}{3}$$

$$v = \sqrt{\frac{2gH}{3}}$$

$$R_{max} = \frac{2H}{3}$$

Force $F = (3d)av^2 = 2adgH$

Case - II :

$$v = \sqrt{\frac{2g}{3d}\left(\frac{dH}{2} + 3d\left(\frac{H}{2} - h\right)\right)}$$

$R = vT$

$$R = \sqrt{\frac{2g}{3d}\left(\frac{dH}{2} + 3d\left(\frac{H}{2} - h\right)\right)}\sqrt{\frac{2\left(h + \frac{H}{2}\right)}{g}}$$

$$\frac{d}{dh}\left[\frac{H}{2}\left(h + \frac{H}{2}\right) + 3\left(\frac{H}{2} - h\right)\left(h + \frac{H}{2}\right)\right] = 0$$

$$\frac{H}{2} + 3\left[\frac{H}{2} - h + \left(h + \frac{H}{2}\right)(-1)\right] = 0$$

$$\frac{H}{2} = 6h$$

$$h = \frac{H}{12}$$

$$v = \sqrt{\frac{7gH}{6}}$$

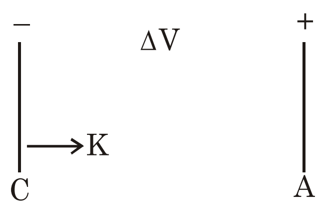
$$R = \sqrt{\frac{7gH}{6}}\sqrt{\frac{7H}{g6}} = \frac{7H}{6}$$

$$F = \frac{7dgHa}{2}$$

11. Ans. (D)

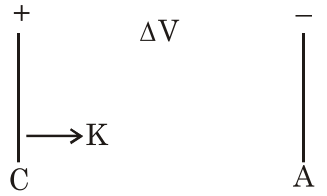
12. Ans. (B)

Sol. $(KE)_{max} = \frac{hc}{\lambda} - \phi \Rightarrow \frac{1240}{200} - 4.7 = 1.5\text{eV}$



$(K_{Anode})_{max} = K_{max} + e\Delta V = 1.5 + 1 = 2.5$ eV

$(K_{Anode})_{min} = K_{min} + e\Delta V = 1$ eV



$(K_{Anode})_{max} = 1.5 - 0.5 = 1eV$

$(K_{Anode})_{min} = 0.5 - 0.5 = 0$

SECTION-II

1. Ans. 1.55 to 1.75

Sol. $S = at^2$

$$v = \frac{ds}{dt} = 2at$$

Tangential acceleration

$a_t = 2a$ [constant]

$v^2 = 0 + 2a\,(2\pi Rn)$

$$\frac{v^2}{R} = 4\pi(2a) = 8\pi an$$

Total acceleration $a = \sqrt{a_t^2 + a_c^2}$

$$= \sqrt{4a^2 + (8\pi na)^2} = a\sqrt{4 + 6.4} = \frac{1}{2}\sqrt{10.4} \approx \frac{3.22}{2} = 1.61$$

2. Ans. 4.90

Sol. Let 'a' the acceleration of block mass m relative to lift & a_0 be acceleration of lift upward

$T - m(g + a_0) = ma$ .....(i)

$M(g + a_0) - 2T = \frac{Ma}{2}$ .....(ii)

Given [M = 5m]

According to condition given in problem,

$$a_0 - \frac{a}{2} > 0$$

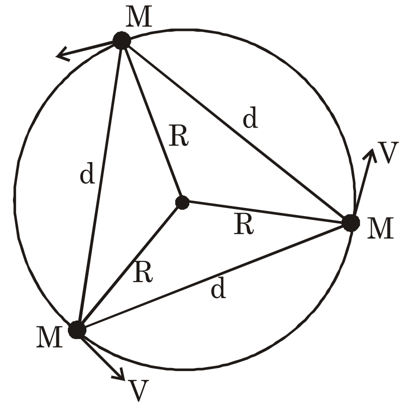
$$a_0 - \frac{M(g + a_0) - 2M(g + a_0)}{(M + 4m)} > 0$$

$$\Rightarrow \quad a_0 > \frac{(M - 2m)}{6M}g$$

$$a_0 > \frac{g}{2}$$

3. Ans. 3.00

Sol. Particle will move in circle.



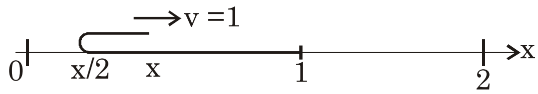
$$2\frac{GM^2}{d^2}\cos 30° = \frac{MV^2}{R}$$

$$v = \sqrt{\frac{GM}{d}} = \sqrt{3}\ \text{m/s} \qquad \left[R\sqrt{3} = d\right]$$

Relative velocity = $2v\cos 30° = 3\text{m/s}$

4. Ans. 0.50

Sol. Let the position of the moving end of the carpet be x as shown in the figure. It follows that the other end of the moving part is at x/2, and hence that the coordinate of its centre of mass is 3x/4. Although dx/dt = 1, the speed of the centre of mass of the moving part is only $\frac{3}{4}$!



The linear momentum of the moving part is p = mv, where v = 1 and m is increasing uniformly with time. The net force acting on the moving part is thus

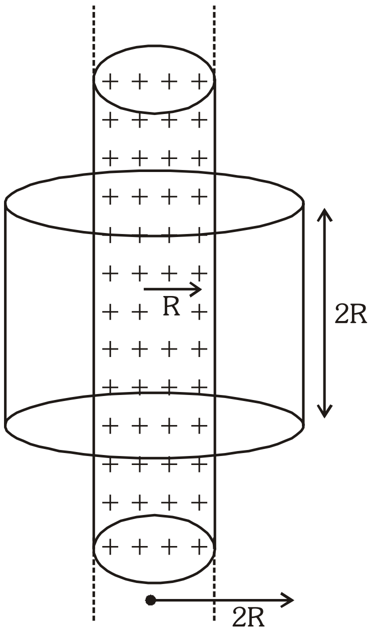
$$F = \frac{dp}{dt} = \frac{dm}{dt}v + \frac{dv}{dt}m = \frac{dm}{dt}1 + 0$$

The part of change of the mass of the moving part can be found with the help of the following argument. The moving end of the carpet starts from the origin and the whole carpet will be moving when it reaches x = 2; this it does after two units of time, i.e., dm/dt = $\frac{1}{2}$. The corresponding minimal force (neglecting all dissipative forces) is

$F = \frac{1}{2}$

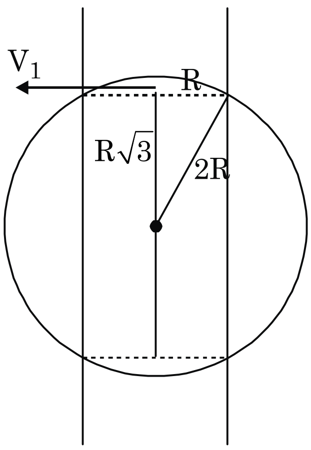
5. Ans. 1.80 to 1.90

Sol.



$$\phi_0 = \frac{\rho\pi R^2.2R}{\varepsilon_0}$$

$$\phi_0 = \frac{2\rho\pi R^3}{\varepsilon_0}$$



$$V_1 = \int_0^{\pi/6} \pi 4R^2 \sin^2\theta\, 2R \sin\theta d\theta$$

$$= \frac{8\pi R^3}{4}\int_0^{\pi/6}(3\sin\theta - \sin 3\theta)d\theta$$

$$= \frac{8\pi R^3}{4}\left(\frac{8}{3} - \frac{3\sqrt{3}}{2}\right)$$

Total volume $V = (V_1 + V_2)2$

$$= \frac{\pi R^3}{2}\left(\frac{8}{3} - \frac{3\sqrt{3}}{2}\right) + \pi R^2 2\sqrt{3}R$$

$$= \pi R^3\left[2\sqrt{3} - \frac{3\sqrt{3}}{4} + \frac{4}{3}\right]$$

$$\left(\frac{15\sqrt{3}+16}{12}\right)\pi R^3$$

$$\frac{\phi}{\phi_0} = \frac{15\sqrt{3}+16}{24} \approx 1.87$$

6. Ans. 1.50

Sol. $W = (\Delta P)_{avg} \times 4\pi R^2 a$

$$= \left[\frac{dP}{2}4\pi R^2 a\right]$$

$$PV = C \Rightarrow dP = -\frac{P}{V}dV = -\frac{P_o}{V}4\pi R^2 a$$

$$= \frac{P_0}{2V}4\pi R^2 a\ 4\pi R^2 a$$

$$= (4\pi P_0 R a^2)\frac{3}{2}$$

$$x = \frac{3}{2} = 1.50$$

PART–2 : CHEMISTRY SOLUTION

SECTION-I

1. Ans. (A,B,C)

Sol. Theroy based.

2. Ans. (B,D)

Sol. (A) $|EA|$ of any $X_g^+ = $ JE of $X_{(g)}$, hence $|EA|$ of $N^+ = 1402$.

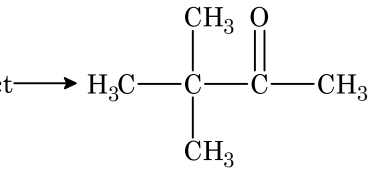
(B) R value > 1402 as IE fluorine is more than that of Nitrogen.

(C) $|EA|$ of C^+ is Q & it is more than P(IE of Be).

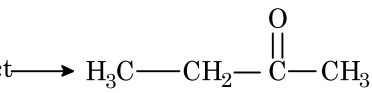
(D) IE of C > IE of B.......So Q > 800.

3. Ans. (A,B,C)

Sol. (A) Product



(B) Product



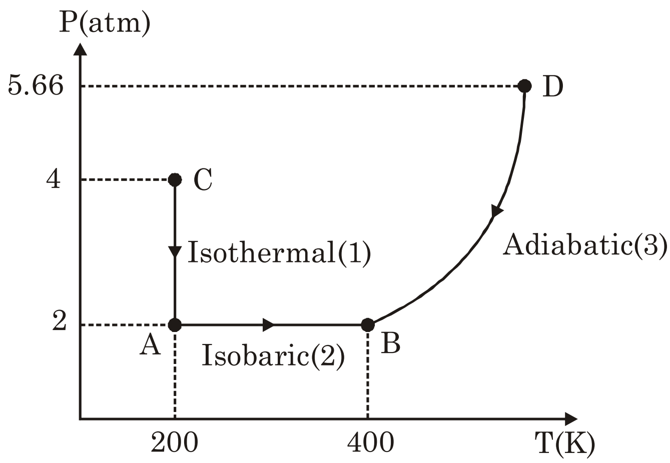
(C) Product $\rightarrow C_6H_5CHO$

4. Ans. (C,D)

Sol. For adiabatic process,

$$P_1V_1^{\gamma} = P_BV_B^{\gamma} \Rightarrow P_1 = 2\times\left(\frac{V_B}{V_1}\right)^{1.5}$$

$$= 2\times 2^{1.5} = 5.66\,\text{atm}$$

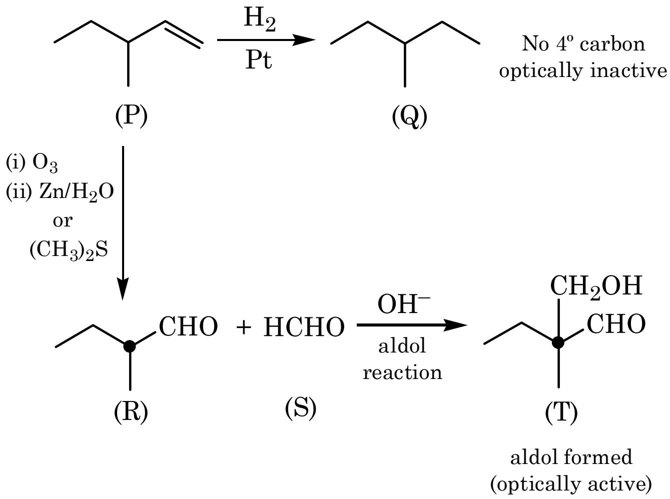


5. Ans. (A,B,C,D)

Sol. All the given options have intermolecular H-bond.

6. Ans. (A,B,D)

Sol.



7. Ans. (A,B,C)

Sol. Average distance between collisions

$$= \text{Mean free path} = \frac{1}{\sqrt{2}\pi\sigma^2 N^*} = \frac{KT}{\sqrt{2}\pi\sigma^2 P}$$

As temperature increases mean free path will increase.

$$\text{Collision frequency} = \frac{\sqrt{2}\pi\sigma^2 u_{avg.}\times(N^*)^2}{2},$$

$$u_{avg.} \propto \sqrt{T}, N^* \propto \frac{1}{T}$$

$\therefore$ Collision frequency will decrease.

Average relative speed of approach $= \sqrt{2}u_{avg.}$ $\therefore$ increases with increase in temperature.

Average angle of approach remains 90°.

8. Ans. (C,D)

Sol. $[PdCl_4]^{2-}$ $dsp^2 \rightarrow$ square planar

$[Cr(NH_3)_3Cl_3] \rightarrow$ 2 geometrical isomers only (facial & meridional) no optical isomers.

$[CoF_6]^{3-} \rightarrow$ high spin as F^- is weak field ligand.

$[Fe(H_2O)_5(NO)]SO_4 \rightarrow$ Brown ring complex $\rightarrow sp^3d^2$.

9. Ans. (D)

Sol. $NaBH_4$ can't reduce RCOCl to RNH_2.

10. Ans. (C)

Sol. Theory based.

11. Ans. (B)

12. Ans. (B)

SECTION-II

1. Ans. (0.08 to 0.09)

Sol.

$$AgBr(s) + 2Na_2S_2O_3 \longrightarrow Na_3[Ag(S_2O_3)_2] + NaBr$$

t = 0	0.2 M	0	0
t	0.2 – x	x/2	x/2

$$K_{sp} \times K_f = \frac{\frac{x}{2} \times \frac{x}{2}}{(0.2-x)^2}$$

On solving x = 0.1774

$$\therefore \ n_{Br^-} = \frac{0.177}{2} = 0.088 \text{ mole}$$

2. Ans.(0.59)

Sol. $E = 0 - \frac{0.0591}{1} \log \frac{[Ag^+]_{anode}}{[Ag^+]_{cathode}}$

$$= \frac{-0.0591}{1} \log \frac{10^{-14}}{10^{-4}}$$

$$= \frac{+0.0591}{1} \times 10 = 0.591V$$

3. Ans. (6.00)

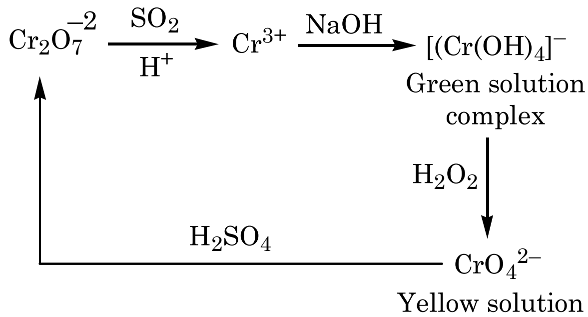
Sol. (i), (ii), (iii), (iv), (v) and (vii).

The compounds which are more acidic than water are soluble is aqueous NaOH.

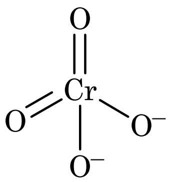
4. Ans. (4.00)

Sol. Reaction (iv) is correct expression.

5. Ans. (5.50)

Sol. 

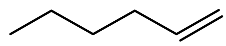
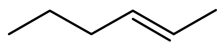
y = 4

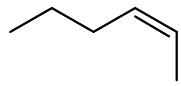


$\Rightarrow$ B.O. of Cr–o is 1.5 $\Rightarrow$ x = 1.5

So, x + y = 5.50

6. Ans. (4.00)

Sol. , ,

, $CH_2=CH_2$

PART-3 : MATHEMATICS SOLUTION

SECTION - I

1. Ans. (A,D)

Sol. $\frac{z_0 - 3i}{z_0 - 2i + 4} = e^{i\pi/2}$

z_0 = 3i + i)(2 – 2i + 4)

$$z_0 = \frac{7i+2}{1-i} = \frac{1}{2}(-5+9i)$$

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

Sol. (A) $P(B_2 \cap B) = P\left(\frac{B}{B_2}\right) \cdot P(B_2) = \frac{4}{7} \times \frac{1}{3} = \frac{4}{21}$

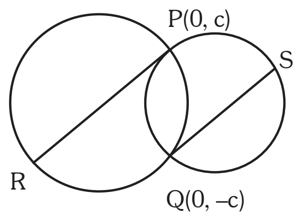
(B) $P(R) = \frac{1}{6} \times \frac{1}{2} + \frac{1}{3} \times \frac{3}{7} + \frac{1}{2} \times \frac{4}{7} = \frac{43}{84}$

(C) $P\left(\frac{R}{B_1}\right) = \frac{1}{2}$

(D) $P\left(\frac{B_2}{R}\right) = \frac{P(B_2 \cap R)}{P(R)} = \frac{1/7}{43/84} = \frac{12}{43}$.

3. Ans. (B,C,D)

Sol. Any line through P is y = mx + c ... (i)



Through Q, y = mx – c ... (ii)

$R\left(\frac{-2(a+mc)}{1+m^2},\frac{-2m(a+mc)}{1+m^2}+c\right)$

$S\left(\frac{-2(b-mc)}{1+m^2},\frac{-2m(b-mc)}{1+m^2}-c\right)$

If (x, y) is mid point of RS, then

$2x=\frac{-2(a+b)}{1+m^2}$, $2y=\frac{-2m(a+b)}{1+m^2}$

$x^2 + y^2 + (a + b)x = 0$

$\lambda = 1$

4. Ans. (B,C)

Sol. $A^{-1} = A \quad \Rightarrow A^2 = I$

$$A^2=\begin{bmatrix} a^2+bc & 2ab \\ 2ac & bc+a^2 \end{bmatrix}=I$$

$\Rightarrow \quad a^2 + bc = 1$

$2ab = 0$ and $2ac = 0$

$b = c = 0, a = \pm 1$

or $\quad a = 0, bc = 1$

$|A| = (a - x)^2 - bc = 0$

if $bc = 0$, then $x = a = \pm 1$

if $bc = 1$, then $(x - a) = \pm 1 \Rightarrow x = \pm 1$

5. Ans. (A,B,C)

Sol. $a = -3$

$b = 1$

6. Ans. (C,D)

Sol. $\lim\limits_{x\to\frac{\pi}{2}}\left(\frac{12\tan^2 x\left(\left(6+3\sin x-2\cos^2 x\right)-\left(3+6\sin x-\cos^2 x\right)\right)}{\sqrt{6+3\sin x-2\cos^2}+\sqrt{3+6\sin x-\cos^2 x}}\right)$

$$=\lim_{x\to\frac{\pi}{2}}\frac{12\tan^2 x\left(1-\cos^2 x-3\sin x+2\right)}{\sqrt{6+3\sin x-2\cos^2 x}+\sqrt{3+6\sin x-\cos^2 x}}$$

$$=\lim_{x\to\frac{\pi}{2}}\frac{12\sin^2 x(\sin^2 x-3\sin x+2)}{(1-\sin^2 x)(\sqrt{6+3\sin x-2\cos^2 x})+\sqrt{3+6\sin x-\cos^2 x})}$$

$$=\lim_{x\to\frac{\pi}{2}}\frac{12\sin^2 x(\sin x-1)(\sin x-2)}{(1+\sin x)(1-\sin x)(\sqrt{9}+\sqrt{9})}$$

$$=12\times\frac{1}{2(\sqrt{9}+\sqrt{9})}=12\times\frac{1}{12}=1$$

7. Ans. (A,C)

Sol. $f'(x)=\frac{f(x)}{\sqrt{b^2-x^2}}\Rightarrow \ln f(x)=\sin^{-1}\left(\frac{x}{b}\right)+c$

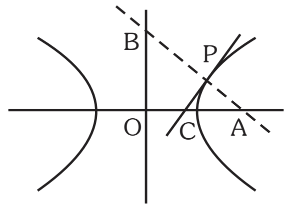
$f(x)=e^{\sin^{-1}(x/b)}$

$$f'(x)=\frac{e^{\sin^{-1}(x/b)}}{\sqrt{1-(x/b)^2}}\cdot\frac{1}{b}$$

8. Ans. (A,C)

Sol. Equation of normal at P(2sec θ, tan θ) is 2x cos θ + y cot θ = 5

$m_N = -2\sin\theta = -1 \qquad \theta=\frac{\pi}{6}$



$P\left(2\sec\frac{\pi}{6},\tan\frac{\pi}{6}\right)=\left(\frac{4}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$

$$\Rightarrow \left(\frac{5}{2\cos\frac{\pi}{6}}\right)=\left(\frac{5}{2\times\frac{\sqrt{3}}{2}}\right)\Rightarrow\left(\frac{5}{\sqrt{3}},0\right)$$

Tangent at P is $y-\frac{1}{\sqrt{3}}=1\left(x-\frac{4}{\sqrt{3}}\right)$

$\sqrt{3}y-1=\sqrt{3}x-4$

$$B\Rightarrow\left(0,\frac{5}{\cot\frac{\pi}{6}}\right)=\left(0,\frac{5}{\sqrt{3}}\right)$$

$C\Rightarrow\left(\sqrt{3},0\right)$

$PA=\sqrt{\frac{2}{3}}$

$PB=\sqrt{\frac{32}{3}}$

$$PC=\left(\sqrt{\left(\frac{4}{\sqrt{3}}-\sqrt{3}\right)^2+\frac{1}{3}}\right)$$

$$= \left(\sqrt{\frac{1}{3}+\frac{1}{3}}\right)$$

$$= \sqrt{\frac{2}{3}}$$

$$\frac{\text{Area of } \Delta PAC}{\text{Area of } \Delta PBC} = \frac{\frac{1}{2}\times PC\times PA}{\frac{1}{2}\times PC\times PB} = \frac{1}{4}$$

Normal touches the ellipse

$c^2 = a^2m^2 + b^2$

$$\left(\frac{5}{\sqrt{3}}\right)^2 = a^2(-1)^2 + b^2$$

$$a^2 + b^2 = \frac{25}{3}$$

SECTION - II

9. Ans. (C)

10. Ans. (B)

Sol. (Q.9-10)

Equation of tangent is $y = 4x - 1$

$a = 1, b = 6, c = 0$

Correct combinations are (I, R), (II, U), (III, U), (IV, T).

11. Ans. (A)

12. Ans. (D)

Sol. (Q.11-12)

G is $\left(\frac{4}{3},\frac{1}{3},\frac{8}{3}\right)$, $|\overline{AG}| = \frac{\sqrt{51}}{3}$

Area of triangle ABC = $4\sqrt{6}$

Area of triangle ABD = $2\sqrt{82}$.

Length of perpendicular from D is $\frac{14}{\sqrt{6}}$.

Correct combinations are (I, S), (II, R), (III, P), (IV, T).

SECTION - II

1. Ans. 792.00

Sol. Apart from these 5 days, there are 15 more days so,

$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 15$

Such that $x_2, x_3, x_4, x_5 \geq 2$

$\Rightarrow \quad x_1 + x_2{}^1 + x_3{}^1 + x_4{}^1 + x_5{}^1 + x_6 = 7$

So, ${}^{12}C_5 = 792$ ways

2. Ans. 44.00

Sol. $D(5) = 44$

3. Ans. 60.00

Sol. P (Prime number) = $\frac{15}{36}$

P (Perfect square) = $\frac{7}{36}$

$$P = \frac{15}{36}\cdot\frac{1}{1-\frac{14}{36}} = \frac{15}{22}$$

$\therefore \quad 88p = 60$

4. Ans. 7.00

Sol. $d_{n+1} = 2d_n + n(1 + 2^n)$

$$\frac{d_{n+1}}{2^{n+1}} = \frac{d_n}{2^n} + \frac{n}{2^{n+1}} + \frac{n}{2}$$

$$\frac{d_{n+1}}{2^{n+1}} - \frac{d_n}{2^n} = \frac{n}{2^{n+1}} + \frac{n}{2}$$

Put n = 1, 2,.................., n and add the following

$$\left(\frac{d_2}{2^2}-\frac{d_1}{2}\right)+\left(\frac{d_3}{2^3}-\frac{d_2}{2^2}\right)+\ldots\ldots\ldots+\left(\frac{d_{n+1}}{2^{n+1}}-\frac{d_n}{2^n}\right)$$

$$=\left(\frac{1}{2^2}+\frac{2}{2^3}+\frac{3}{2^4}+\ldots\ldots\ldots+\frac{n}{2^{n+1}}\right)+\frac{1}{2}(1+2+\ldots\ldots+n)$$

$$\Rightarrow \quad \frac{d_{n+1}}{2^{n+1}}-\frac{1}{2} = 1-\left(\frac{1}{2}\right)^n - \frac{n}{2^{n+1}} + \frac{n(n+1)}{4}$$

Let $\quad x = \frac{1}{2^2}+\frac{2}{2^3}+\ldots\ldots\ldots+\frac{n}{2^{n+1}}$

$$\frac{x}{2} = \frac{1}{2^3}+\ldots\ldots\ldots\ldots\ldots+\frac{n}{2^{n+2}}$$

$$\frac{x}{2} = \frac{1}{2^2}+\frac{1}{2^3}+\ldots\ldots\ldots\ldots\ldots\ldots+\frac{1}{2^{n+1}}-\frac{n}{2^{n+2}}$$

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

$\Rightarrow \quad \frac{d_n}{2^n} - \frac{1}{2} = 1 - \left(\frac{1}{2}\right)^{n-1} - \frac{(n-1)}{2^n} + \frac{n(n-1)}{4}$

$\Rightarrow \quad \frac{d_n}{2^n} = \frac{3}{2} - \frac{1}{2^{n-1}} - \frac{(n-1)}{2^n} + \frac{n(n-1)}{4}$

$\Rightarrow \quad d_n = 3.2^{n-1} - 2 - (n-1) + 2^{n-2}(n-1)n$

$= 2^{n-2}(6 + n^2 - n) - (n+1)$

$\therefore \quad 2^{n-2}(6 + n^2 - n) = (n^2 - 2n + 13)\, 2^{n-2}$

$2^{n-2}(n - 7) = 0 \Rightarrow n = 7$

5. Ans. 34.00

Sol. $I = \int_{-3}^{3} x^{16}\left\{x^{17}\right\} dx$

$I = \int_{-3}^{3} x^{16}\left\{-x^{17}\right\} dx$

$2I = \int_{-3}^{3} x^{16} dx$

$I = \frac{3^{17}}{17}$

6. Ans. 9.00

Sol. $y^2 = \alpha x^3 - \beta$

$\frac{dy}{dx} = \frac{3\alpha x^2}{2y}$

$\Rightarrow \quad -\frac{dx}{dy}$ at $(2, 3) = \frac{-1}{4}$.

$\alpha = 2, \beta = 7$