

Section - I

1.(a) Distance \geq displacement. But for st. line motion distance = displacement.

2.(b) $H_1 = \frac{u^2 \sin^2 \theta}{g} \Rightarrow u \sin \theta = \sqrt{2H_1 g}$

$H_2 = \frac{u^2 \cos^2 \theta}{2g} \Rightarrow u \cos \theta = \sqrt{2H_2 g}$

$R = \frac{2u^2 \sin \theta \cdot \cos \theta}{g} = \frac{2u \sin \theta \cdot u \cos \theta}{g}$
 $= \frac{2}{g} \sqrt{2H_1 g \times 2H_2 g}$
 $= 4\sqrt{H_1 H_2}$

3.(a) $F = \frac{YAe}{l} \propto A \propto d^2$

For a wire of double the thickness, the breaking force will be 4F.

4.(b) $R = (n)^{1/3} r = (10^3)^{1/3} r = 10r$

$\frac{u_r}{u_i} = \frac{T \cdot 4\pi R^2}{T \cdot 4\pi r^2 \times n} = \frac{(10r)^2}{10^3 r^2} = 1:10$

5.(a) $t - 0 = \frac{95 - 80}{110 - 80} (100 - 0)$

$t = 50^\circ\text{C}$

6.(b) Usually, $C_p dT = C_v dT + PdV$

But when water is heated from 0°C to 4°C , dV is -ve

$C_p dT = C_v dT - PdV$

$C_p = C_v - R \Rightarrow C_p > C_v$

7.(a) $80 \times 1 \times 30 = M \times 80$

$\Rightarrow M = 30\text{g}$

8.(b) $e = 0.3d$

$\therefore d = \frac{e}{0.3} = \frac{1}{0.3} = 3.3\text{ cm}$

9.(c) Only α -particle has charge.

10.(c) $P \propto i^2$

$\frac{\Delta P}{P} = \frac{2\Delta i}{i} \times 100\% = -2 \times 2\% = -4\%$

11.(c) $F = BI l = 10^{-4} \times 1 \times 1 = 10^{-4}\text{ m}$

12.(c) Increase in KE = work done = $qV = 1\text{ eV}$

13.(b) 1st membr. of Balmer series $\frac{1}{\lambda_B} = R \times \frac{5}{36}$

1st membr. of Lyman series $\frac{1}{\lambda_L} = R \times \frac{3}{4}$

$\frac{1}{\lambda_L} = \frac{R \times \frac{3}{4}}{R \times \frac{5}{36}} \Rightarrow \frac{\lambda_B}{\lambda_L} = \frac{27}{5}$

14.(d) $\delta = 180^\circ - 2i = 180^\circ - 2 \times 30^\circ = 120^\circ$

15.(c) de Broglie wavelength $\lambda = \frac{h}{mv}$; m is maximum for α -particle

16.(a) CH_3^+ possess sp^2 -hybridisation

17.(d) CrO_2Cl_2

18.(a) The extent of H-bonding is maximum in glycerol due to three -OH groups per molecule.

19.(a)

20.(c) Two miscible liquids can be separated by distillation

21.(a)

22.(a)

23.(a)

24.(b)



26.(c)

27.(d)

28.(c)

29.(c) $A \cap B = \phi$ [$y = e^x$ and $y = x$ do not meet for any $x \in \mathcal{R}$]

30.(c)

31.(c) $x^2 = -\frac{b}{a}$ gives real roots if $\frac{b}{a} < 0 \Rightarrow ab < 0$

32.(b) $\sum_{n=0}^{\infty} \frac{(\ln x)^n}{n!} = e^{\ln x} = x$

33.(a) $\tan 3\theta = \tan\left(\frac{\pi}{2} - \theta\right)$

$3\theta = n\pi + \frac{\pi}{2} - \theta \Rightarrow \theta = (2n + 1)\frac{\pi}{8}$

34.(c) $\cos^{-1}\left[\cos\left(\pi - \frac{\pi}{3}\right)\right] = \frac{2\pi}{3}$

35.(b) $PQ = PR$ is possible if P^{-1} exists $\Rightarrow P$ is non-singular matrix

36.(a) $T_n = S_n - S_{n-1} = [2n^2 + 5n] - [2(n-1)^2 + 5(n-1)] = 4n + 3$

37.(b) $2x - y + k = 0$ passes through $(-3, 3)$

so $-6 - 3 + k = 0$

$\therefore k = 9$

38.(c) length = $\sqrt{1 + 4 + 9} = \sqrt{14}$

39.(c) $\frac{(x-3)^2}{9} + \frac{(y-4)^2}{25} = 1$ so ellipse

- 40.(c) The point is on directrix so angle between tangent is 90°
- 41.(d) For $x < 3$, $\sqrt{x-3}$ is undefined so does not exist.
- 42.(b) Valid $|\frac{3x}{6}| < 1 \Rightarrow |x| < 2$
- 43.(a) $\frac{dx}{dy} = \frac{2t}{2t-1} = 0, \therefore t = 0$
- 44.(b) $\int a^3 \cdot a^{3x} dx = a^3 \frac{a^{3x}}{3 \log a} + c = \frac{a^{3x+3}}{3 \log a} + c$
- 45.(c) $|4\vec{a} + 3\vec{b}|^2 = 16 \times 9 + 9 \times 16 + 2 \cdot 4 \cdot 3 \cdot 3 \cdot 4 \left(-\frac{1}{2}\right)$
 $= 144 + 144 - 144 = 144$
 $|4\vec{a} + 3\vec{b}| = 12$
- 46.(d) If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, their graph is intersecting.
- 47.(b) $\sum_{r=1}^n \frac{nPr}{r!} = \sum_{r=1}^n {}^nC_r = {}^nC_1 + {}^nC_2 + \dots + {}^nC_n = 2^n - 1$
- 48.(c)
- 49.(d) 50.(a) 51.(b) 52.(c) 53.(b) 54.(a)
- 55.(b) 56.(c) 57.(a) 58.(d) 59.(d) 60.(b)

Section - II

- 61.(b) $\Delta p = (\mu \cos \theta \hat{i}) - (\mu \cos \theta \hat{i} + \mu \sin \theta \hat{j})$
 $= \mu \sin \theta (-\hat{j})$
 $= 0.1 \times 20 \times \sin 30^\circ$
 $= 1 \text{ kg m/s}$
- 62.(b) 1st case
 $Mg - U = Ma \dots (1)$
 2nd case
 $U - (M - m)g = (M - m)a \dots (2)$
 Adding (1) & (2)
 $(M - M + m)g = (2M - m)a$
 or, $mg = 2Ma - ma$
 or, $m(g + a) = 2Ma$
 or, $m = \frac{2Ma}{g + a}$
- 63.(c) $-\frac{GMm}{R} + \frac{1}{2}mv^2 = -\frac{GMm}{R+h} + 0$
 or, $\frac{1}{2}m(0.9v_e)^2 = GMm \left[\frac{1}{R} - \frac{1}{R+h} \right]$

- or, $\frac{1}{2}m \times 0.81 v_e^2 = gR^2m \left[\frac{R+h-R}{R(R+h)} \right]$
- or, $\frac{81}{200} \times 2gR = gR^2 \times \frac{h}{R(R+h)}$
- or, $100h = 81R + 81h$
- or, $19h = 81R$
- or, $h = \frac{81R}{19}$
- 64.(b) Volume of metal (V_m) = $\frac{40}{8} = 5 \text{ cc}$
 Loss in wt = upthrust
 or, $40 - 20 = V\sigma_w$
 or, $V = 20 \text{ cc}$
 Volume of cavity = $V - V_m$
 $= 20 - 5 = 15 \text{ cc}$
- 65.(a) $PV_1 = m \frac{R}{M} T$
 $V_1 = \frac{mRT}{PM} = \frac{10 \times 10^{-3} \times 8.31 \times 383}{3 \times 10^5 \times 32 \times 10^{-3}} = 3.32 \times 10^{-3} \text{ m}^3$
 $W = PdV = P(V_2 - V_1)$
 $= 3 \times 10^5 (0.1 - 3.32 \times 10^{-3})$
 $= 29004 \text{ J} = 2.9 \times 10^4 \text{ J}$
- 66.(d) $E = \frac{d\phi}{dt} = \frac{NAB}{t} = 500 \times 100 \times 10^{-4} \times 1 = 5 \text{ V}$
- 67.(d) $f = \frac{1}{2\pi\sqrt{LC}}$
 Again, $f' = \frac{1}{2\pi\sqrt{2L \times 4C}} = \frac{2}{2\sqrt{2}}$
- 68.(d) $Q_1 + Q_2 = (4\pi\epsilon_0 r_1 + 4\pi\epsilon_0 r_2) V$
 or, $V = \frac{10^{-2} + 0.5 \times 10^{-2}}{4\pi\epsilon_0 (r_1 + r_2)}$
 $= \frac{1.5 \times 10^{-2} \times 9 \times 10^9}{(1+2) \times 10^{-2}}$
 $= 4.5 \times 10^9 \text{ V}$
 $Q' = C_1 V$
 $= 4\pi\epsilon_0 r_1 V$
 $= \frac{1 \times 10^{-2}}{9 \times 10^9} \times 4.5 \times 10^9$
 $= 0.5 \times 10^{-2} \text{ C}$

69.(a) $C = \frac{4\pi\epsilon_0 ab}{b-a}$

or, $\frac{C \times (b-a)}{4\pi\epsilon_0} = b(b-10^{-3})$

or, $9 \times 10^9 \times 10^{-6} \times 10^{-3} = b^2 - b \times 10^{-3}$

or, $b = 3\text{m}$

70.(d) $eV_e = E_3 - E_2$

$V_e = \left(-\frac{13.6}{9} + \frac{13.6}{4} \right) \frac{eV}{e} = (3.4 - 1.51) \text{ V} = 1.89 \text{ V}$

71.(c) $I = I_0 e^{-\mu x}$

or, $\frac{I_0}{8} = I_0 e^{-\mu x}$

or, $\frac{1}{8} = \frac{1}{e^{\mu x}}$

or, $e^{\mu x} = 8$

or, $\mu x = \ln 8$

or, $\mu = \frac{\ln 8}{48}$

Again, $\frac{I_0}{2} = I_0 e^{-\mu x'}$

or, $\frac{1}{2} = \frac{1}{e^{\mu x'}}$

or, $e^{\mu x'} = 2$

or, $\mu x' = \ln 2$

or, $x' = \frac{\ln 2}{\ln 8} \times 48 = 16 \text{ mm}$

72.(a) $\frac{1}{f} = (\mu - 1) \frac{1}{R}$

or, $\frac{1}{R} = (\mu - 1) \frac{1}{R} \quad [\because f = R]$

or, $\mu = 1 + 1 = 2$

73.(b) For open pipe

$f_0 = \frac{v}{2l_0}$

or, $l_0 = \frac{v}{2f_0} = \frac{v}{2 \times 300} \dots(i)$

Again, $2f^o = 3f_0^c$

or, $2 \times \frac{v}{2l_0} = 3 \times \frac{v}{4l_c}$

or, $l_c = \frac{3l_0}{4} = \frac{3}{4} \times \frac{v}{2 \times 300}$

$= \frac{3}{8 \times 300} \times 330$

$= 0.41 \text{ m} = 41 \text{ cm}$

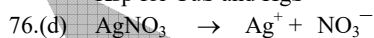
74.(c) New concentration of

$\text{HCl} = \frac{10^{-6}}{100} = 10^{-8} \text{M}$

$\therefore [\text{H}^+] = 10^{-8} + 10^{-7} = 1.1 \times 10^{-7} \text{m}$

$\therefore \text{pH} \approx 6.95$

75.(d) Find solubility by $4s^3 = K_{sp}$ for Ag_2S and $s^2 = K_{sp}$ for CuS and HgS



100 ml 0.1N 100 ml 0.1 N

100 ml 0.1 N = 200 ml N_2

$\text{N}_2 = 0.05 \text{ N}$ with respect to NO_3^- ion.

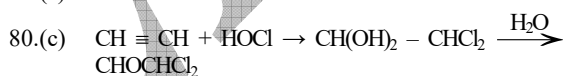
77.(c) 9 gram element \rightarrow 8 gm O_2

So, eq. wt. of element is 9

At. wt. = $E \times v = 9 \times 3 = 27$

78.(a) Reaction whose rate is not affected by concentration or in which the concentration of the reactant do not change with time is called zero order reaction.

79.(a)



81.(a) The order of reactivity of alkyl halides towards elimination reaction follows the order: $3^\circ > 2^\circ > 1^\circ$.

82.(c) $-1 \leq \sin 3x \leq 1$

so, $1 \leq 2 - \sin 2x \leq 3$

$\Rightarrow \frac{1}{3} \leq \frac{1}{2 - \sin 3x} \leq 1$

So range of $\left[\frac{1}{3}, 1 \right]$

83.(c) $|x + iy - 1| = |x + iy - 1|$

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

$\Rightarrow y = x$, st. line

84.(a) $\frac{(x-1)^n (1-x)^n}{x^n} = \frac{(-1)^n (1-x)^{2n}}{x^n}$

Middle term = $T_{n+1} = \frac{(-1)^n}{x^n} \cdot 2^n \cdot C_n (-1)^n x^n = 2^n C_n$

85.(b) Total number of ways in which 3 integers can be chosen is ${}^{20}C_3$.

The product is even if at least one of them is even.

Prob = $1 - \text{prob of none of them is even}$

- $= 1 - \frac{{}^{10}C_3}{{}^{20}C_3} = 1 - \frac{2}{19} = \frac{17}{19}$
- 86.(c) $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0$
 $\Rightarrow (abc+1+1)-(b+c+a) = 0$
 $\Rightarrow a + b + c = abc + 2$
- 87.(a) $bhx^2 + ahy^2 + 2abxy = 0$
 $m_1 + m_2 = -\frac{2b}{h}$ and $m_1m_2 = \frac{b}{a}$
 $m_2 = 2m_1$
 $\Rightarrow 3m_1 = -\frac{2b}{h}$, $2m_1^2 = \frac{b}{a}$
 $\Rightarrow 2 \times \frac{4b^2}{9h^2} = \frac{b}{a} \Rightarrow ab : h^2 = 9 : 8$
- 88.(c) $y = -2x - \lambda$
 $\therefore -\lambda = -2(-2)(-2) + 2(-2)^3$
 $\lambda = 24$
- 89.(b) abscissa = $\pm ae = \pm \sqrt{a^2 + b^2} = \pm \sqrt{\cos^2 \alpha + \sin^2 \alpha}$
 $= \pm 1$, no change
- 90.(c) $2xy \, dy = y^2 \, dx - x^2 \, dx$
 $\frac{x \, dy^2 - y^2 \, dx}{x^2} = -dx$
 $d\left(\frac{y^2}{x}\right) = -dx$
 $\frac{y^2}{x} = -x + c$
 $y^2 = -x^2 + cx$
 $x^2 + y^2 - cx = 0$
- 91.(a) $\lim_{x \rightarrow \infty} \left(\frac{x+2}{x+1}\right)^{x+3}$
 $= \lim_{x \rightarrow \infty} \left(\frac{x+1+1}{x+1}\right)^{x+3}$
 $= \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x+1}\right)^{(x+1) \left(\frac{x+3}{x+1}\right)}$
 $= \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x+1}\right)^{(x+1) \left(\frac{1+3/x}{1+1/x}\right)}$
 $= e^1 = e$
- 92.(a) $\int (x^3 + \frac{1}{e} e^x) dx = \frac{x^4}{4} + \frac{1}{e} e^x + c = \frac{x^4}{4} + e^{x-1} + c$
- 93.(d) $A = \frac{\sqrt{3}}{4} a^2 \Rightarrow \frac{dA}{dt} = \frac{\sqrt{3}}{2} a \frac{da}{dt}$
 $\Rightarrow \frac{dA}{dt} = \frac{\sqrt{3}}{2} ak$
- 94.(c) $\int_1^2 \ln x \, dx = [x \ln x - x]_1^2 = \ln\left(\frac{4}{e}\right)$
- 95.(c) $\left(\frac{a \sin C}{c}\right) \cdot \left(\frac{b \sin C}{c}\right) = \frac{ab}{c^2}$
 $\sin^2 C = 1 \Rightarrow C = 90^\circ$
- 96.(b) $\sin^{-1}\left(\frac{x}{5}\right) = \frac{\pi}{2} - \operatorname{cosec}^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2} - \sin^{-1}\left(\frac{4}{5}\right)$
 $\sin^{-1}\left(\frac{x}{5}\right) = \cos^{-1}\left(\frac{4}{5}\right) = \sin^{-1}\left(\frac{3}{5}\right)$
 $\therefore x = 3$
- 97.(d) 98.(d) 99.(b) 100.(d)

... The End ...