FIITJEE MONTHLY ASSESSMENT TEST
BATCHES – 1719
CM TEST–3

ANSWER KEY

PHYSICS			CHEMISTRY			MATHEMATICS		
Q. No.	Ans.	Concept Code	Q. No.	Ans.	Concept Code	Q. No.	Ans.	Concept Code
1.	A	P111802	1.	C	C110402	1.	B	M110105
2.	A	P111802	2.	B	C110402	2.	D	M110109
3.	D	P111822	3.	D	C110402	3.	C	M112403
4.	B	P111816, P111825	4.	A	C110504	4.	B	M112403
5.	C	P111823	5.	A	C110503	5.	C	M111008
6.	ABC	P111825	6.	AC	C110403	6.	A	M110117
7.	ACD	P111826	7.	ABC	C110402	7.	BD	M110117
8.	ABCD	P111822, P111825	8.	AB	C110403	8.	ABC	M112403
9.	BC	P111816, P111825	9.	ABCD	C110505	9.	AB	M110112
10.	ACD	P111810, P111812	10.	AD	C110501	10.	ABCD	M110112
11.	C	P111816, P111831	11.	ABD	C110501	11.	BC	M112403
12.	BCD	P111825	12.	ACD	C110402	12.	AB	M111007
13.	ACD	P111825, P111826	13.	BCD	C110402	13.	ABD	M111019
PART–C			PART–C			PART–C		
1.	6	P111821	1.	3	C110504	1.	6	M110102
2.	7	P111828	2.	2	C110504	2.	2	M112403
3.	7	P111816, P111822	3.	5	C110506	3.	2	M111007
4.	7	P111825, P111826	4.	5	C110402	4.	3	M110109
5.	2	P111802	5.	4	C110402	5.	7	M111002

Hint and Solution

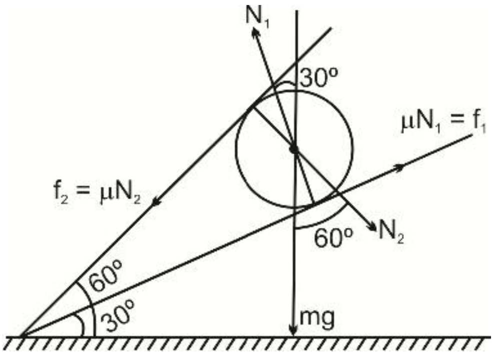
PHYSICS

Part-A

1. For horizontal equilibrium of sphere

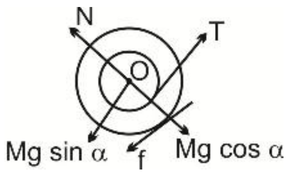
$N_1 \sin 30^o + \mu N_2 \cos 60^o = \mu N_1 \cos 30^o + N_2 \sin 60^o$

$\frac{N_1}{N_2} = \frac{1}{\sqrt{3}}\left(4+\sqrt{3}\right)$



$\frac{f_1}{f_2} = \frac{\mu N_1}{\mu N_2} = \frac{4}{\sqrt{3}} + 1$

2. $\tau_0 = 0 \quad \Rightarrow \quad f2R = TR$



$T = 2f$ …. (1)

and $T = f + Mg \sin \alpha$ …. (2)

$T = mg$ …. (3)

$T = \frac{T}{2} + Mg\sin\alpha$

$m = 2 M \sin\alpha$

3. $I_1\omega_1 = I_2\omega_2$

$\frac{m_0 r^2}{2}\omega_0 = \left[\frac{m_0 r^2}{2} + \mu t r^2\right]\frac{\omega_0}{2}$

$m_0 = \frac{m_0}{2} + \mu t$

$\mu t = \frac{m_0}{2} \Rightarrow t = \frac{m_0}{2\mu}$

4. come at heigest pt and point B

$\frac{1}{2}m\left(\sqrt{gR}\right)^2 + mg2R = \frac{1}{2}mv_B^2 + MgR$

$\frac{1}{2}mv_B^2 = \frac{3}{2}mgR$

Between A and B

$mgh = mgR + \frac{1}{2}\ mv_B^2 + \frac{1}{2}\left(\frac{2}{5}mr^2\right)\left(\frac{v_B}{r}\right)^2$

$mgh = mgR + \frac{3}{2}\ mgR\left(\frac{7}{5}\right)$

$h = R + \frac{3}{2}\times\frac{7R}{5} = 3.1R$

5. $\frac{dL}{dt} = \tau = (r+R)F = (r+R)2t$

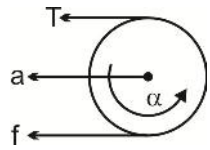
$\int dL = \int (r+R)2t\ dt$

$L = (r + R)t^2$

6. $T + f = m_A a$ ……. (1)

$TR - fR = \frac{m_A R^2}{2}\alpha$

$T - f = \frac{m_A R}{2}\alpha$ …… (2)

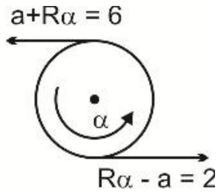


$a + R\alpha = 6$

$R\alpha - a = 2$

$2R\alpha = 8$

$\alpha = \frac{4}{R} = \frac{4}{4} = 1\,rad/s^2$



$a + 4 = 6 \quad \Rightarrow \quad a = 2m/s^2$

$T + f = m_A(2)$

$T - f = \frac{m_A(4)}{2}(1)$

$2T = 4m_A$

$T = 2m_A \Rightarrow f = 0$

$m_B g - T = m_B\, 6$

$T = m_B(10 - 6)$

$T = 2m_A = 4m_B$

$\frac{m_A}{m_B} = 2$

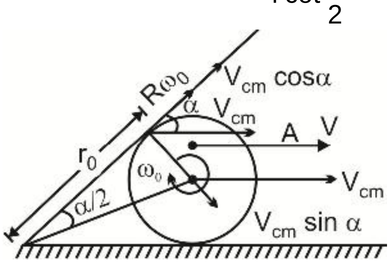
$l - l_0 = \left(\frac{1}{2}\alpha t^2\right)R$

$= \frac{1}{2}(1)(2)^2 \times 4$

$l = l_0 + 8$

7. $\omega_0 = \frac{V_{cm}}{R} = \frac{V}{R + r}$

$\omega = \frac{V_{cm}\sin\alpha}{r_0} = \left(\frac{VR}{R + r}\right)\frac{\sin\alpha}{r\cot\frac{\alpha}{2}}$



$= \frac{VR}{(R+r)r}\sin\alpha\tan\frac{\alpha}{2}$

$S_A = vt$

$= v\frac{2\pi}{\omega_0}$

$= 2\pi(r + R)$

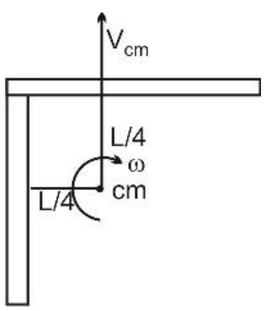
8. $mv_0 = 2mVcm$

COAM about CM

$mv_0\frac{L}{4} = 2\left[\frac{mL^2}{12} + m\left(\frac{L^2}{16} + \frac{L^2}{16}\right)\right]\omega$

$L\omega = \frac{V_0 \times 48}{8 \times 10} = \frac{3V_0}{5}$

$V_A = \omega\sqrt{\frac{L^2}{16} + \frac{9L^2}{16}} + Vcm$

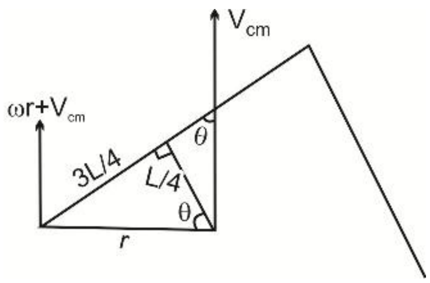


$$= \frac{3v_0}{5}\sqrt{\frac{10}{16}} + \frac{v_0}{2}$$

$$= \frac{v_0}{2}\left[\frac{3}{\sqrt{10}} + 1\right]$$

$$t = \frac{\theta}{\omega} = \frac{\tan^{-1}(3)}{\omega}$$

$$= \frac{5L}{3V_0}\tan^{-1}(3)$$



9. COME about point A

$$mg\frac{a}{3}\sin\theta = \frac{1}{2}\left[\frac{m(2a)^2}{12} + m\left(\frac{a}{3}\right)^2\right]\omega^2$$

$$\omega^2 = \frac{3g\sin\theta}{2a}$$

$$f - mg\sin\theta = m\omega^2\frac{a}{3} = \frac{m3g\sin\theta}{2a}\frac{a}{3}$$

$$f = mg\sin\theta + \frac{mg\sin\theta}{2} = \frac{3mg\sin\theta}{2}$$

$$\tau_A = \tau_A\alpha$$

$$mg\frac{a}{3}\cos\theta = \left[\frac{m(2a)^2}{12} + m\left(\frac{a}{3}\right)^2\right]\alpha$$

$$\alpha = \frac{3g\cos\theta}{4a}$$

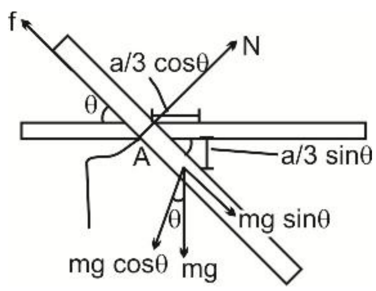
$$Mg\cos\theta - N = m\frac{a}{3}\alpha = \frac{mg\cos\theta}{4}$$

$$N = mg\cos\theta - \frac{mg\cos\theta}{4}$$

$$\Rightarrow \quad N = \frac{3mg\cos\theta}{4}$$

$$\mu = \frac{f}{N} = \frac{(3mg\sin\theta)/2}{(3mg\cos\theta)/4}$$

$$\Rightarrow \quad \mu = 2\tan\theta$$



10. (A) $\frac{9MR^2}{2} - \left[\frac{M}{2}\left(\frac{R}{3}\right)^2 + M\left(\frac{2R}{3}\right)^2\right]$

$$= \frac{MR^2}{18}[72] = 4MR^2$$

(B) $\frac{9MR^2}{2} + 9M\left(\frac{2R}{3}\right)^2 - \frac{M}{2}\left(\frac{R}{3}\right)^2$

$$= \frac{152MR^2}{18}$$

(C) $Ycm = \dfrac{9M(0) - M\left(\frac{2R}{3}\right)}{9M - M}$

$$= -\frac{2R}{3\times 8} = -\frac{R}{12}$$

$$\frac{2R}{3} + \frac{R}{12} = \frac{8R + R}{12} = \frac{3R}{4}$$

$$\frac{9MR^2}{2}+9M\left(\frac{R}{12}\right)^2-\left[\frac{M}{2}\left(\frac{R}{3}\right)^2+M\left(\frac{3R}{4}\right)^2\right]$$

$$=\frac{71MR^2}{18}$$

(D) $$3\left[\frac{9MR^2}{2}-\frac{M}{2}\left(\frac{R}{3}\right)^2\right]$$

$$=\frac{40}{3}MR^2$$

11. $P = m(u - 0)$

$P(0.4r) = \frac{2}{5}mr^2(\omega-0)$

$\omega=\frac{P}{mr}=\frac{u}{r}$

At heighest point

mv = mv + 4 mv

$v = \frac{u}{5}$

$KE_{wedge} = \frac{1}{2}4mv^2$

$=\frac{1}{2}4m\left(\frac{u}{5}\right)^2$

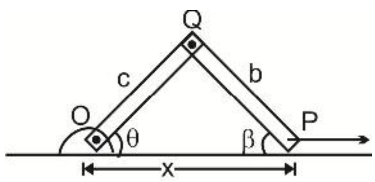
12. $c\sin\theta = b\sin\beta$

$c\cos\theta\,\omega_1 = b\cos\beta\,\omega_2$ …. (1)

$c\cos\theta + b\cos\beta = x$

$c\sin\theta\,\omega_1 + b\sin\beta\,\omega_2 = v$ ….. (2)

By eq. (1)



$\omega_1=\frac{b\cos\beta\omega_2}{c\cos\theta}$

$\frac{c\sin\theta b\cos\beta\,\omega_2}{c\cos\theta}+b\sin\beta\omega_2=v$

$\omega_2=\frac{v\cos\theta}{b\sin(\theta+\beta)}$

$\omega_1=\frac{b\cos\beta}{c\cos\theta}\times\frac{v\cos\theta}{b\sin(\theta+\beta)}$

$\omega_1\frac{v\cos\beta}{c\sin(\theta+\beta)}$

$=\frac{4v}{15}$

$\omega_2=\frac{v\cos53^o}{4}$ $=\frac{3v}{20}$

$V_\theta = c\omega_1$ $= 3\left(\frac{4v}{15}\right)$

$=\frac{4v}{5}$

13. $v_c=R\omega=r\omega_c$

$v_c = 3(4) = 1\omega_c$

$\omega_c = 12$ rad/s

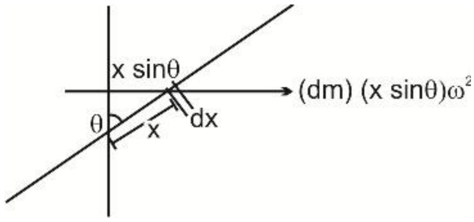
$\alpha = \omega \times \omega_c = (4)(12)$

$= 48$ rad/s^2

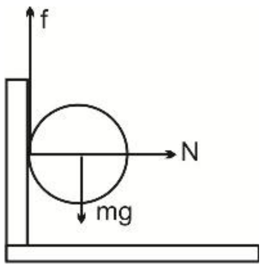
$KE = \frac{1}{2} m v_{cm}^2 + \frac{1}{2} I\omega^2_{net}$
$= 624$ J

Part – C

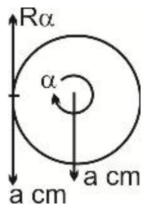
1. $dm = (\lambda\, dx)$
$d\tau = x \cos\theta\, dm\, a_c$
$= x \cos(\lambda\, dx)(x \sin\theta)\omega^2$
$\tau = \int_{-l/2}^{l/2} x^2 \sin\theta \cos\theta \omega^2 \frac{m}{l} dx$
$= \sin 45^o \cos 45^o\ \omega^2 \frac{m}{l} dx$
$= \frac{\omega^2 m}{2L \times 3}\left[\frac{2L^3}{8}\right]$
$= \frac{9 \times 4}{6} = 6$



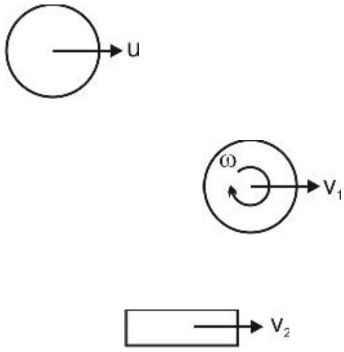
2. $N = ma = \frac{mg}{2}$ …… (1)
$fR = \frac{2}{5} mR^2\alpha$



$f = \frac{2}{5} mR\alpha$ …… (2)
$mg - f = m\, a_{cm}$ …… (3)
for pure rolling
$a_{cm} = R\alpha$
$\frac{mg - f}{m} = R\frac{5f}{2mR}$
$f = \frac{2mg}{7} \le \mu N$
$\frac{2mg}{7} \le \mu \frac{mg}{2}$
$\mu \ge \frac{4}{7}$



3. $mgh = \frac{1}{2} mu^2$
$u^2 = 2gh$
$V_1 - R\omega = v_2$ …… (1)
COLM
$mu = mv_1 + mv_2$
$v_1 + v_2 = u$ …… (2)
COAM about cm of shall
$mu(0) = mv_2R - \frac{2}{3} mR^2\omega$
$v_2 = \frac{2}{3} R\omega$
by equation (1)



$v_1 = R\omega + v_2 = \frac{5R\omega}{3}$

by equation (2)

$\frac{5R\omega}{3} + \frac{2}{3}R\omega = u$

$\omega = \frac{3u}{7R}$

$KE_f = \frac{1}{2}\ mv_1^2 + \frac{1}{2}\left(\frac{2}{3}mR^2\right)\omega^2\ + \frac{1}{2}mv_2^2\ = \frac{5}{7}mgh$

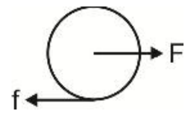
$W_f + Wmg = \Delta KE$

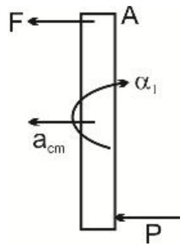
$= -\frac{2}{7}mgh$

4. $r\alpha = a$ ….. (1)

$F - f = ma$ ….. (2)

$Fr = \frac{3}{2}mr^2\alpha$

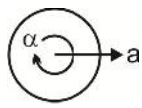




$F = \frac{3}{2}mr\alpha$

$F = \frac{3}{2}ma$ ….. (3)

$F + P = ma_{cm}$



$\frac{PL}{2} - F\frac{L}{2} = \frac{mL^2}{12}\alpha_1$

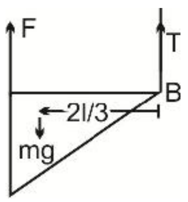
$\alpha_1 = \frac{6}{mL}(P - F)$

$a_A = \frac{L}{2}\alpha_1 - a_{am} = a \quad \Rightarrow \quad \frac{L}{2}\frac{6}{mL}(P - F) - \frac{(F+P)}{m} = \frac{2F}{3m}$

$6P = 14\ F = 14\ \left(\frac{3}{2}ma\right) \quad \Rightarrow \quad a = \frac{6 \times 2P}{14 \times 3m} = \frac{2}{7}\frac{P}{m}$

5. $\tau_B = 0$

$\Rightarrow \quad mg\frac{2l}{3} - Fl = 0$



$F = \frac{2mg}{3}$

CHEMISTRY
Part – A

4.

$NH_4^+ + H_2O \rightleftharpoons NH_4OH + H_3O^+$; $K_a = 10^{-9.26}$

$H_3O^+ + OH^- \rightleftharpoons H_2O + H_2O$; $K_w = 10^{-14}$

So $NH_4OH \rightleftharpoons NH_4^+ + OH^-$; $K_b = 10^{-4.74}$

$NH_4OH \quad + \quad HCl \rightleftharpoons NH_4Cl + H_2O$

$300 - x \qquad x\,mL$

$(300 - x) - x \quad x - x \qquad x$

$$pOH = 14 - pH = pK_b + \log\frac{x}{300-2x}$$

$$= 14 - 9.26 = -\log(10^{-4.74}) + \log\frac{x}{300-2x}$$

$$\Rightarrow \frac{x}{300-2x} = 1$$

$$\Rightarrow 300 = 3x \;\Rightarrow x = 100mL$$

$So\ v_{NH_4OH} : v_{HCl} :: 2:1$

5. $pH = \frac{1}{2}[14 - pK_b - \log C]$

$2.669 = \frac{1}{2}[14 - pK_b - \log 0.2]$

$pK_b = 14 - 0.3010 - 2 \times 2.669$

$-\log K_b = 8.3010 = 8 + 0.3010$

$= \log(10^8 \times 2)$

$K_b = \frac{1}{2 \times 10^8} = 5 \times 10^{-9}$

9.

$H_2C_2O_4 \rightleftharpoons HC_2O_4^- \quad + \quad H^+$

initialy 0.12

$0.12(1-\alpha_1) \qquad 0.12\alpha_1 \quad 0.12\alpha_1 + 0.12\alpha_1\alpha_2 \quad --(1)$

$\simeq 0.12\alpha_1$

$HC_2O_4^- \rightleftharpoons C_2O_4^- + H^+$

$0.12\alpha_1$

$0.12\alpha_1(1-\alpha_1) \quad 0.12\alpha_1\alpha_2 \quad 0.12\alpha_1 + 0.12\alpha_1\alpha_2 \quad --(2)$

$\simeq 0.12\alpha_1$

For (1) $\alpha_1 = \dfrac{-10^{-2} + \sqrt{(10^{-2})^2 + 4\times 0.12\times 0.01}}{2\times 0.12} = 0.25$

$\%\alpha_1 = 25\%$

so $0.12\alpha_1 = 0.12\times 0.25 = 0.03$

so $[H^+] = 0.03$

now $\dfrac{(0.12\alpha_1)\alpha_2 \times 0.12\alpha_1}{0.12\alpha_1(1-\alpha_2)} = \dfrac{0.03\times\alpha_2}{(1-\alpha_2)} = 3\times 10^{-4}$

$= \dfrac{\alpha_2}{(1-\alpha\ )} \quad = 10^{-2} = \alpha_2 = 10^{-2} \qquad 1-\alpha = 1$

$\%\alpha = 1\%$

$[C_2O_4] = 0.03\times 0.01 = 3\times 10^{-4}M$

$[HC_2O_4] = 0.03\times .99 = 0.0297M$

$[H_2C_2O_4] = 0.12\times(1-0.25) = 0.09M$

10. $pOH = -pK_b + \log\dfrac{[NH_4Cl]}{[NH_4OH]}$

$= -\log(2\times 10^{-5}) + \log\dfrac{0.50}{0.25}$

$= -\log 2 + 5 + \log 2 = 5$

So $[OH^-] = 10^{-5}M$

Now $[Mg^{2+}][OH^-]^2 = 9\times 10^{-12}$

$[Mg^{2+}] = \dfrac{9\times 10^{-12}}{(10^{-5})^2} = 9\times 10^{-2}M$

11. Ag_2SO_4 and $PbCrO_4$do not have any common ion so there is no question of precipitation of these two. Now first we have to calculate the conc. of Ag^+, SO_4^{2-}, Pb^{2+} &CrO_4^{2-} after mixing.

Before mixing:

300mL

$Ag_2SO_4 \rightleftharpoons 2Ag^+ + SO_4^{2-}$

$2s \qquad s$

$4s^3 = 4\times 10^{-6}$

$s = 10^{-2}$

so $[Ag^+] = 2\times 10^{-2}$

$[SO_4^{2-}] = 10^{-2}$

100mL

$PbCrO_4 \rightleftharpoons Pb^{2+} + CrO_4^{2-}$

$s \qquad s$

$s^2 = 16\times 10^{-14}$

$s = 4\times 10^{-7}$

so $[Pb^{2+}] = 4\times 10^{-7}$

$[CrO_4^{2-}] = 4\times 10^{-7}$

After mixing:

$[Ag^+] = 2\times 10^{-2}\times\left(\dfrac{3}{4}\right)$

$[SO_4^{2-}] = 10^{-2}\times\left(\dfrac{3}{4}\right)$

$[Pb^{2+}] = 4\times 10^{-7}\times\left(\dfrac{1}{4}\right)$

$[CrO_4^{2-}] = 4\times 10^{-7}\times\left(\dfrac{1}{4}\right)$

Now Ionic product for $PbSO_4$=

$$\left(\frac{4\times10^{-7}}{4}\right)\times\left(\frac{10^{-2}\times3}{4}\right)=7.5\times10^{-10}$$

$$\leq K_{sp}[PbSO_4]$$

So $PbSO_4$ will not precipitate out.

Now Ionic product for Ag_2CrO_4=

$$\left(2\times10^{-2}\times\frac{3}{4}\right)^2\times\left(\frac{4\times10^{-7}}{4}\right)=2.25\times10^{-11}s$$

$$=22.5\times10^{-12}$$

$$\geq K_{sp}[Ag_2CrO_4]$$

So some Ag_2CrO_4 will precipitate out.

Part C

1.

m.m of NaOH=30×0.2=6 m.m

m.m of CH_3COOH=50×0.2=10 m.m

Now:

$$CH_3COOH \quad + \quad NaOH \longrightarrow CH_3COONa + H_2O$$

$$10 \qquad\qquad 6 \qquad\qquad 0$$

$$10-6=4 \qquad 6-6=0 \qquad 6$$

$$pH=-\log(2\times10^{-5})+\log\frac{6}{4}$$

$$=4.87$$

Suppose ‘v’mL of NaOH is added then

m.m of CH_3COONa= (6+v×0.2)

m.m of CH_3COOH= (4–v×0.2)

$$5=-\log(2\times10^{-5})+\log\left(\frac{6+0.2v}{4-0.2v}\right)$$

$$0.3010=\log\left(\frac{6+0.2v}{4-0.2v}\right)$$

$$\text{So }\left(\frac{6+0.2v}{4-0.2v}\right)=2\Rightarrow v=3.33mL$$

2.

$$CdS \rightleftharpoons Cd^{2+}+S^{2-}$$

$$0.1 \qquad s$$

For precipitation of CdS

$$[Cd^{2+}][S^{2-}]=K_{sp(CdS)}$$

$$0.1\times[S^{2-}]=8\times10^{-27}$$

$$[S^{2-}]=8\times10^{-26}$$

For precipitation of ZnS

$$[Zn^{2+}][S^{2-}]=K_{sp(ZnS)}$$

$$0.1\times[S^{2-}]=10^{-21}$$

$$[S^{2-}]=10^{-20}$$

CdS will start precipitate as the conc of $[S^{2-}]=8\times10^{-26}$ and ZnS will start precipitate as the conc of $[S^{2-}]=10^{-20}$ so we can raise the concentration of $[S^{2-}]$ upto 10^{-20}

Now

$$\begin{array}{cccc} H_2S & \rightleftharpoons & 2H^+ & + \quad S^{2-} \\ 0.1(1-\alpha) & & 2\times 0.1\alpha & 0.1\alpha = 10^{-20} \\ \approx 0.1 & & = \dfrac{x}{20}M & \end{array}$$

$$\frac{\left(\frac{x}{20}\right)^2 \times 10^{-20}}{0.1} = 10^{-21} \quad \Rightarrow \left(\frac{x}{20}\right)^2 = 10^{-2}$$

$$\frac{x}{20} = 10^{-1}$$

$$x = 2$$

3.

$$\begin{array}{ccc} HIn & \rightleftharpoons & H^+ + In^- \\ 1-0.6 & & 0.6 \\ = 0.4 & & \end{array}$$

$$pH = pK_{In} + \log\frac{[In^-]}{[HIn]}$$

$$2.176 = pK_{In} + \log\frac{0.6}{0.4}$$

$$pK_{In} = 2 \quad \Rightarrow K_{In} = 10^{-2}$$

$$\begin{array}{ccc} HIn & \rightleftharpoons & H^+ + In^- \\ 1-0.6 & & 0.6 \\ = 0.4 & & \end{array}$$

now

$$\begin{array}{cccc} HIn & \rightleftharpoons & H^+ & + \quad In^- \\ C(1-\alpha) & & 3.33\times 10^{-3} & C\alpha \end{array}$$

$$\frac{3.33\times 10^{-3} \times C\alpha}{C(1-\alpha)} = 10^{-2}$$

$$\frac{\alpha}{1-\alpha} = 3 \quad \Rightarrow \alpha = 3 - 3\alpha$$

$$\Rightarrow \alpha = 0.75$$

So $[HIn] = 1 - 0.75 = 0.25$

$\%[HIn] = 25\%$

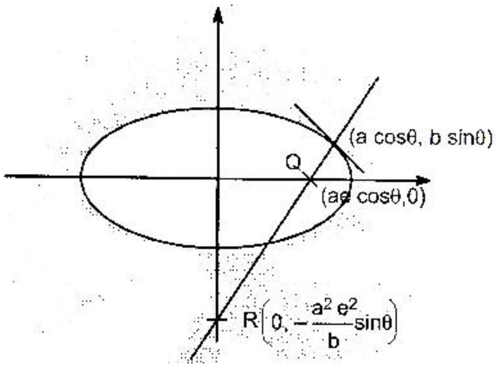
Mathematics

Part – A

5. C

$2h = ae^2 \cos\theta$

$2k = \dfrac{-a^2e^2 \sin\theta}{b}$



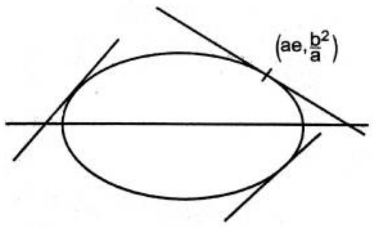
$\Rightarrow \quad \dfrac{4h^2}{(ae^2)^2} + \dfrac{4k^2}{\left(a^2 \dfrac{e^2}{b}\right)^2} = 1$

$\dfrac{x^2}{\left(\dfrac{ae^2}{2}\right)^2} + \dfrac{y^2}{\left(\dfrac{a^2e^2}{2b}\right)^2} = 1$

$\Rightarrow \quad b^2 = a^2(1 - e')^2$

$\Rightarrow \quad e = e'$

12. AB



Tangents at extremities of L.R. are

$\dfrac{xe}{a} + \dfrac{y}{a} = 1$

or $\quad \dfrac{xe}{a} - \dfrac{y}{a} = 1$

xe + (y – a) = 0

or xe – (y + a) = 0

Fixe3d points are (0, a) or (0, – a)

13. ABD

$\angle SQP = \angle S'QP = \frac{\pi}{2}$

$\Rightarrow$ S',Q,S are collinear

T is radical centre of C, C_1 and C_2.

Equation of circle C_2

$C_2 : (x - a\cos\theta)(x + ae) + (y - b\sin\theta)y = 0$

$C : x^2 + y^2 - a^2 = 0$

Equation of tangent to C_2 and C is

$a(\cos\theta - e)x + b\sin\theta y + a^2(e\cos\theta - 1) = 0$

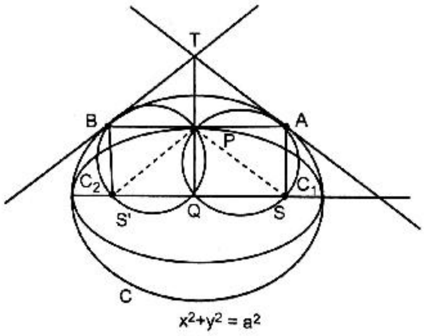
Put $x = a\cos\theta$

$a^2(\cos^2\theta - e\cos\theta) + b\sin\theta\, y + a^2(e\cos\theta - 1) = 0$

$\Rightarrow$ $b\sin\theta y = a^2\sin^2\theta$

$\Rightarrow$ $y = \frac{a^2}{b}\sin\theta$

$y = \left(a\cos\theta, \frac{a^2}{b}\sin\theta\right)$



Equation of chord of contact of T w.r.t.

$x^2 + y^2 = a^2$

$x\cos\theta + y\frac{a}{b}\sin\theta = a$

$\Rightarrow$ $\frac{x\cos\theta}{a} + \frac{y\sin\theta}{b} = 1$ which is same as equation of tangent to ellipse at P.

$\because$ SA and S'B both are $\perp$ to AB

$\Rightarrow$ S'B || SA

Part – C

1. 6
2. 2
3. 2

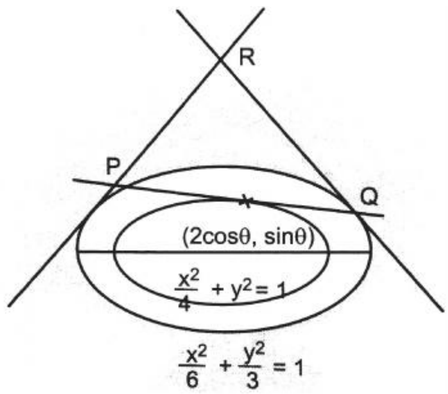
Equation of tangent to $\frac{x^2}{4} + y^2 = 1$ at point $(2\cos\theta, \sin\theta)$ is

$\frac{x\cos\theta}{2} + y\sin\theta = 1$ .... (1)

Equation of chord of contact of R(h, k)

w.r.t. $\frac{x^2}{6} + \frac{y^2}{3} = 1$ is

$\frac{hx}{6} + \frac{ky}{3} = 1$



$\because$ Eq. (1) and (2) are identical

$\Rightarrow$ $\frac{h/3}{\cos\theta} = \frac{k/3}{\sin\theta} = 1$

$\Rightarrow$ $h^2 + k^2 = 9 = 6 + 3$

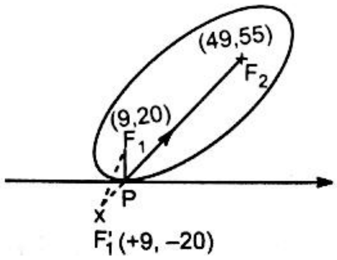
$\Rightarrow$ (h, k) lies on director circle of ellipse

$\frac{x^2}{6} + \frac{y^2}{3} = 1$

$\Rightarrow$ k = 2

4. 3

5. 7



$2a = PF_1 + PF_2 = PF_1' + PF_2$

$= F_1'F_2 = \sqrt{40^2 + (75)^2} = 85$

$\Rightarrow$ L = 85

$\therefore$ $\left[\frac{L}{11}\right] = 7$