Section – I

1.(c) $\overrightarrow{\Delta P} = \{P\cos\theta\hat{i} + P\sin\theta(-\hat{j})\} - (P\cos\theta\hat{i} + P\sin\theta\hat{j})$
$= -2p\sin\theta\hat{j}$
$= 2P\sin\theta$ downward

2.(d) When a ball is dropped from spacecraft revolving around earth then it will remain revolving around earth in original orbit.

3.(b) First increases and become saturated after some time & pressure remain constant.

4.(b) For A
$f_t = \frac{1}{2l}\sqrt{\frac{T_A}{m}}$
For B
$f_t = 2 \times \frac{1}{2l}\sqrt{\frac{T_B}{m}}$
$\therefore \quad 2\sqrt{T_B} = \sqrt{T_A}$
$\therefore \quad T_A = 4T_B$

5.(b) Deviation will be maximum if total internal reflection takes place at critical angle so
$\delta = 180^o - 2C$

6.(d) $\phi = E.A = \frac{Q}{\varepsilon_o}$
$\therefore \quad E = \frac{Q}{\varepsilon_o \times 2\pi r l}$
$\therefore \quad E \propto \frac{1}{r}$ for line charge

7.(b) $\frac{R_2}{R_1} = \left(\frac{l_2}{l_1}\right)^2$
$\therefore \quad R_2 = \left(\frac{40}{20}\right)^2 \times 5 = 20\Omega$

8.(c) $\lambda = \frac{h}{\sqrt{2m_eE_e}} = \frac{h}{\sqrt{2m_pE_p}}$
$\therefore \quad m_e < m_p$ so $E_e > E_p$

9.(c) The layer of fixed ions formed at junction of diode is called depletion layer.

10.(b) $\frac{t_1}{t_2} = \frac{\sqrt{\frac{2 \times h}{g}}}{\sqrt{\frac{2 \times 9h}{g}}} = \frac{1}{3}$

11.(b) $P = \frac{\text{gain in KE}}{t} = \frac{1}{2}\frac{mv^2}{t} = \frac{mv^2}{2t}$

12.(a) $L = 10\log\frac{I}{I_o} = 10\log\frac{10^{-6}}{10^{-12}} = 10\log 10^6$
$= 60\text{db}$

13.(c) $E = -\frac{d\phi}{dt}$

14.(c) $\frac{N}{N_o} = \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}} = \left(\frac{1}{2}\right)^{\frac{T_{\frac{1}{2}}}{2T_{\frac{1}{2}}}} = \left(\frac{1}{2}\right)^{1/2} = \frac{1}{\sqrt{2}}$

15.(b) Haematite – Fe_2O_3

16.(b) Alternate single and double bonds have no equal length

17.(c)

18.(c) $CH_3COONa + H_2O \rightarrow CH_3COOH + Na^+ + OH^-$

19.(b)

20.(a) Molecular weight = 2 × vapour density

21.(c)

22.(b)

23.(a)

24.(a) 100cc of 1m H_2SO_4 = 100cc of 2N H_2SO_4
VaNa = 100 × 2 = 200
20cc of 5M NaOH = 20cc of 5N NaOH
VbNb = 20 × 5 = 100
Va Na > Vb Nb solution is acidic

25.(a) $\overset{+7}{MnO_4^-} \longrightarrow \overset{+4}{MnO_2}$
Change in

26.(c)

27.(a)

28.(b) PO_3^- metaphosphate

29.(a) On solving: $\sin^2 x = 1$
$x = n\pi \pm \frac{\pi}{2}$

30.(b) $P(\bar{A}) = 1 - P(A) = 1 - \frac{3}{8} = \frac{5}{8}$

$P(\overline{B}) = 1 - P(B) = 1 - \frac{1}{2} = \frac{1}{2}$

31.(c) $(\alpha + \beta)^2 = (\alpha - \beta)^2 + 4\alpha\beta$

$P^2 = (2)^2 + 4.8 = 36$

$P = \pm 6$

32.(c) $I = A - A^2$

$A^{-1}. I = A^{-1}.A - A^{-1}.A.A$

$A^{-1} = I - I.A = I - A$

33.(d) $f'(x) = \frac{\cos x}{|\cos x|}.-\sin x$

At $x = 3\pi/4$ $f'\left(\frac{3\pi}{4}\right) = \frac{1}{\sqrt{2}}$

34.(d) $\lim_{x \to 0} \frac{\frac{\pi}{180}}{\sin\left(\frac{\pi x}{180}\right)} = 1$

35.(a) $\int \frac{x+2}{x-2}\, dx = \int \frac{(x-2)+4}{(x-2)}\, dx$

$= \int dx + \int \frac{4}{(x-2)}\, dx$

$= x + 4\log(x-2) + c$

36.(b) It is obvious

37.(d) $3x + 4y = 12$

$\Rightarrow \frac{x}{4} + \frac{y}{3} = 1$

$l = \sqrt{(4-0)^2 + (0-3)^2} = 5$ units

38.(d) $D = \frac{1}{2}(Q_3 - Q_1) = \frac{1}{2}(16 - 4) = 6$

39.(a) $X \cap (X \cup Y) = X$

40.(c) $\sin^{-1}\left[\sin\left(\pi - \frac{\pi}{3}\right)\right] = \sin^{-1}\left(\sin\frac{\pi}{3}\right) = \frac{\pi}{3}$

41.(a) $\log_e x(1+x) = \log_e 1 \Rightarrow x^2 + x - 1 = 0$

42.(d) $\overline{z} = \frac{1}{z}$

$z\overline{z} = 1$

$\therefore x^2 + y^2 = 1$

43.(c) At no point f(x) is continuous.

44.(c) $\frac{dy}{dx} = \frac{2a}{y}$

$\therefore \left.\frac{dy}{dx}\right|(at^2, 2at) = \frac{1}{t}$

Slope of normal = –t

45.(a) $I = \int x^{51}\frac{\pi}{2}dx = \frac{\pi}{2}\frac{x^{52}}{2} + c = \frac{x^{52}}{2}(\tan^{-1}x + \cot^{-1}x) + c$

46.(b) Differentiating partially w.r. to y = 0

$\therefore 2y - 4 = 0 \quad \therefore y = 2$

47.(a) $-\frac{K}{9} = 5$ or, $K = -45$

48.(b) Each mapping from E to F can be done in 2 ways.

Hence total no. of ways

$= 2 \times 2 \times 2 \times 2 = 16$ ways

49.(c)	50.(c)	51.(d)	52.(b)
53.(d)	54.(d)	55.(a)	56.(d)
57.(b)	58.(b)	59.(b)	60.(d)

Section – II

61.(c) 70 % of mgh = mgh′

or, $h' = 0.7 \times 10 = 7$m

62.(b) $0 = u + at$

or, $0 = 9 - 2t$

or, $t = 4.5$ sec

Body will come to rest after 4.5 second and start to move west.

Distance covered in 4 sec

$S_1 = ut + \frac{1}{2}at^2 = 9 \times 4 - \frac{1}{2} \times 2 \times 4^2 = 20$m

Distance covered is 4.5 sec

$S_2 = 9 \times 4.5 - \frac{1}{2} \times 2(4.5)^2$

$= 40.5 - 20.25 = 20.25$ m

Distance covered in 0.5 sec

$S' = S_2 - S_1 = 20.25 - 20 = 0.25$ m

After 4.5 sec

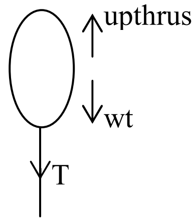
Distance moved in 0.5 sec is

$S'' = \frac{1}{2} at^2 = \frac{1}{2} \times 2(0.5)^2 = 0.25m$

$\therefore$ Distance moved in 5^{th} second

$S_5 = S' + S'' = 0.25 + 0.25 = 0.5m$

63.(d)



T + wt = upthrust

or, T = upthrust – wt

$= V\sigma g - (m + m_a)g$

$= 1500 \times 1.3 \times 10 - (1650 + 1500 \times 0.2) \times 10$

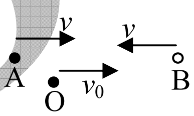
$= 19500 - 19500 = 0$

64.(b) $PV = nRT_1 = \left(n - \frac{n}{4}\right) RT$

or, $nR \times 333 = \frac{3}{4} nRT$

or, $T = 444k = 171^0C$

65.(c) For A



$f' = \frac{v - v_0}{v} f$ ...(i)

For B

$f'' = \frac{v + v_0}{v} f$ ...(ii)

$\therefore$ $f'' - f' = f_b$

or, $\frac{v + v_0}{v} f - \left(\frac{v - v_0}{v}\right) f = 10$

or, $\frac{2v_0}{v} f = 10$

or, $v_0 = \frac{10 \times 340}{2 \times 680} = 2.5$ m/s

66.(a) $C = \frac{4\pi\varepsilon_0 ab}{b - a}$

or, $\frac{C \times (b - a)}{4\pi\varepsilon_0} = b(b - 10^{-3})$

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

or, b = 3m

67.(b) $I = \frac{2E}{3 + 2r} = \frac{E}{\frac{r}{2} + 3}$

or, $2\left(\frac{r}{2} + 3\right) = 3 + 2r$

or, r + 6 = 3 + 2r

or, $r = 3\Omega$

68.(b) $L = 2\pi R$ or, $R = \frac{L}{2\pi}$

$M = IA = I\pi R^2 = I\pi \left(\frac{L}{2\pi}\right)^2 = \frac{I L^2}{4\pi}$

69.(c) $Tan\phi = \frac{X_L}{R} = \frac{2\pi fL}{R}$

or, $\phi = \tan^{-1}\left(\frac{2\pi \times 50 \times 0.21}{12}\right) = 80^0$

70.(b) $x = 2.5\beta$

$= 2.5\frac{D\lambda}{d} = \frac{2.5 \times 1 \times 6.5 \times 10^{-7}}{10^{-3}}$

$= 1.625 \times 10^{-3}m = 1.63mm$

71.(c) v = –120cm

u = 40 cm

$f = \frac{uv}{u + v} = \frac{40(-120)}{40 - 120}$

$= \frac{40 \times 120}{80} = 60$ cm

72.(c) $dv = \frac{hc}{e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]$

or, $V_2 - V_1 = \frac{hc}{e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]$

or, $V_2 = V_1 + \frac{hc}{e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]$

$= 0.18 + \frac{6.62\times10^{-34}\times3\times10^8}{1.6\times10^{-19}}$

$\left(\frac{1}{180\times10^{-9}} - \frac{1}{550\times10^{-9}}\right)$

$= 0.18 + 4.64 = 4.82V$

73.(c) $\frac{U}{Pb} = \frac{4}{3}$

$m_U = 4x, m_{Pb} = 3x$

206g of Pb is formed from 238g of U

or, 3x g of Pb is formed from $\left(\frac{238}{206} \times 3x\right)$ g of U

$= 3.466x$ g

$m_0 = 4x + 3.466x = 7.466x$ g

$$\frac{m}{m_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}} \qquad or, \frac{4}{7.45} = \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$$

$$t = T_{\frac{1}{2}} \times \frac{ln\left(\frac{4}{7.45}\right)}{ln0.5} = 4 \times 10^9 \text{ yrs}$$

74.(b) $2HCl + CaCO_3 \longrightarrow CaCl_2 + CO_2 + H_2O$

$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$

1mole of Na_2CO_3 = 1mole of CO_2 = 2moles of HC*l*.

106g 73g

5.3g $\frac{73}{100} \times 100 = 3.65$g

75.(d) Conc^n of HC*l* in diluted solution

$= \frac{10^{-5}}{100} = 10^{-7}$

Total conc^n of H^+ –ion = $10^{-7} + 10^{-7} = 2\times10^{-7}$

$pH = -\log[2\times10^{-7}] = 6.69$

76.(c) $I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$

77.(b) For alkane,

No. of possible chain isomers = $2^{n-4} + 1$

$= 2^{6-4} + 1 = 5$

78.(b) $4KI + 2CuSO_4 \longrightarrow 2K_2SO_4 + Cu_2I_2 + I_2$

79.(b) pH = 12, $[H^+] = 10^{-12}$

$[OH^-] = \frac{10^{-14}}{10^{-12}} = 10^{-2}$

$Ba(OH)_2 \rightleftharpoons Ba^{++} + 2OH^-$

S 2S

$2S = 10^{-2}$

$S = \frac{10^{-2}}{2}$

$K_{sp} = S \times (2S)^2$

$= 4 \times S^3$

$= 4 \times \left(\frac{10^{-2}}{2}\right)^3 = 5.0 \times 10^{-7}$

80.(c)

$$CH_2 = CH_2 + H_2O \xrightarrow[\text{Pressure}]{H_3PO_4} CH_3CH_2OH$$

81.(a) $E_{cell} = E_{cathode} - E_{anode}$ (always +ve)

and $\Delta G = -nFE°$

82.(a) Average $= \frac{x + x^2 + x^3 + x^4}{4}$

$= \frac{x(1 + x + x^2 + x^3)}{4} = \frac{x.60}{4} = 15x$

83.(b) $G = \sqrt{xy}$

$$\frac{1}{G^2 - x^2} + \frac{1}{G^2 - y^2} = \frac{1}{xy - x^2} + \frac{1}{xy - y^2}$$

$$= \frac{1}{xy} = \frac{1}{G^2}$$

84.(c) $({}^{51}C_3 + {}^{50}C_3 + {}^{49}C_3 + {}^{48}C_3 + {}^{47}C_3) + {}^{47}C_4$

$= {}^{51}C_3 + {}^{50}C_3 + {}^{49}C_3 + {}^{48}C_3 + {}^{48}C_4$

$= {}^{51}C_3 + {}^{50}C_3 + {}^{50}C_4$

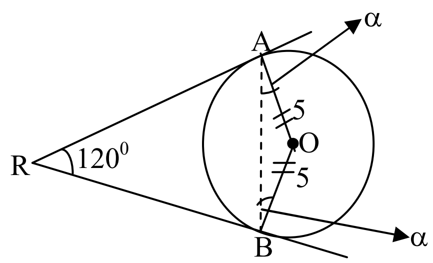
$= {}^{51}C_3 + {}^{51}C_4$

$= {}^{52}C_4$

85.(d) P(7 or 10) = P(7) + P(10)

$= \frac{4}{52} + \frac{4}{52} = \frac{2}{13}$

86.(d)



$\angle AOB = 180^0 - 120^0 = 60^0$

Then $\alpha + \alpha + 60^0 = 180^0 \quad \alpha = 60^0$

AOB is an equilateral Δ length of the chord = 5 units.

87.(a) $r = 4R \sin\frac{A}{2} \sin\frac{B}{2} \sin\frac{C}{2}$

$= 4R \sin\frac{60}{2} . \sin\frac{60}{2} . \sin\frac{60}{2}$

$= 4R \frac{1}{2} . \frac{1}{2} . \frac{1}{2} \quad \therefore R = 2r$

88.(c) $= 4\int \frac{dx}{4\sin^2 x \cos^2 x}$

$= 4 \int \frac{1}{(2\sin x \cos x)^2} dx = 4\int \text{cosec}^2 2x\, dx$

$= \frac{4(-\cot 2x)}{2} + c = -2\cot 2x + c$

89.(c) $\frac{dy}{dx} = \frac{y}{x}$

90.(a) $2\vec{SD} = \vec{AO}$

We have

$\vec{SA} + \vec{SB} + \vec{SC}$

$= \vec{SA} + 2\vec{SD}$

$= \vec{SA} + \vec{AO} = \vec{SO}$

91.(b) $A_1 = \int_0^{\pi/3} y\, dx = \int_0^{\pi/3} \cos x\, dx$

$= (\sin x)_0^{\pi/3} = \frac{\sqrt{3}}{2}$

$A_2 = \int_0^{\pi/3} \cos 2x\, dx = \frac{1}{2} (\sin 2x)_0^{\pi/3} = \frac{1}{2}\left(\frac{\sqrt{3}}{2}\right)$

$A_1 : A_2 = 2 : 1$

92.(b) $\frac{x^2}{9} + \frac{y^2}{9/4} = 1$ i.e. $a^2 = 9, b^2 = \frac{9}{4}$

We have: $b^2 = a^2(1 - e^2) \Rightarrow e^2 = \frac{3}{4}$

(a) latus rectum $= \frac{2b^2}{a} = \frac{2.\frac{9}{4}}{3} = \frac{3}{2}$ (true)

(b) focus: $(ae, 0) = \left(\frac{3\sqrt{3}}{2}, 0\right)$

(c) directrix: $x = \frac{a}{e} = 3\left(\frac{2}{\sqrt{3}}\right) = 2\sqrt{3}$

$x = 2\sqrt{3}$ (True)

93.(c) $f'(x) = \cos x - \sqrt{3} \sin x$

For maximum value: $f'(x) = 0$

$\cos x - \sqrt{3} \sin x = 0 \Rightarrow \cos x = \sqrt{3} \sin x$

$\Rightarrow \tan x = \frac{1}{\sqrt{3}}$ i.e. $x = 30^0$

94.(c) Putting $y = -\frac{px}{q}$ in $ax^2 + 2hxy + by^2 = 0$

We get

$aq^2 - 2hpq + bp^2 = 0$

95.(d) a = 1, b = 2, c = 3

Required equation is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

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

$6x + 3y + 2z = 6$

96.(b) $2^m - 2^n = 56$

Taking option (b), we get

$2^6 - 2^3 = 56$

97.(b) 98.(b) 99.(c) 100.(d)

…The End…