TECHNO INDIA GROUP PUBLIC SCHOOL

JEE Mock Test Series-II (Part-2)

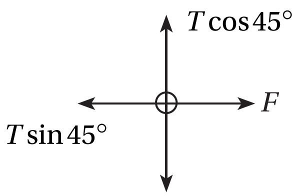
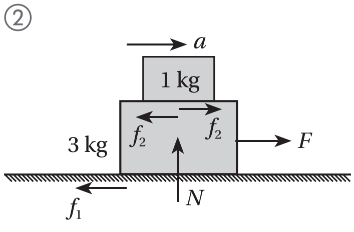
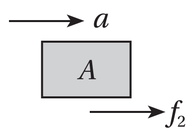
SOLUTION

Time: 3 hours F.M.: 300

PHYSICS

SECTION A

Section A consists of 20 questions of 4 mark each.

1.	① $m=\frac{4}{3}\pi R^3 \times \rho \quad \Rightarrow \ln m = \ln(4\pi/3)+3\ln R+\ln \rho$ $0=0+3\frac{dR}{Rdt}+\frac{1}{\rho}\frac{d\rho}{dt}$ $\frac{dR}{dt}=v \quad \therefore v \propto R$	
2.	① $\lvert\vec{v}\rvert = a\omega\sqrt{(-\sin\omega t)^2+(\cos\omega t)^2+1}=\sqrt{2}a\omega$	
3.	③  $\therefore \; F = mg = (10)(10) = 100$ N	
4.	②   $F - f_1 = (m_A + m_B)a$ … (1) $\quad f_2 = m_A \cdot a = (0.2)(1)(10)$ $a = \mu g = (0.2)(10) = 2$ m/s^2 … (2) $f_1 = \mu N = (0.2)(1+3)(10) = 8$ N … (3) $\therefore \; F - 8 = 8 \quad F = 16$ N	

5. ④

$$\theta = \omega t = \omega \frac{\pi}{2\omega} = \left(\frac{\pi}{2}\right)$$

at t (s): 

$$V_A = \omega R_1\left(-\hat{i}\right)$$

$$V_B = \omega R_2\left(-\hat{i}\right)$$

V_B

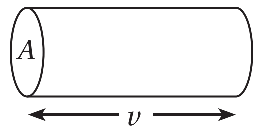
$$V_A - V_B = -\omega R_1\hat{i} + \omega R_2\hat{i} = \omega\left(R_2 - R_1\right)\hat{i}$$

6. ③

$P = Fv$

$$F = v\frac{dm}{dt} = v\frac{d(\rho \times V)}{dt} = \rho v\frac{d}{dt}(\text{Volume})$$

$$= \rho v \; Av = \rho A v^2$$



$$\therefore P = \left(\rho A v^2\right)v = \rho A v^3 \quad \therefore P \propto v^3$$

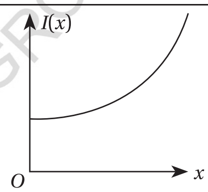
7. ④

$$20 = v_1 \times \sqrt{\frac{2h}{g}} = v_1 \times \sqrt{\frac{2\times 5}{10}} = v_1 \qquad 100 = v_2 \times \sqrt{\frac{2h}{g}} = v_2$$

$0.01 \times v = 0.01 \times 100 + 0.2 \times 20 = 5 \qquad v = 500$ m/s

8. ②

$$I(x) = \frac{2}{5}MR^2 + Mx^2$$



9. ①

$$v_i = -\frac{GM}{R^3}\left(1.5R^2 - 0.5r^2\right)$$

$$v_p = -\frac{GM}{R^3}\left[1.5R^2 - 0.5\times\left(\frac{R}{2}\right)^2\right] = -\frac{GM}{R}\left(1.5 - 0.5\times\frac{1}{4}\right) = -\frac{GM}{R}\left(\frac{6-0.5}{4}\right) = -GM\times\frac{5.5}{4R}$$

$$v'_p = v'_c = -\frac{3GM}{8R}$$

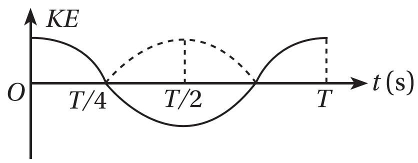
$$v_R = v_p - v'_p = -\frac{GM}{R}\times\frac{5.5}{4} + \frac{3GM}{8R} = \frac{-11GM + 3GM}{8R} = -\frac{8GM}{8R} = -\frac{GM}{R}$$

10. ③

$$y = A\sin\omega t$$

$$\frac{dy}{dt} = A\omega\cos\omega t = v$$

$$k = \frac{1}{2}mv^2 = \frac{1}{2}mA^2\omega^2 \cdot \cos^2 \omega t$$



12. ①

$$v_T \propto r^2 \qquad \therefore \frac{v_1}{v_2} = \frac{R^2}{(R/3)^2} = 9$$

11. ①

$$\frac{4}{3}\pi R^3 \rho g + kx = \frac{4}{3}\pi R^3 \cdot 2\rho \cdot g \qquad \ldots (1)$$

$$\frac{4}{3}\pi R^3 \cdot 3\rho g - kx = \frac{4}{3}\cdot\pi R^3 \cdot 2\rho g \qquad \ldots (2)$$

$$kx = \frac{4}{3}\pi R^3 \cdot \rho g$$

$$x = \left(\frac{4\pi R^3}{3k}\right)\rho g$$

13. ①

$$L = 10\log_{10}\frac{I}{I_0} = 120 \quad \Rightarrow 10^{12} = \frac{I}{10^{-12}}$$

$$\therefore I = 1\, w/m^2 = \frac{\rho}{4\pi r^2} \qquad \Rightarrow r = \sqrt{\frac{\rho}{4\pi}} = \sqrt{\frac{2}{4\pi}} = \frac{1}{\sqrt{2\pi}} \simeq 0.4 \text{ m} \simeq 40 \text{ cm}$$

14. ①

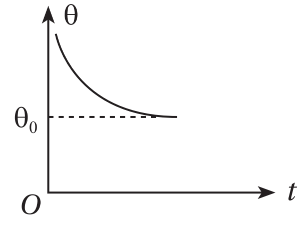
$$W = nR(T_2 - T_1) = 0.5\times 8.31\times 70 = 8.31\times 35 = 291 \text{ J}$$

15. ③

$$-ms\frac{d\theta}{dt} = k(\theta-\theta_0) \qquad \Rightarrow \int\frac{d\theta}{\theta-\theta_0} = -\left(\frac{k}{ms}\right)\int dt$$

$$\ln(\theta-\theta_0) = -\frac{kt}{ms} + c; \qquad t = 0;\ \theta = \theta_i;\ c = \ln(\theta_i - \theta_0)$$

$$\frac{\theta-\theta_0}{\theta_i-\theta_0} = e^{-\lambda t} \qquad \Rightarrow \theta = \theta_0 + e^{\lambda t}(\theta_i - \theta_0) \qquad \theta = \theta_0 + (\theta_i-\theta_0)e^{-\lambda t}$$



16. ①

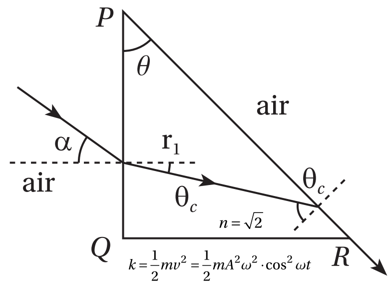
$$\sin\alpha = \sqrt{2}\cdot\sin r_1$$

$$\Rightarrow \frac{1}{\sqrt{2}} = \sqrt{2}\sin r_1 \quad \Rightarrow r_1 = 30^\circ$$

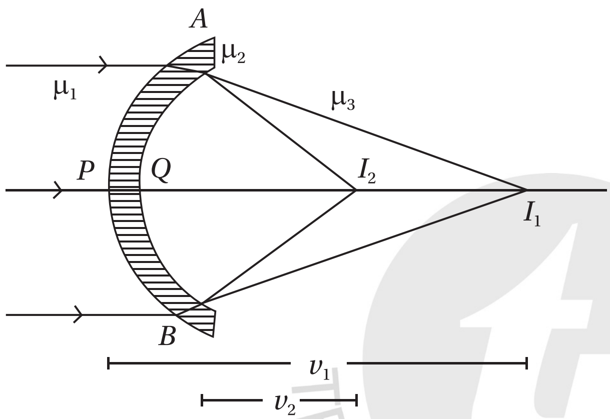
$$\sin\theta_c = \frac{1}{n} = \frac{1}{\sqrt{2}} \quad \Rightarrow \theta_c = 45^\circ$$

$$90^\circ + r_1 + 90^\circ - \theta_c + \theta = 180^\circ$$

$$\therefore \theta = \theta_c - r_1 = 15^\circ$$



17. ②



<u>*APB*</u>

$$\frac{\mu_2}{v_1} - \frac{\mu_1}{\alpha} = \frac{\mu_2 - \mu_1}{+R}$$

<u>*AQB*</u>

$$\frac{\mu_3}{v_2} - \frac{\mu_2}{v_1} = \frac{\mu_3 - \mu_2}{+R}$$

<u>Add</u>

$$\frac{\mu_3}{v_2} = \frac{\mu_3 - \mu_1}{R}$$

$$v_2 = f \quad \Rightarrow \left(\frac{\mu_3}{\mu_3 - \mu_1}\right)R$$

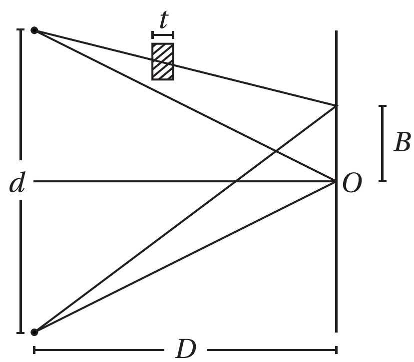
18. ①

$$\Delta x\ (extra) = (\mu t - t) = n\lambda$$

$$(\mu - 1)t = n\lambda$$

Put $n = 1$ $\quad (\mu - 1)t = \lambda$

$\mu = 1.5$ $\quad t_{min} = 2\lambda$



19. ①

$$\frac{3R}{4} + \frac{R}{8} = \frac{7R}{8} \qquad \frac{7R}{8} \,||\, \frac{R}{8} = \frac{\frac{7R}{8}\times\frac{R}{8}}{R} = \frac{7}{64}R$$

20. ①

$$Q_2 = \frac{2cE}{c+3} = \frac{2E}{1+(3/c)}$$ $c\uparrow$ then Q_2 $(\uparrow)$ non-linearly

$$\frac{d(Q_2)}{dc} = \frac{6E}{(c+3)^2}$$ +ve slope decreases with $c\uparrow$

SECTION B

Section B consists of 5 questions of 4 marks each.

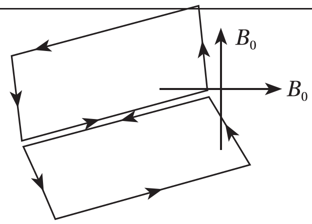
21. $(18)(5)\cos 0° - (1)(10)(4) = k_f - 0 \quad \Rightarrow \quad 90 - 40 = k_f = 5 \times 10 \qquad$ Ans: $n = 5$

22.

$$\vec{B} = B_0\hat{i} + B_0\hat{k}$$

$$\hat{B} = \frac{\hat{i}+\hat{k}}{\sqrt{2}}$$

$$n = \sqrt{2} \qquad n^2 = 2$$

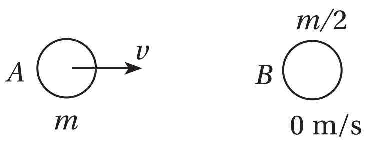


23.

$$i = i_0\left(1 - e^{-\frac{Rt}{L}}\right) \qquad i^2R = \frac{d}{dt}\left(\frac{1}{2}Li^2\right) \Rightarrow iR = L\frac{di}{dt} \qquad i_0R\left(1-e^{-Rt/L}\right) = L \cdot i_0 \cdot \frac{R}{L}e^{-Rt/L}$$

$$1 - e^{-Rt/L} = e^{-Rt/L} \quad \Rightarrow 2e^{-Rt/L} = 1 \quad \therefore \frac{t}{\ln 2} = (2) \text{ Ans.}$$

24.



$$mv = mv_A + \frac{m}{2}v_B$$

$$2v = 2v_A + v_B \qquad \ldots (1) \qquad\qquad e = \frac{v_B - v_A}{v} = 1 \qquad \therefore v_B - v_A = v \qquad \ldots (2)$$

$$v_B = 4v/3$$

$$v_A = v/3 \qquad \frac{\lambda_A}{\lambda_B} = \frac{P_B}{P_A} = \frac{\frac{m}{2}\cdot 4v/3}{\frac{mv}{3}} = 2 \qquad \left[\because \lambda = \frac{h}{P}\right]$$

25. **Step I :** Constituent proton and neutron combined mass > mass of Nucleus. This difference is called mass defect which is responsible for mass defect.

mass $\text{defect}_1 = 10(m_p + m_n) - M_1 \qquad$ mass $\text{defect}_2 = 20(m_p + m_n) - M_2$

heavier the nucleus, more is the mass defect

$\therefore\ 20(\text{m}_\text{p} + m_n)\ m_2 > 10(m_p + m_n) - M_1$

$\Rightarrow\ 10(m_p + m_n) > M_2 - M_1 \qquad \Rightarrow\ M_2 < M_1 + 10(m_p + m_n)$

but $M_1 < 10(m_p + m_n) \qquad M_2 < 20(m_p + m_n)$

$$\therefore M_2 < 2M_1 \quad \Rightarrow \frac{M_2}{M_1} < 2$$

CHEMISTRY

SECTION A

Section A consists of 20 questions of 4 mark each.

26. ③

$\mu = \sqrt{n(n+2)} = \sqrt{35}$

$\Rightarrow\ n^2 + 2n - 35 = 0$

$\Rightarrow\ n^2 + 7n - 5n - 35 = 0$

$\Rightarrow\ (n + 7) - 5(n + 7) = 0$

$\Rightarrow\ (n + 7)(n - 5) = 0$

$\therefore\ n = 5$

But, M^{3+} ion; so, total electrons = 5 – 3 = 2.

27. ③

3P $\Rightarrow$ n = 3, $l = 1$

$\therefore$ Radial nodes = n – l – 1 = 3 – 1 – 1 = 1

28. ①

Normally, N = n – f × Molarity (M)

= 2 × 0.2

= 0.4

100 ml 0.2 (M) H_2SO_4

≡ 100 × 0.2 ml 1(M) H_2SO_4

≡ 20 ml 1(M) H_2SO_4

≡ 20 × 2(N) H_2SO_4

≡ 40 ml 1(N) H_2SO_4

100 ml 0.2 (M) NaOH

≡ 100 ml × 0.2 ml 1(M) NaOH

≡ 20 ml 1(N) NaOH

≡ 20 ml 1(N) H_2SO_4

$\therefore$ Excess = 40 – 20 = 20 ml 1(N) H_2SO_4

$\therefore$ Let the strength of final volume = x

$\therefore\ 20 \times 1 = x \times 200$

$$\Rightarrow\ x = \frac{\cancel{20}}{\cancel{200}_{10}} = 0.1$$

29. ④

$$m = \frac{X_A \times 1000}{X_B \times M_B} = \frac{0.2 \times 1000}{0.8 \times 18}$$

$$= \frac{250}{18} = 13.8$$

30. ①

CO : Total e's = 6 + 8 = 14 ; B . O = 3

NO^- : ,, ,, = 7 + 8 + 1 = 16; B . O = 2.5

NO^+ : ,, ,, = 15 – 1 = 14, B . O = 3

CN^- : ,, ,, = 14 ; B . O = 3

N_2 : ,, ,, = 14 ; B . O = 3

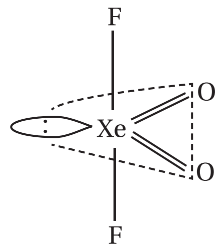
31. ④

XeO_2F_2 ; $H = \frac{1}{2}(V + M - C + A)$

$= \frac{1}{2}(8 + 2) = 5 = sp^3d$

l . p = 1

So, according to V.S.E.P.R theory, sea-saw shape:



According to Bent rule, more e.n. atom will occupy at axial position.

32. ④

	CH_3COOH	+	NaOH	$\longrightarrow$	CH_3COONa	+	H_2O
Initial m mole:	5		10		0		0
m. mole after reaction:	0		10–5=5		5		5

Hydrolysis of CH_3COONa is supressed by strong Base NaOH

$$(OH^-) = \frac{5}{150} = \frac{1}{30}$$

$$pOH = -\log_{10}[OH^-] = -\log_{10}\left(\frac{1}{30}\right) = -\log 30 \quad = 1.4771$$

pH + pOH = 14 ; pH = 14 – 1.4771 = 12.52

33. ②

$$AgCl(S) \rightleftharpoons Ag^+(aq) + Cl^{\ominus}(aq)$$

$$\underset{}{AgNO_3} \rightleftharpoons \underset{0.1(M)}{Ag^+} + \underset{0.1\,M}{NO_3^-}$$

$K_{sp} = [Ag^+]_{Total}\ [Cl^-] = (S + 0.1)\ S = S^2 + 0.1S$

$\approx 0.1S \qquad [\because S \ll 0.1]$

$$\therefore\ S = \frac{K_{sp}}{0.1} = \frac{2.8\times10^{-10}}{0.1} = 2.8\times10^{-9}\,mol/k$$

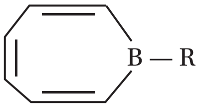
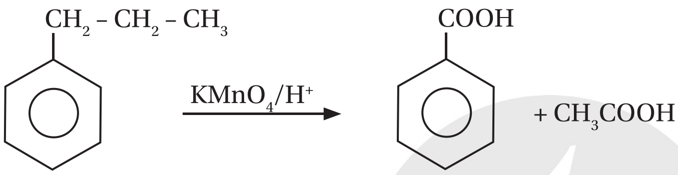
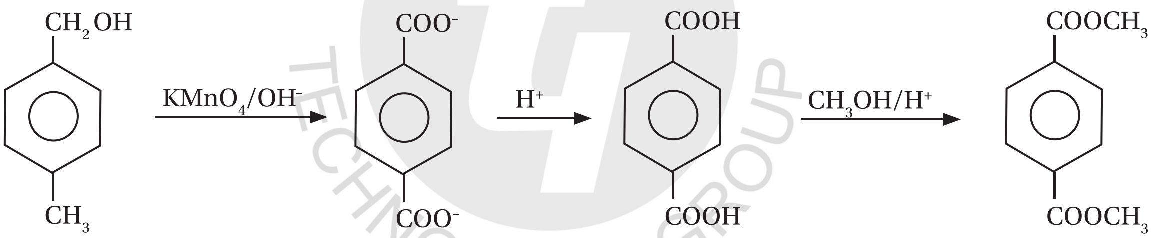
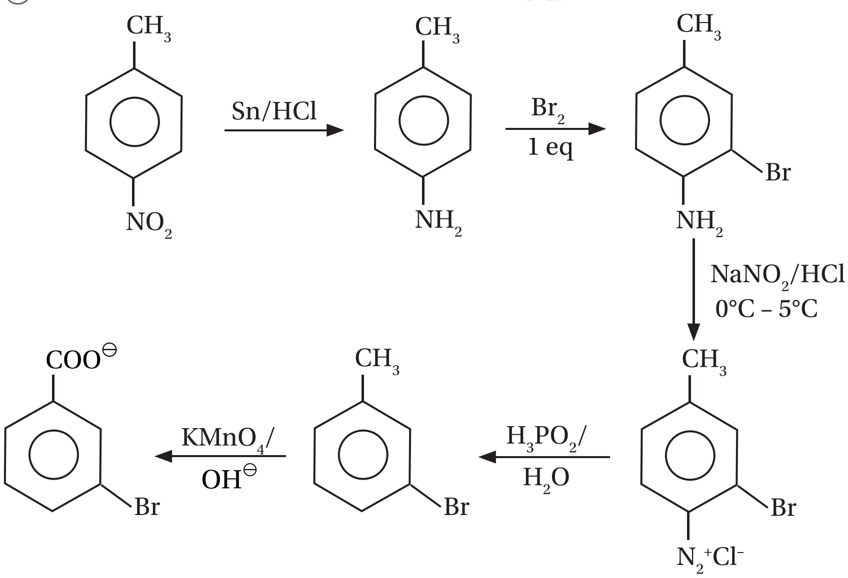
34. ③

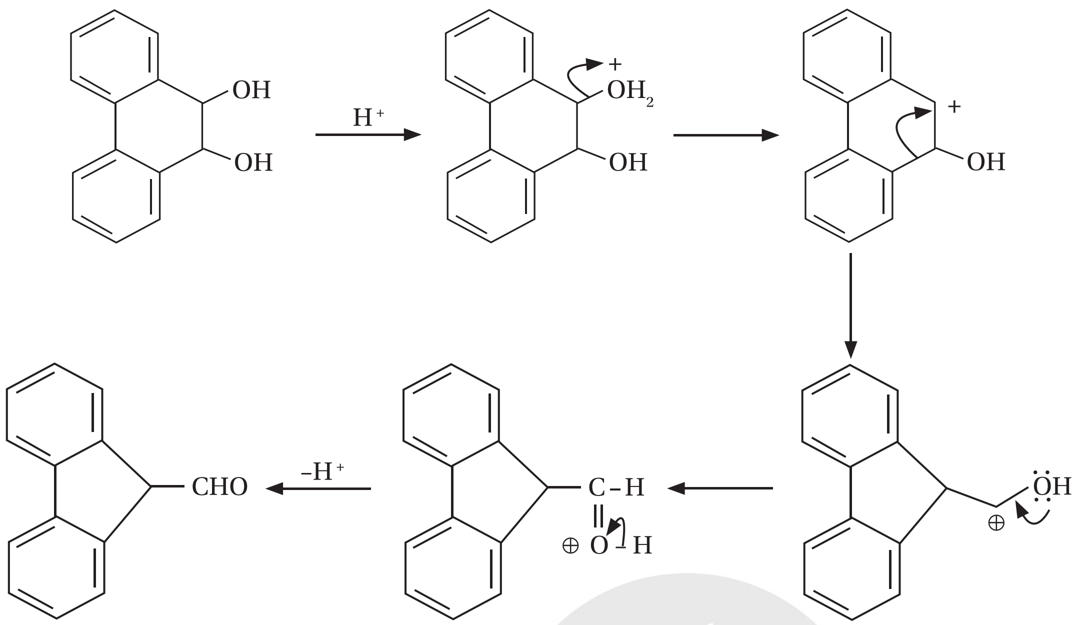
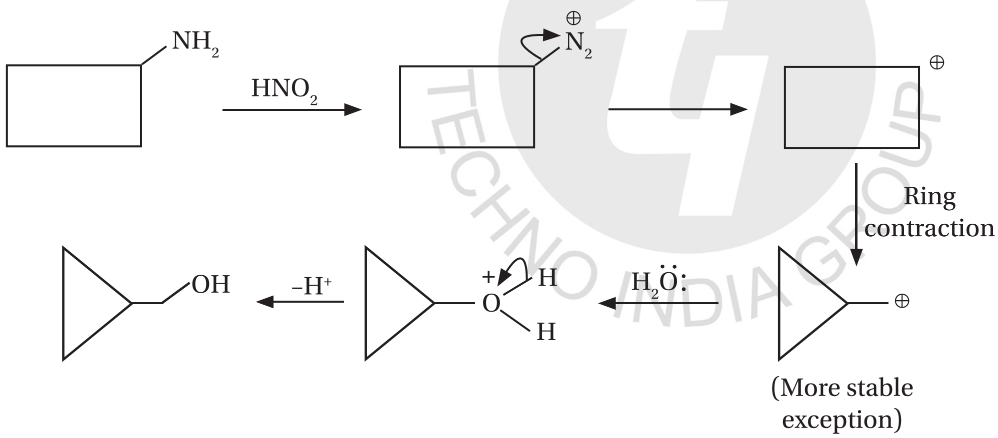
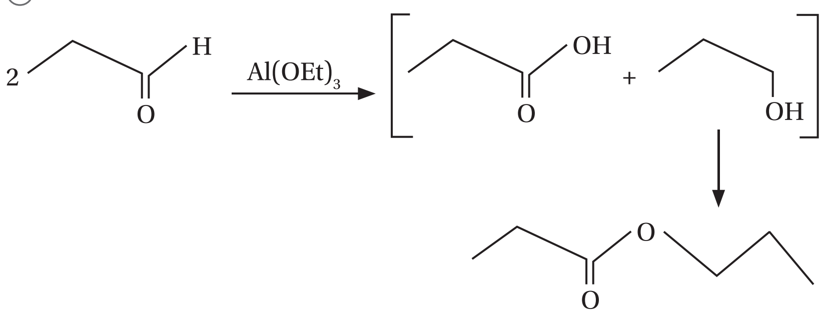
1 M of 10 ml H_2SO_4 ≡ 1 M of 20 ml of NH_3

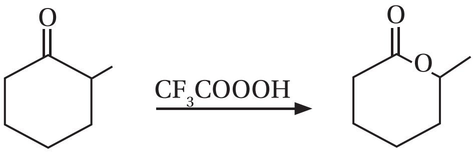
1000 ml of 1(M) ammonia contains = 14 g N

$\therefore$ 20 ml of 1(M) ammonia contains $= \frac{14\times20}{1000}$ gN

$\therefore\ \%\ of\ N = \frac{14\times20}{1000\times0.5}\times100 \qquad = 56.0\%$

35.	③  Obeys $(4n + 2)\ \pi$ electrons i.e. Huckel's rule n = 1, 6π e's
36.	④ Due to +R effect of $-\ddot{O}CH_3$, electron density over 'N' atom in $-NH_2$ group further increased. Hence, it is most basic.
37.	① 
38.	④ 
39.	② 

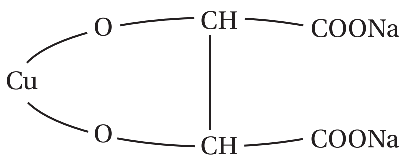
40.	① 
41.	① 
42.	② Fehling's solution: PhCHO does not give Fehling's solution test while aliphatic aldehyde give this test. All aldehydes give Tollen's reagent test.
43.	① 

44.	③ Glucose does not give D.N.P test. (No free -CHO gr.)
45.	④ Baeyer's villiger oxidation: 

SECTION B

Section B consists of 5 questions of 4 marks each.

46.	(4) Equivalent weight of copper $=\frac{63.5}{2}$ $\therefore$ 2 mol require 4F or 1 mole $Cu^{++} \equiv 63.5$ g Cu^{++} $\frac{63.5}{2}$ g Cu ≡ 1 g equivalent weight of Cu^{++} $\therefore$ 63.5 g of $Cu^{++} \equiv$ 2 g equivalent weight of Cu^{++} $\therefore$ 1 mole $Cu^{++} \equiv$ 2 g equivalent weight of Cu^{++} 2 mole $Cu^{++} \equiv$ 4 g equivalent weight of $Cu^{++} \equiv$ 4F
47.	(3) $K_4(Fe(CN)_6] \rightleftharpoons 4K^{\oplus} + (Fe(CN)_6]^{4-}$ $x = 4 + 1 = 5$ $\alpha = \frac{1-i}{1-x} \Rightarrow 0.50 = \frac{1-i}{1-5} = \frac{1-i}{-4}$ $\Rightarrow$ 1 – i = – 2.0 $\Rightarrow$ i = 2 + 1 = 3
48.	(0) $\frac{t_2}{t_1} = \left(\frac{a_1}{a_2}\right)^{n-1}$ $\Rightarrow \frac{160}{320} = \left(\frac{58}{29}\right)^{n-1}$ $\Rightarrow \left(\frac{1}{2}\right) = (2)^{n-1}$ $\Rightarrow 2^{-1} = 2^{n-1}$ $\therefore n - 1 = -1$ $\Rightarrow n = -1 + 1 = 0$

49.	(+6) $4KOH + 2MnO_2 + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$ (Potassium Manganate) K_2MnO_4 $2(+1) + x - 8 = 0$ $\Rightarrow 2 + x - 8 = 0$ $\Rightarrow x = +6.$
50.	(2) Fehling's solution is a complex of Cu^{2+}. Formula of Fehling solution is:  E.C. of $Cu^{2+} = 3d^9$ Number of unpaired electron in Cu^{2+} ion = 1 $\therefore \ \mu = \sqrt{n(n+2)} = \sqrt{1(1+2)} = 1.73 \approx 2BM$

Mathematics

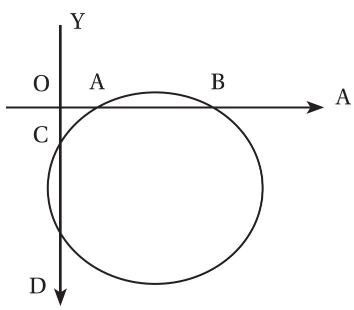
SECTION A

Section A consists of 20 questions of 4 mark each.

	Solution	Answer	[4]
51.	$f(x) = \frac{\tan x}{\tan 3x} = \frac{1-3\tan^2 x}{3-\tan^2 x} \Rightarrow \tan^2 x = \frac{1-3f(x)}{3-f(x)} \geq 0$ $\Rightarrow \left(f(x) \leq \frac{1}{3}\right) \cup (f(x) > 3)$	Ⓐ	[4]
52.	$x = \frac{50+59+46+62+48+x}{6} \Rightarrow x = 53$ $\sigma^2 = \frac{\sum x_i^2}{n} - (\bar{x})^2 = \frac{100}{3} \Rightarrow \sigma = \frac{10}{\sqrt{3}}$	Ⓒ	[4]
53.	Let $P\left(Ct_1, \frac{C}{t_1}\right), Q\left(Ct_2, \frac{C}{t_2}\right)$, be the points. Circle : $(x - Ct_1)(x - Ct_2) + \left(y - \frac{C}{t_1}\right)\left(y - \frac{C}{t_2}\right) = 0$ .... (1) $m_{PQ} = -\frac{1}{t_1 t_2} = 1 \left(m_{PQ} = m_{y=x}\right) \Rightarrow t_1 t_2 = -1$ .... (2)	Ⓐ	[4]

	From (1) & (2) : $(x^2 + y^2 - 2c^2) - (t_1 + t_2)(Cx - Cy) = 0$ $C + \lambda L = 0$ Family of circle passing through the intersection of C = 0, and L = 0 $C : x^2 + y^2 - 2c^2 = 0$ $L : cx - cy = 0 \Rightarrow x = y \Rightarrow x = \pm c = y$ Points are (C, C) and (–C, –C)		
54.	$(x + a)(x + b)(x + c)$ .... 50 terms $= x^{50} + x^{49}.\, S_1 + x^{48} S_2 + \ldots$ The Coefficient of x^{49} $S_1 = \left[\frac{C_1}{C_O} + 2^2.\frac{C_2}{C_1} + 3^2.\frac{C_3}{C_2} + \ldots\ldots + r^2\,\frac{C_0}{C_{r-1}}\right]$ $r^2.\frac{C_r}{C_{r-1}} = r^2.\frac{n-r+1}{r} = (51 - r) = 51r - r^2 \quad (\because n = 50)$ $\sum_{r=1}^{50} r^2.\frac{C_r}{C_{r-1}} = 51\sum_{r=1}^{50} r - \sum_{r=1}^{50} r^2 = 25\times17\times52$	Ⓒ	[4]
55.	For n = 1, P(1) : (65 + k) is divisible by 64 $\therefore$ k should be –1	Ⓐ	[4]
56.	OR = 5, C = –5 $\frac{-D}{4a} = -9$ $\Rightarrow \frac{b^2 + 20a}{4a} = 9 \Rightarrow b^2 = 16a$ $Y = ax^2 + bx - 5$ $ar(\Delta OQB) = \frac{45}{4} \Rightarrow OB = \frac{5}{2}$ $\text{at } x = \frac{5}{2}\ y = 0 \Rightarrow \frac{25a}{4} + \frac{5b}{2} - 5 = 0$ $\Rightarrow 5a + 2b - 4 = 0$ $\Rightarrow 5b^2 + 32b - 64 = 0 \quad (\because b^2 = 16a)$ $\Rightarrow b = -8, \frac{8}{5}$ $OB > OA \Rightarrow b = -8 \;\&\; a = 4$ $Y = 4x^2 - 8x - 5 = (2x + 1)(2x - 5)$ For A $x = -\frac{1}{2} \quad \therefore AB = 3$	Ⓐ	[4]
57.	Tangent : $y = mx \pm \sqrt{1+m^2}$ it passes through (–2, 0) $m = \pm\frac{1}{\sqrt{3}}$ Equation of tangents are : $\sqrt{3}y = x + 2$ & $\sqrt{3}y = -x - 2$ Centre of smaller circle $(h_2, 0)$ $-1 - h_2 = \lvert h_2 + 2 \rvert \Rightarrow h_2 = -\frac{4}{3}$ Centre $\left(-\frac{4}{3}, 0\right)$, radius $= \frac{1}{3}$	Ⓐ	[4]

58.	$\lim\limits_{x\to 0}\frac{\left(2-\sqrt{x+4}\right)\left(2+\sqrt{x+4}\right)}{\sin 2x\left(2+\sqrt{x+4}\right)}=-\frac{1}{8}$	Ⓐ	[4]
59.	$S\infty=\frac{a}{1-r}=162,\ \ S_n=\frac{a(1-r^4)}{(1-r)}=160$ $\longrightarrow$ 1 $\qquad\longrightarrow$ 2 1 ∩ 2 : $r^n=\frac{1}{81}=3^{-4}\quad\Rightarrow\left(\frac{1}{r}\right)^n=81$ $\left.\begin{matrix}\frac{1}{r}=3,\ 9,\ 81\\ n=4,\ 2,\ 1\end{matrix}\right\}$ $a=162\left(1-\frac{1}{3}\right)=108$ $a=162\left(1-\frac{1}{9}\right)=144$ $a=162\left(1-\frac{1}{81}\right)=160$ Sum = 108 + 144 + 160 = 412 .	Ⓒ	[4]
60.	$\lim\limits_{x\to 0}\frac{\left(-2\sin^2\frac{x}{2}\right)\left[\left(1-\frac{x^2}{21}+\frac{x^4}{4!}-...\right)-\left(1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+...\right)\right]}{x^n}$ $=\lim\limits_{x\to 0}(-2).\left(\frac{\sin\left(\frac{x}{2}\right)}{\frac{x}{2}}\right)^2.\frac{1}{4}.\frac{\left(-x-\frac{2x^2}{2!}+\frac{x^3}{3!}+...\right)}{x^{n-2}}$ $=\lim\limits_{x\to 0}\left(-\frac{1}{2}\right)\frac{\left(-1-\frac{2x}{2!}-\frac{x^3}{3!}+...\right)}{x^{n-3}}=\text{a finite}$ $n=3\Rightarrow \text{limit}=\frac{1}{2}$	Ⓒ	[4]
61.	For non trivial solution, $\begin{vmatrix}p+a & b & c\\ a & q+b & c\\ a & b & r+c\end{vmatrix}=0$ $\Rightarrow\begin{vmatrix}p & -q & o\\ o & q & -r\\ a & b & r+c\end{vmatrix}=0\quad\begin{matrix}(R_1\to & R_1-R_2\\ R_2\to & R_2-R_3)\end{matrix}$ $\Rightarrow$ pqr + pqc + prb + qra = 0 $\Rightarrow\frac{a}{p}+\frac{b}{q}+\frac{c}{r}=-1$	Ⓐ	[4]
62.	B is symmetric but it is not transitive as (r, p), (p, q) $\in$B but (r, q) $\notin$B	Ⓒ	[4]

63.	$32 \text{ Sin } \frac{A}{2}.\sin \frac{SA}{2}$ $= 2.16 \sin \frac{A}{2}. \sin \frac{SA}{2}$ $= 16 (\cos 2A - \cos 3A)$ $= 16 (2 \cos^2 A - 1 - 4 \cos^3 A + 3 \cos A) = 16\left(2.\left(\frac{3}{4}\right)^2 - 1 - 4.\left(\frac{3}{4}\right)^3 + 3.\left(\frac{3}{4}\right)\right) = 11.$	Ⓐ	[4]
64.	For concurrency, $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0.$ $\Rightarrow a^3 + b^3 + c^3 - 3abc = 0.$	Ⓒ	[4]
65.	$\frac{dy}{dx} = \frac{y^2 - x^2}{2xy}$ put $y = vx.$ $\Rightarrow \int \frac{2v}{v^2+1} dv = -\int \frac{dx}{x}$ $\Rightarrow x\left(\frac{y^2}{x^2} + 1\right) = c$ When x = 1, then y = 1 $\Rightarrow c = 2$. Curve : $x^2 + y^2 - 2x = 0$.	Ⓐ	[4]
66.	$f(x) = -f(-x) \Rightarrow f(x) + f(-x) = 0.$ $\Rightarrow \frac{x^2+5}{\lambda} - \left\{\frac{x^2+5}{\lambda}\right\} = 0$ $\Rightarrow \left[\frac{x^2+5}{\lambda}\right] = 0$ $\Rightarrow 0 \le \frac{x^2+5}{\lambda} < 1$ As $x \in [-3, 3] \Rightarrow x^2 + 5 \in [5, 14] \Rightarrow \lambda > 14$.	Ⓒ	[4]
67.	h = 0 for circle. $AB > 0 \Rightarrow g^2 - c > 0 \Rightarrow g^2 > c$ $CD > 0 \Rightarrow f^2 - c > 0 \Rightarrow f^2 > c$ As origin lies out side the circle $\therefore c > 0$. Required conditions : $g^2 > c$, $f^2 > c$, $c > 0$ h = 0.  	Ⓒ	[4]
68.	$\vec{a} = \hat{i} + \hat{j}$ (let) $\because \vec{b}_1 \parallel \vec{a}$ $\vec{b}_1 = \frac{\vec{b}.\vec{a}}{\lvert\vec{a}\rvert}.\hat{a} = \frac{3}{2}(\hat{i} + \hat{j})$ $\vec{b}_1 + \vec{b}_2 = \vec{b} \Rightarrow \vec{b}_2 = \frac{3}{2}\hat{i} + \frac{3}{2}\hat{j} + 4\hat{k}$	Ⓑ	[4]

69.	$\lvert f(x)\rvert+\lvert g(x)\rvert=\begin{cases}7-2x & \text{if} \quad x<3\\ 1 & \text{if} \quad 3<x<4\\ 2x-7 & \text{if} \quad x>4\end{cases}$ $f(x) - g(x) = -1 \Rightarrow \lvert f(x)-g(x)\rvert=1$ $\because$ L. H. S > 1 $\Rightarrow \; x\in R - [3, 4]$	Ⓓ	[4]
70.	$f(g(x)) = 3\,g(x) - 1$ Range of $f(g(x)) = R - \{2\}$ + codomain of $f(g(x))$ $\Rightarrow$ $f(g(x))$ is not onto. $f(g(x_1)) = f(g(x_2)) \Rightarrow x_1 = x_2 = f(g(x))$ is one-one .	Ⓒ	[4]
71.	2401 . $\vec{A}\times\vec{B}=2\left(\vec{a}\times\vec{b}\right)$ $= \left\lvert\vec{A}\times\vec{B}\right\rvert^2=4\left(\left\lvert\vec{b}\right\rvert^2\left\lvert\vec{a}\right\rvert^2-(b.a)^2\right)$ $= 4\,(2401 - (b.\,a)^2)$ $= \left\lvert\vec{A}\times\vec{B}\right\rvert=2\left(2401-(b.a)^2\right)^{1/2} \quad \Rightarrow \lambda=2401.$		[4]
72.	0 $F(x)=\int_0^x f(t)\,dt \Rightarrow F'(x)=f(x).$ $I=\int_o^\pi \left(f'(x)+f(x)\right).\cos x\,dx = \int_o^\pi f'(x)\cos x\,dx+\int_o^\pi f(x)\cos x\,dx$ $J=\int_o^\pi f'(x)\cos x\,dx$ $= 4-f(o)+\int_o^\pi \sin x\, f(x)\,dx$ $= 4-f(o)+\int_o^o \pi\sin x\;F'(x)\,dx$ $= 4-f(o)+0-\int_o^\pi \pi\sin x\;f(x)\,dx$ $\therefore \int_o^\pi f'(x)\cos x+\int_o^\pi \cos f(x)\,dx=4-f(0)=4-4=0.$		[4]

73.	4 S (Q ∪ R) = S(Q) + S(R) – S(Q ∩ R) ; Q = { 101, 110, ... 992} $S(Q)=\frac{100}{2}(101+992)=54650$ Case 1 : If $l=2$ the $Q\cap R=Q$ $\therefore S(Q\cup R)=S(Q)$ not possible as given sum=109500 Case 2 : If $l \pm 2$, then Q ∩ R = Q $\therefore$ S(Q∪R) = S(Q) + S(R) = 109500 $\Rightarrow$ $54650 = \sum_{k=11}^{110}(9k+l) = 109500$ $\Rightarrow$ $l = 4$		[4]
74.	2 For equal roots : $(a-b)^2 - 4(1-a-b) > 0$ $\Rightarrow b^2 + b(4-2a) + a^2 + 4a - 4 > 0$ $\Rightarrow (4-2a)^2 - 4(a^2+4a-4) < 0$ $\Rightarrow a > 1$.		[4]
75.	(256) $A^n = \begin{bmatrix} 2^n & 2^n-(-1)^n \\ 0 & (-1)^n \end{bmatrix}$ 2A . (adj 2A) = $\|2A\|$I $\Rightarrow$ A . (adj 2A) = -2^2.I Now, $\left\|A^{10}-\text{adj}(2A)^{10}\right\| = \frac{1}{\|A\|^{10}}\left\|A^{20}-2^{20}I\right\| = 0$. $\therefore$ $\left\|A^8\right\| + \left\|A^{10}-\text{adj}(2A)^{10}\right\| = \|A\|^8 + 0 = (-2)^8 = 256$.		[4]