Section - I

1.(c)

2.(a) $g' = g - \omega^2 R\cos^2\lambda$
$\omega = 0, g' = g$

3.(d)

4.(d) Ring $\rightarrow MR^2$
Disc $\rightarrow \frac{1}{2}MR^2$
Spherical shell $\rightarrow \frac{2}{3}MR^2$
Sphere $\rightarrow \frac{2}{5}MR^2$

5.(b) $h = \frac{2T\cos\theta}{r\rho g}$
$\theta = 90°, h = 0$

6.(c) $dQ = du + d\omega$
or, $\gamma du = du + Pdv$ or, $du = \frac{PV}{\gamma - 1}$

7.(a) $dQ = du + dw$, Here $dw = 0$ & $dQ < 0$ means –ve so du is also negative i.e. internal energy decreased.

8.(a) $v \propto T^{1/2}$
or, $\frac{\Delta v}{v} = \frac{1}{2}\frac{\Delta T}{T}$ or, $\Delta T = \frac{1}{100} \times 2 \times 273 = 5.5°C$

9.(b) Here $kx = \frac{2\pi x}{3}$
or, $\frac{2\pi x}{\lambda} = \frac{2\pi x}{3}$ or, $\lambda = 3$ cm
Distance between nodes $= \frac{\lambda}{2} = 1.5$ cm

10.(c) $H = \frac{1}{2}cv^2 = \frac{1}{2} \times 2 \times 10^{-6} \times 100^2 = 0.01$ J

11.(d) $I = venA = v'e\,nA'$
or, $v \times \pi r^2 = v'\pi(2r)^2$ or, $v' = \frac{v}{4}$

12.(b) Potential gradient $= \frac{V_P}{l} = \frac{IR_P}{l}$
r = resistance per unit length
If emf is tripled then current become three times so the potential gradient also become three times.

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

14.(b) $\beta = \frac{D\lambda}{d}$
β increases if 'd' decreases

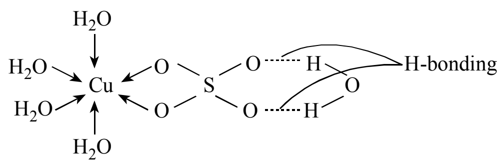
15.(b) $m = -2 = \frac{v}{4}$ $v = -24$
Now, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$
or, $\frac{1}{10} = \frac{1}{u} - \frac{1}{2u} = \frac{2-1}{2u}$
or, $u = \frac{10}{2} = 5$ cm

16.(d) $Bqv = \frac{mv^2}{r}$ or, $P = Bqr$

17.(b) Resistance is high then no current flows so act as capacitor.

18.(d) Maximum oxidation number of element is equal to group number.

19.(d)



20.(b) $NaCl \rightarrow Na^+ + Cl^-$
$H_2O \rightleftharpoons H^+ + OH^-$
At cathode $2H^+ + 2e^- \longrightarrow H_2$
At anode $2e^- - Cl_2 \longrightarrow H_2$
Remaining ions are $Na^+ + OH^- \Rightarrow$ Basic

21.(d)

22.(c) n = 1
$C_1H_{2\times1+1}OH = CH_3OH$ methyl alcohol

23.(c) HCO_3^- and OH^- -ion cann't exist together because they react as $HCO_3^- + OH^- \longrightarrow CO_3^{--} + H_2O$

24.(b) Mg and Mn are only metals that gives H_2 gas with dilute HNO_3

25.(b) Zn^{++} ion lies in group IIIB metal ions and can give precipitate only in alkaline medium.

26.(c) All metal nitrates are soluble in water.

27.(b) The structure of glyoxal is
$H-\overset{\overset{O}{\parallel}}{C}-\overset{\overset{O}{\parallel}}{C}-H$ IUPAC name ethanedial

28.(c) The reaction of sodium alkoxide with alkylhalide to give ether is called Williamson's reaction.

29.(d) $y = \log_{x^{1/2}}x = \frac{1}{\frac{1}{2}}\log_x x$
$y = 2.1$
$\frac{dy}{dx} = 0$

30.(a) $1 + 1 + 1 = 3$
$1 + 1 + 3 = 5$
$1 + 3 + 5 = 9$
$3 + 5 + 9 = 17$

31.(d) $\lim\limits_{x\to0}\frac{a^x-1}{x} + \lim\limits_{x\to0}\frac{b^x-1}{x} + \lim\limits_{x\to0}\frac{c^x-1}{x}$
$= \log a + \log b + \log c = \log(abc)$

32.(b) $\int_0^a a^2dx - \int_0^a x^2dx$

$= a^2(x)_0^a = \left(\frac{x^3}{3}\right)_0^a$

$= a^2(a - 0) - \left(\frac{a^3}{3} - 0\right) = \frac{2a^3}{3}$

33.(b) $2^x = e^{kx}$
$e^{\log 2^x} = e^{kx}$
$e^{x\log 2} = e^{kx}$
$k = \log_e 2$

34.(d) $O(A \times B) = mn$

35.(a) $n = 18$
For the greatest coeff. $r = \frac{n}{2} = \frac{18}{2} = 9$
Greatest coefficient = $C(n, r) = C(18, 9)$

36.(a) Squaring and adding, we get
$x^2 + y = a^2$ (circle)

37.(a) It is obvious.

38.(d) Length at major axis = 2a
$= 2 \times 5 = 10$

39.(d) $(\vec{i} + \vec{j} + \vec{k}) \cdot \frac{2\vec{i} + \vec{j} + \vec{k}}{\sqrt{6}} = \frac{2 + 1 + 1}{\sqrt{6}}$

40.(b) $a = 2b\left(\frac{a^2 + b^2 - c^2}{2ab}\right)$
$c^2 = b^2$
$\boxed{c = b}$

41.(b) $A = 2ab$
$= 24.3$
$= 24$ sq. units

42.(c) $\cos^2\theta + \sec^2\theta = (\cos\theta - \sec\theta)^2 + 2\cos\theta\sec\theta$
$= (\cos\theta - \sec\theta)^2 + 2 \geq 2$

43.(d) Put $\cot^{-1}x = \theta$
$\cot\theta = \frac{x}{1} = \frac{b}{p}$
$h = \sqrt{1 + x^2}$
Now, $\sin\theta = \frac{1}{\sqrt{1 + x^2}}$

44.(d) $a^2 = 9, b^2 = 16$ $(b > a)$
$e = \sqrt{1 - \frac{a^2}{b^2}} = \frac{\sqrt{7}}{4}$
Foci = $(0, \pm be) = (0, \pm\sqrt{7})$

45.(b) $2x + 4y - 4z + 10 = 0$
$2x + 4y - 4z + 1 = 0$
Distance = $\left|\frac{d_1 - d_2}{\sqrt{a^2 + b^2 + c^2}}\right| = \frac{9}{6} = \frac{3}{2}$

46.(c) $(2 - k)x + (k - 3)y + 5k + 4 = 0$
For horizontal line, slope = 0
i.e. $-\frac{2 - k}{k - 3} = 0$
$\therefore$ $k = 2$

47.(c) Centre = (2, 3)
Let other end be (x_1, y_1)
So, $2 = \frac{x_1 + 3}{2}$, $3 = \frac{y_1 + 4}{2}$
$\therefore$ $x_1 = 1, y_1 = 2$
Other end = (1, 2)

48.(a) $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = |\vec{a}|^2 |\vec{b}|^2$
or, $144 = 3^2 (|\vec{b}|^2)$ $\therefore$ $|\vec{b}| = 4$

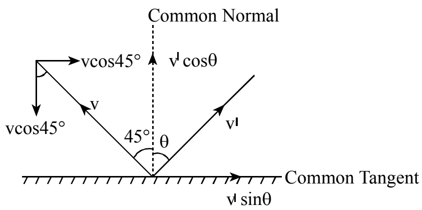
49.(a)	50.(c)	51.(d)	52.(c)	53.(d)	54.(c)
55.(d)	56.(a)	57.(a)	58.(c)	59.(d)	60.(b)

Section – II

61.(c) $\vec{r} = (1 - \alpha t)t\vec{A} = (t - \alpha t^2)\vec{A}$
At time t_0, $\vec{r} = 0$, $t_0 = \frac{1}{\alpha}$
At $t = t_0$; $\vec{v} = -\vec{A}$

62.(a) Retardation, $a = \mu g = 0.5 \times 10 = 5$
Stopping distance, $S = \frac{v^2}{2a} = \frac{2^2}{2 \times 5} = 0.4$ m

63.(a)



$1 \Rightarrow$ particle
$2 \Rightarrow$ ground
$(v_2 = 0, v_2 = 0)$

$v'\sin\theta = v\sin 45° = \frac{v}{\sqrt{2}}$ ……. (i)

$e = \left(\frac{v_2 - v_1}{u_1 - u_2}\right)$ along common normal

$e = \frac{0 - v'\cos(\uparrow)}{v\cos 45° (\downarrow)} = \frac{v'\cos\theta}{v\cos 45°}$

$'v'\cos\theta = ev\cos 45° = \frac{1}{\sqrt{2}} \times v \times \frac{1}{\sqrt{2}} = \frac{v}{2}$ … (ii)

Solving (i) & (ii) we get

$v' = \sqrt{\left(\frac{v}{2}\right)^2 + \left(\frac{v}{\sqrt{2}}\right)^2} = \frac{\sqrt{3}}{2}v$

64.(a) $v = \sqrt{\frac{GM}{r}} = \sqrt{\frac{GM}{R + R}} = \sqrt{\frac{GM}{2R}}$
$\therefore$ $KE = \frac{1}{2}mv^2 = \frac{1}{2}m\frac{gR^2}{2R} = \frac{1}{4}mgR$

65.(c) $d\omega = Pdv$
$= 10^5 (1671 - 1) \times 10^{-6}$
$= 167$ J $= 40$ cals
$\therefore$ $du = dQ - d\omega$
$= 540 - 40 = 500$ cals

66.(a) $Q = \int_0^{10} dQ = \int_0^{10} msd\theta$
$= \int_0^{10} \times 0.6\theta^2 d\theta$
$= 6\left(\frac{\theta^3}{3}\right)^{10} = 2(10^3 - 0^3) = 2000$ cal

67.(a) $y = r\sin\omega t$
or, $\frac{r}{2} = r\sin\omega t$
or, $\sin30 = \sin\omega t$
or, $30 \times \frac{\pi}{180} = \frac{2\pi}{T} . t$
or, $t = \frac{T}{12} = \frac{12}{12} = 1s$

68.(b) $C = C'$
or, $\frac{\varepsilon_0 A}{d} = \frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{\varepsilon_r}\right) + 3.5 \times 10^{-5}}$
or, $d = d - 4 \times 10^{-5}\left(1 - \frac{1}{\varepsilon_r}\right) + 3.5 \times 10^{-5}$
or, $4 \times 10^{-5}\left(1 - \frac{1}{\varepsilon_r}\right) = 3.5 \times 10^{-5}$
or, $4 - \frac{4}{\varepsilon_r} = 3.5$
or, $\frac{4}{\varepsilon_r} = 0.5$ or, $\varepsilon_r = \frac{4}{0.5} = 8$

69.(b) $I = \frac{2E}{3 + 2r} = \frac{E}{3 + \frac{r}{2}}$
or, $\frac{2}{3 + 2r} = \frac{1}{3 + \frac{r}{2}}$
or, $6 + r = 3 + 2r$ or, $r = 3\Omega$

70.(b) $\frac{V^2}{R} = mL_f$
or, $m = \frac{210^2}{50 \times 80 \times 4200} = 2.6 \times 10^{-3}$ kg = 2.6 g

71.(a) $B_a = \frac{1}{8} B_c$
or, $\frac{\mu_0 NIR^2}{2(R^2 + x^2)^{3/2}} = \frac{1}{8} \times \frac{\mu_0 NI}{2R}$
or, $8R^3 = (R^2 + x^2)^{3/2}$
or, $2R = (R^2 + x^2)^{1/2}$
or, $4R^2 = R^2 + x^2$
or, $x^2 = 3R^2$
or, $x = \sqrt{3}\, R$

72.(b) $x = 1.5\ \beta = 1.5 \frac{D\lambda}{d}$
$= \frac{1.5 \times 1 \times 6.5 \times 10^{-7}}{10^{-3}}$
$= 9.75 \times 10^{-4}$ m = 0.975 mm

73.(c) $E = \frac{hc}{\lambda} = \frac{6.62 \times 10^{-34} \times 3 \times 10^8}{975 \times 10^{-10}} = 12.73$ eV
Here $E_n = E_1 + E$
$= -13.6 + 12.73 = -0.87$ eV
Now, $E_n = -\frac{13.6}{n^2}$
or, $n = \sqrt{\frac{13.6}{0.87}} = 4$

74.(d) 206g of Pb^{206} is formed from 238g
3xg of Pb^{206} is formed from $= \frac{238}{206} \times 3x$
$= 3.47x$
Total mass $(m_0) = 4x + 3.47x$
$= 7.47x$
$m = 4x$
Now $\frac{m}{m_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$
or, $\frac{4}{7.47} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$
or, $t = \frac{ln\left(\frac{4}{747}\right)}{ln\left(\frac{1}{2}\right)} \times 4.5 \times 10^9$
$= 4 \times 10^9$ years

75.(b) 80g of NH_4NO_3 contains 6.023×10^{23} no. of NO_3^-
80g of NH_4NO_3 contains $\frac{6.023 \times 10^{23} \times 8}{80}$
$= 6.023 \times 10^{22}$
$[NH_4NO_3 = 14 + 4 + 14 + 48 = 80]$

76.(c) $\frac{\text{Mass of metal oxide}}{\text{Mass of metal chloride}}$
$= \frac{\text{Ew of metal + Ew of O}}{\text{Ew of metal + Ew of Cl}}$
$= \frac{3}{5} = \frac{E + 8}{E + 35.5}$
$5E + 40 = 3E + 106.5$
$2E = 66.5$
$E = 33.25$

77.(c) pH = 2, $H^+ = 10^{-2}$ M
Diluted 10 times $= \frac{10^{-2}}{10} = 10^{-3}$
pH $= -\log [10^{-3}] = 3$

78.(c) $\frac{\text{Volume of } CO_2 \text{ at STP}}{\text{Eq. volume of } CO_2 \text{ at STP}} = \frac{V \times N}{1000}$
$\frac{224}{11200} = \frac{100 \times N}{1000}$ $\therefore$ $N = \frac{1}{5}$

79.(d) Eq. wt. of acid $= \frac{\text{wt. of Al salt} \times 9}{\text{wt. of Al}} - 8$
$= \frac{21.3 \times 9}{2.7} - 8 = 63$

80.(c) The gas formed is Cl_2 and gives a mixture of NaCl and $NaClO_3$ with hot and conc. NaOH
$4HCl + MnO_2 \rightarrow Cl_2 + MnCl_2 + 2H_2O$
$3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$

81.(b) The gas is acetylene which on catalytic hydration gives vinyl alcohol which rearranges forming acetaldehyde.
$CaC_2 + H_2O \longrightarrow C_2H_2 + Ca(OH)_2$
$$HC \equiv CH \xrightarrow[HgSO_4]{dil.\ H_2SO_4} CH_2 = \underset{}{\overset{OH}{\overset{|}{C}}}H \longrightarrow \underset{\text{acetaldehyde}}{CH_3 - \overset{O}{\overset{||}{C}} - H}$$

82.(b) $\int_0^{\pi/2} e^x(\sin x + \cos x)\,dx = [e^x \sin x]_0^{\pi/2}$
$= e^{\pi/2}.\sin\frac{\pi}{2} - e^0\sin 0 = e^{\pi/2}$

83.(d) $f'(x) = |\sin x|$
$f'\left(\frac{3\pi}{4}\right) = \left(\sin\frac{3\pi}{4}\right) = \frac{1}{\sqrt{2}}$

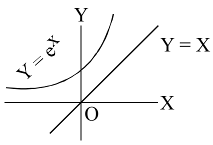
84.(a) Put $\cos^{-1}x = \theta$
$\cos\theta = \frac{x}{1} = \frac{b}{h}$
$P = \sqrt{1-x^2}\,\sin\cot^{-1}\tan\theta = \sin\cot^{-1}\frac{\sqrt{1-x^2}}{x}$
Put $\cot^{-1}\frac{\sqrt{1-x^2}}{x} = \beta$ and find $\sin\beta$

85.(b) $2s = 2r_1$ $\quad s = s\tan\frac{A}{2}$
$\tan 45 = \tan\frac{A}{2}$ $\quad A = 90°$ (Rt. angled Δ)

86.(a) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} + 2$
$= \frac{w}{w^2} + \frac{w^2}{w} + 2$
$= \frac{1}{w} + w + 2 = (w^2 + w) + 2 = -1 + 2 = 1$

87.(b) $3\alpha + 4\alpha = -\frac{q}{p}$
$\alpha = -\frac{q}{7p}$ and $(3\alpha.4\alpha) = \frac{r}{p}$
$12\left(-\frac{q}{7p}\right)^2 = \frac{r}{p}$
$\boxed{12q^2 = 49pr}$

88.(a) $114 + \frac{2}{8} + \frac{3}{16} + \frac{4}{32} + \ldots\ldots.. \infty$
Let p = 2
Taking: $s_\infty = \frac{1}{4} + \frac{2}{8} + \frac{3}{6} + \ldots\ldots. \infty$
Using: $s_\infty = \frac{a}{1-r} + \frac{d.r}{(1-r)^2}$
We get, $s_\infty = 1$ $\quad$ So, $p = 2' = 2$

89.(a)


From the graph
No solution
i.e. $(P \cap Q) = \phi$

90.(c) Coplanar if: $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0$
On expanding: $\boxed{abc + 2 = a + b + c}$

91.(d) $t_n = \frac{2 + 4 + 6 + \ldots\ldots + n \text{ terms}}{n!}$
$= \frac{n(n+1)}{n(n-1)!} = \frac{(n-1)+2}{(n-1)!}$
$= \frac{1}{(n-1)!} + \frac{2}{(n-1)!}$
Putting n = 1, 2, 3 …… and adding
Sum = e + 2e = 3e

92.(c) An solving: $(2x + \lambda)^2 = 2x$
$4x^2 + 2x(2\lambda - 1) + \lambda^2 =$
Does not intersect if
$b^2 - 4ac < 0$
$[2(2\lambda - 1)]^2 - 4.4\,\lambda^2 < 0$ $\quad \lambda > \frac{1}{4}$

93.(a) $10 - \alpha > 0$ and $\alpha - 4 > 0$ $\quad \Rightarrow\ \alpha < 4$

94.(d) Equation of tangent is $y = \frac{1}{t}x + at$
Slope of tangent $= \frac{1}{t}$
Slope of normal $= -t$

95.(a) $m_1 + m_2 = -\frac{2h}{b} = \frac{k}{3}$
$m_1m_2 = \frac{a}{b} = -\frac{1}{3}$
By question, $\frac{k}{3} = 2\left(-\frac{1}{3}\right)$
$\Rightarrow\ k = -2$

96.(d) D.C's are $\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}$
$\therefore\ r = 9$
Coordinates = (lr, mr, nr)
$= \left(\frac{2}{3} \times 9, \frac{1}{3} \times 9, -\frac{2}{3} \times 9\right)$
= (6, 3, –6)
or, OP = 9 is given by only (d).

97.(d) $\quad$ 98.(c) $\quad$ 99.(b) $\quad$ 100.(a)

…The End…