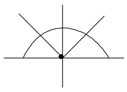
Section – I

1.(a) $A^{-1}(A^2 - A + I) = A^{-1}\,0 = 0$
or, $A - I + A^{-1} = 0$
$A^{-1} = I - A$

2.(b)



3.(b) $\lim\limits_{n \to \infty} \dfrac{n(n+1)}{2n^2} = \lim\limits_{n \to \infty} \dfrac{\left(1 + \frac{1}{n}\right)}{2}$
$= \dfrac{1}{2}$

4.(c) $t_3 = 4 = a + 2d$
$S_5 = \dfrac{5}{2}[2a + 4d]$
$= 5(a + 2d)$
$= 20$

5.(d) $y^2 = |x|^2 = x^2$
$2y\dfrac{dy}{dx} = 2x$
$\dfrac{dy}{dx} = \dfrac{x}{|x|}$

6.(a) $x^2 = -9 \Rightarrow x = \pm 3i \to$ Imaginary

7.(d) $(1 + x)^n = {}^nc_0 + {}^nc_1x + {}^nc_2\,x^2 + ... + {}^nc_n\,x^n$
Put x = 4;
$5^n = {}^nc_0 + 4.{}^nc_1 + 4^2\,{}^nc_2 + ... + 4^n\,{}^nc_3$

8.(d) Centre; $(-g, -f) = (-3, 3)$
$2x - y + k$ passes through $(-3, 3)$
or, $-2 \times 3 - 3 + k = 0$
$k = 9$

9.(d) $|k|\,|\vec{a}| = 1$
$|k| = \dfrac{1}{|\vec{a}|}$
$\therefore\ k = \dfrac{1}{\pm|\vec{a}|}$

10.(b) $\tan^2\theta + \dfrac{1}{\tan^2\theta} = 2$
$\tan^2\theta = 1 = \tan^2\dfrac{\pi}{4}$
$\theta = n\pi \pm \dfrac{\pi}{4}$

11.(a) xy will be maximum
When x = y
$\therefore\ x = y = 6$

12.(a) Direction cosines are
$\dfrac{a}{\sqrt{a^2 + b^2 + c^2}}, \dfrac{b}{\sqrt{a^2 + b^2 + c^2}}, \dfrac{c}{\sqrt{a^2 + b^2 + c^2}}$

13.(a) $i^n(1 + i + i^2 + i^3)$
$= i^n(1 + i - 1 - i) = 0$

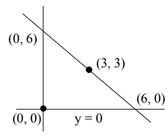
14.(b) $\cos^{-1}x = \dfrac{\pi}{2} - \cos^{-1}y = \sin^{-1}y$
$\cos^{-1}x = \cos^{-1}\sqrt{1 - y^2}$
or, $x^2 + y^2 = 1$

15.(c) ${}^8c_2 - {}^3c_2 + 1 = 26$

16.(c) Put $x = \sin\theta$
$y = \sin^{-1}(\sin 3\theta) = 3\sin^{-1}x$
$\dfrac{dy}{dx} = \dfrac{3}{\sqrt{1 - x^2}}$

17.(d) $= \int x^9 dx = \dfrac{x^{10}}{10} + c$

18.(c)



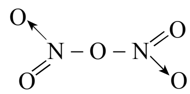
$x + y = 6$
Circumcentre – mid point of hypotaneous
$\left(\dfrac{0 + 6}{2}, \dfrac{6 + 0}{2}\right) = (3, 3)$

19.(b) $5 - x > 0$
$x < 5$
$x \in (-\infty, 5)$

20.(a) $R = f(k) = 6k^2 - k - 2 = 0$
$k = -\dfrac{1}{2}, \dfrac{2}{3}$

21.(d) HXO_3^-
$x + 1 - 2 \times 3 = -1$
$x = +4$

22.(b) **Structure**



23.(c) At. No. = 24, element chromium 4th period, d-block, VI B group.

24.(c)

25.(a) Which gives 1 mole of cation or anion.

26.(a) Electron releasing group.

27.(b)

28.(d) Composition Fe, Ni & Cr

29.(a) An acid salt ($NaHCO_3$) can not exist with a base ($NaOH$) in a solution.

30.(a) $Mg + 2HNO_3 \to Mg(NO_3)_2 + H_2$

31.(d) $SO_2 + H_2S \to H_2O + S\downarrow$ ppt

32.(c) $x = at^2 - bt^3$
$v = \dfrac{dx}{dt} = 2at - 3bt^2$
and $a = \dfrac{dv}{dt} = 2a - 6bt$

or, $0 = 2a - 6bt$

$t = \frac{2a}{6b} = \frac{a}{3b}$

33.(d) $F = \frac{YAl}{L} = Kl$

$K = \frac{YA}{L}$

34.(c) In myopia, image is formed infront of retina.

35.(a) $E_k = \frac{3}{2}k_BT$ at T = OK

$\Rightarrow \quad E_k = 0$

36.(a) Velocity of sound is independent of change in pressure.

37.(a) When light passes through glass slab then its velocity decreases so wavelength decreases.

38.(b) $E = \frac{V}{d} = \frac{Q}{Cd}$

On introducing dielectric slab capacitance increases so electric field intensity decreases.

39.(b) Stream of proton at as parallel conductor carrying current in same direction so they attract each other.

40.(a) To emit x-ray energy difference between two energy level must lie in x-ray region.

41.(b) $\frac{V_{out}}{V_{in}} = \frac{I_cR_c}{I_bR_b}$

or, $\frac{3}{0.01} = \beta \times \frac{R_c}{1000}$

$\Rightarrow \quad R_c = 3000\ \Omega = 3\ K\Omega$

42.(a) $R = \sqrt{(2p)^2 + 2.2p\sqrt{2}\ p\cos\theta + (\sqrt{2}\ p)^2}$

or, $(\sqrt{10}p)^2 = 4p^2 + 4\sqrt{2}\ p^2\cos\theta + 2p^2$

or, $\cos\theta = \frac{1}{\sqrt{2}} = \cos45°$

$\therefore \quad \theta = 45°$

43.(c) $a = \frac{g\sin\theta}{1 + R^2/R^2} = \frac{g\sin30°}{1+1} = \frac{g}{4}$

44.(c) $m_T = m_0 \times m_e$

$= 25 \times 6 = 150$

45.(d) Sound can be identified by overtones.

46.(c) $V_1 = V$ $\qquad r_1 = 10$ cm

$V_2 = ?$ $\qquad r_2 = 10 + 5 = 25$ cm

$\frac{V_2}{V_1} = \frac{r_1}{r_2} = \frac{10}{25} = \frac{2}{5}$

$V_2 = \frac{2V}{5}$

47.(b) $Bqv = \frac{mv^2}{r}$

$Bqr = mv$ .... (1)

Here $\frac{Bq}{2}r' = m \times 2v$ .... (2)

Dividing (2) by (1)

$\frac{r'}{2r} = 2 \Rightarrow r' = 4r$

48.(c) $\frac{1}{\lambda_l} = R\left[\frac{1}{1} - \frac{1}{4}\right]$

$\lambda_l = \frac{4}{3R}$ .... (1)

For Balmer series

$\frac{l}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\lambda_B = \frac{36}{5R}$ ..... (2)

Now $\frac{\lambda_B}{\lambda_C} = \frac{36}{5R} \times \frac{3R}{4}$

$\lambda_B = \frac{27}{5} \times 1215\ Å = 6561\ Å$

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

Section – II

61.(d) $e^x = e^{-x}$

$e^{2x} = 1 = e^0$

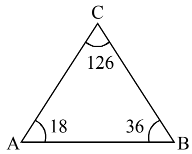
$\therefore \quad x = 0$

and $y = e^0 = 1$

$\therefore \quad n(A \cap B) = 1$

62.(b) $x + 2x + 7x = 180$

or, $x = 18$



Angles are 18°, 36°, 126°

A B C

$\frac{\text{greatest side (c)}}{\text{least side (a)}} = \frac{2R\sin C}{2R\sin A}$

$= \frac{\sin126°}{\sin18°} = 2.61$

(Check option)

63.(b) $t_2 = {}^nc_1$; $t_3 = {}^nc_2$; $t_4 = {}^nc_3$

(Coefficient)

${}^nc_2 = \frac{{}^nc_1 + {}^nc_3}{2}$

Check with option.

64.(c) For 2α, 2β roots

$f\left(\frac{x}{2}\right) = 0$

or, $7\left(\frac{x}{2}\right)^2 - 4\left(\frac{x}{2}\right) + 3 = 0$

$7x^2 - 8x + 12 = 0$

65.(d) $(-2\omega)^6 + (-2\omega^2)^6$ $\quad [\because 1 + \omega + \omega^2 = 0]$

or, $64\omega^6 + 64\omega^{12}$

or, $64(\omega^3)^2 + 64(\omega^3)^4$

$= 64 + 64 = 128$

66.(a) $I_1 + I_2 = \int_0^{\pi/4} (\sin^2x + \cos^2x)\,dx$

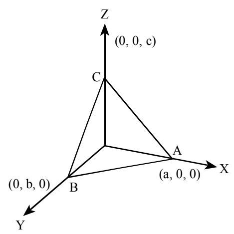
$= [x]_0^{\pi/4} = \frac{\pi}{4}$

$\therefore \quad I_1 = \frac{\pi}{4} - I_2$

67.(a) $c = \frac{a}{m}$

or, $c = \frac{4}{2} = 2$

68.(a)



$\frac{a + 0 + 0}{3} = \alpha \Rightarrow a = 3\alpha$

Similarly $b = 3\beta$

and $c = 3\gamma$

Eq^n: $\frac{x}{3\alpha} + \frac{y}{3\beta} + \frac{z}{3\gamma} = 1$

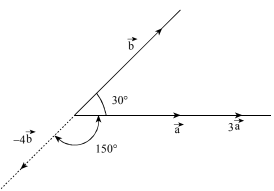
69.(c) In x-axis; y = 0

So, $4x - x^2 - 3 = 0$

or, $x = 1, 3$

$\int_1^3 (4x - x^2 - 3)\,dx = \frac{4}{3}$

70.(a)



71.(a) $a + b = 0$

72.(a) $\int \frac{1 - \sin x}{1 - \sin^2x}\,dx$

$= \int \frac{1 - \sin x}{\cos^2x}\,dx$

$= \int (\sec^2x - \sec x \tan x)\,dx$

$= (\tan x - \sec x) + c$

73.(c) Perform $R_2 \to R_2 - R_1$

$R_3 \to R_3 - R_1$

$\therefore \quad \Delta = \begin{vmatrix} 1 & 1 & 1 \\ 0 & \sin\theta & 0 \\ 0 & 0 & \cos\theta \end{vmatrix}$

$= \sin\theta.\cos\theta$

$\Delta = \frac{1}{2}\sin 2\theta$

Max. value of $\Delta = \frac{1}{2}$

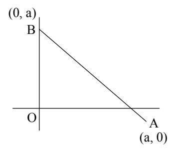
74.(c) $\sin^{-1}y = \frac{\pi}{2} - \sin^{-1}x = \cos^{-1}x$

$= \sin^{-1}\sqrt{1 - x^2}$

$\therefore \quad y = \sqrt{1 - x^2}$

$\frac{dy}{dx} = \frac{1}{2\sqrt{1 - x^2}} \times (-2x) = -\frac{x}{y}$

75.(c)



Intercept: $AB = \sqrt{2}\,a$

and $A'B' = \sqrt{2}\,ar$ ... and so on.

Sum $= \sqrt{2}\,a + \sqrt{2}\,ar + \ldots\ldots$

$= \sqrt{2}\,a\,(1 + r + r^2 + \ldots\ldots)$

$= \sqrt{2}\,a.\,\frac{1}{1 - r}$

$= \sqrt{2}\,a \times \frac{1}{\left(1 - \frac{1}{2}\right)} = 2\sqrt{2}\,a$

76.(a) $Na_2SO_4 \longrightarrow 2Na^+ + SO_4^{--}$

$H_2O \longrightarrow H^+ \quad + \quad OH^-$

$\downarrow \qquad \downarrow$

castrode anode

(H_2) (O_2)

more tendency to get reduce | more tendency to get oxidize

77.(b) N wt of NaH_2PO_4 & volume of NaOH

$\frac{W}{E} = \frac{V \times N}{1000}$

$\frac{12}{60} = \frac{V \times 1}{1000} = 200$ ml

78.(c) For ppt^n

$K_{ip} > K_{sp}$

79.(d) $3BaCl_2 + 2Na_3PO_4 \to Ba_3(POH)_2 + 6NaCl$

3 mole 2 mole

0.5 mole $\frac{2}{3} \times 0.5 = 0.33$ mole Na_3POH

0.2 mole Na_3PO_4 limiting

Thus 2 mole Na_3PO_4 gives 1 mole $Ba_3(POH)_2$

0.2 mole Na_3PO_4 gives 0.1 mole $Ba_3(POH)_2$

80.(c) $CH_3 - C \equiv C - CH_3$ but-2-yne does not contain Acidic Hydrogen.

81.(b) $Cu_2O + Cu_2S \rightarrow Cu + SO_2$

82.(d) IF_7

$1 + 7 = 8$

83.(a) $mv\cos\theta = -\frac{m}{2} v\cos\theta + \frac{m}{2} v'$

$\frac{3mv\cos\theta}{2} = \frac{mv'}{2}$

$v' = 3v\cos\theta$

84.(a) $v = \sqrt{2gh}$

volme/sec = Av

$= 10^{-4} \times \sqrt{2 \times 10 \times 5}$

$= 10^{-3}\ m^3/sec$

85.(b) The speed of child observed by stationary observer in platform is

$v = (9 + 4.5)$ km/hr

$= \frac{13.5 \times 1000}{3600}$

$= 3.75$ m/s

86.(a) Dew point $= \frac{4.6 + 5.4}{2} = 5°C$

$R.H. = \frac{\text{SVP at dew point}}{\text{SVP at room temperature}}$

$= \frac{6.8}{17.6} \times 100\% = 37\%$

87.(c) 1^{st} case $\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100\%$

or, $\frac{40}{100} = 1 - \frac{T_2}{T_1}$

or, $\frac{T_2}{800} = 1 - \frac{2}{5} = \frac{3}{5}$

$T_2 = 480$ K

2^{nd} case $\eta_2 = \left(1 - \frac{T_2'}{T_1}\right) \times 100\%$

$T_2' = 400K$

$\therefore$ Temperature of sink should be decreased $= T_2 - T_2' = 80$ K

88.(d) $I = \frac{P}{A} = \frac{200\pi}{4\pi \times 10^2} = 0.5\ w/m^2$

$L = 10\log\left(\frac{I}{I_0}\right) = 10\log\left(\frac{0.5}{10^{-12}}\right) = 117$ db

89.(b) $\omega = \frac{\delta_B - \delta_R}{\frac{\delta_B + \delta_R}{2}} = \frac{2}{11}$

$\omega' = \frac{\delta_B' - \delta_R'}{\frac{\delta_B' + \delta_R'}{2}} = \frac{2}{9}$

$\frac{\omega}{\omega'} = \frac{2}{11} \times \frac{9}{2} = \frac{9}{11}$

90.(c) $\Delta U = \frac{C_1C_2(V_1 - V_2)^2}{2(C_1 + C_2)}$

$= 0.0375$ J

91.(b) $L = 2\pi R \Rightarrow R = \frac{L}{2\pi}$

$M = IA = I \times \pi R^2 = \frac{IL^2}{4\pi}$

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

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

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

$= 2.5\frac{D\lambda}{d}$

$= \frac{2.5 \times 1 \times 6.5 \times 10^{-7}}{10^{-3}} = 1.63 \times 10^{-3}$ m $= 1.63$ mm

$= 2.5\frac{\lambda}{d} = 1.63$ mm

94.(c) N.P. = 50 cm

u = 25 cm, v = –50 cm

$f = \frac{uv}{u + v} = \frac{25\ (-50)}{25 - 50} = 50$ cm

95.(c) $V_2 - V_1 = \frac{hc}{c}\left(\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right)$

or, $V_2 = V_1 + \frac{hc}{c}\left(\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right)$

$= 0.18 + \frac{6.62 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19}}$

$\left(\frac{1}{180 \times 10^{-9}} \frac{1}{550 \times 10^{-9}}\right)$

$= 4.8$ V

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

$m_u = 4x,\ m_{pb} = 3x$

206 gm is formed from 238 gm of U

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

$= 3.466x$ gm

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

$\frac{m}{m_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$

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

$t = T_{1/2} \times \frac{ln\left(\frac{4}{7.45}\right)}{ln\ 0.5} = 4 \times 10^9$ yrs.

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

…The End…