**Section - I**

1.(b) Configuration of will be $Cu^{2+}$: $1s^2, 2s^2\ 2p^6, 3s^2\ 3p^6\ 3d^9$

2.(d) The emission spectrum of hydrogen atom in visible region consists of a series of lines that are closer at higher energies.

3.(b) PV = nRT
Constant = n, T, R
$P_1 V_1 = P_2 V_2$
$10 \times 1 = 1 \times V_2$
$V_2 = 10$ml

4.(a) For the given equilibrium $H_2O(s) \rightleftharpoons H_2O(l)$
By increasing pressure over the system melting point of ice will decrease and amount of water will increase.

5.(c) Acidic buffer having pH = pKa has maximum buffer capacity.

6.(a) Cs is used in photoelectric cells because of low ionization enthalpy as electrons could be emitted very easily when exposed to light.

7.(a) Actually, $PH_3$ is formed there along with acetylene under the reaction of $Ca_3P_2$ with $CaC_2$ where, the phosphene reacts with acetylene formed and catches fire to get smoke which forms the smoke screen.

8.(d) Leaching method is used to concentrate the ores of gold, silver, aluminium, etc.

9.(b) $C_2H_4$ decolorizes alkaline $KMnO_4$ solution.
Alkaline $KMnO_4$ (Bayer's reagent) oxidizes ethylene to ethylene glycol and itself is reduced to $MnO_2$.

10.(d)

11.(d)

12.(d) The electric lines of force cannot enter the metallic sphere as electric field inside the solid metallic sphere is zero. The electric field is always perpendicular to the surface of a conductor. On the surface of a metallic solid sphere, the electrical field is oriented normally (i.e. directed towards the centre of the sphere).

13.(b) $KE = \frac{GMm}{2r}$ i.e. $KE \propto r^{-1}$
& $KE \propto T^{-n}$ & $T^2 \propto r^3$
$r \propto T^{2/3}$
Hence $r^{-1} \propto T^{-n}$
or, $r \propto T^n$
$\therefore\ n = \frac{2}{3}$

14.(a) $A_1v_1 = A_2v_2$
or, $\frac{\pi d_1^2}{4} v_1 = \frac{\pi d_2^2 v_2}{4}$
or, $2^2 \times v_1 = 4^2 \times v_2$
or, $v_1 = 4v_2$

15.(c) $v \propto r^2$
$\therefore\ \frac{v'}{v} = \left(\frac{2r}{r}\right)^2 = 4$
$\therefore\ v' = 4v$
Hence for r' = 2r

16.(a) Tension must be the same in both the rods for their junction to be in equilibrium.
$Y_1A\alpha_1\theta = Y_2A\alpha_2\theta \Rightarrow Y_1\alpha_1 = Y_2\alpha_2$

17.(a) 2.54 contain the least significant figures of 3
97.52/2.54 = 38.393 = 38.4

18.(a) $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
or, $\frac{P_2}{P_1} = \frac{T_2}{T_1} = 2$
% increase $= \left(\frac{P_2}{P_1} - 1\right) \times 100\%$
$= (2 - 1) \times 100\%$
$= 100\%$

19.(b) $\frac{C}{100} = \frac{R - LFP}{UFP - LFP}$
or, $\frac{C}{100} = \frac{60 + 5}{95 + 5} = \frac{65}{100}$
$\therefore\ C = 65°C$

20.(b) $C = \frac{\varepsilon_0 A}{d}$
$C' = \frac{\varepsilon_0 A}{d - \frac{d}{2}\left(1 - \frac{1}{\varepsilon_r}\right)} = \frac{\varepsilon_0 A}{d - \frac{d}{2}} = \frac{2\varepsilon_0 A}{d} = 2C$

21.(d) Side of square loop, l=10cm=0.1m
Rate of change of magnetic field, $\frac{dB}{dt} = 1\ T\ s^{-1}$
$E = \frac{d\phi}{dt} = \frac{d(BAN)}{dt} = NA\frac{dB}{dt} = 500 \times 0.1^2 \times 1 = 5V$

22.(a) The charge passing through any cross section per unit time remain same i.e. current remain same.

23.(d) If the refractive index of the body becomes equal to surrounding liquid, there will not be any deviation in the direction of light neither will any light get reflected from its surface. So, the object becomes invisible.

24.(a) Interference in light waves is just a re-distribution of energy, depending on exactly which parts of the light wave overlap at each point in space. The pattern of light you see is then determined by the geometry.

25.(a) $P = I^2R = \frac{E^2}{(R + r)^2} R$
E is constant and (R + r) increases rapidly then P ↓

26.(d) $eV_s = hf - \phi$

27.(d) The forbidden energy gap in Ge is 0.7V.

28.(c) Let wire 1 lie along x-axis and wire 2 lie along y-axis. If at point (x,y) magnetic field is zero.
Then $\frac{\mu_0 i_1}{2\pi y} - \frac{\mu_0 i_2}{2\pi x} = 0 \Rightarrow y = \frac{i_1}{i_2} x$
Which is a straight line passing through the origin.

29.(d) A = {–2, 2}
$B = \{x : x^2 = 4\}$
B = {2, –2}
Hence, they are equal sets.

30.(a) $\cos\theta = \frac{(\vec{i} + \vec{j} + \vec{k}).(\vec{i} - \vec{j} - \vec{k})}{\sqrt{1^2 + 1^2 + 1^2}.\sqrt{1^2 + (-1)^2 + (-1)^2}}$
$= -\frac{1}{\sqrt{3}\sqrt{3}} = -\frac{1}{3}$

31.(d) If x > 0, then $\lim_{x \to 0^+} \frac{x}{x} = 1$
If x < 0, then $\lim_{x \to 0^-} \left(-\frac{x}{x}\right) = -1$
Since, RHL ≠ LHL limit does not exist.

32.(a) $y = \sinh^{-1}x + \cosh^{-1}x$
$\frac{dy}{dx} = \frac{1}{\sqrt{1 + x^2}} + \frac{1}{\sqrt{x^2 - 1}}$

33.(b) $\frac{dy}{dx} = 0$ $\quad 2x - 2 = 0 \quad \therefore\ x = 1$
Putting x = 1, we get y = ±2

34.(d) Minimum value of $x = -\frac{b}{2a} = -\frac{8}{2} = -4$
Minimum value = 16 – 32 + 17 = 1

35.(a) $\cot^{-1}\left(\tan\frac{\pi}{7}\right) = \cot^{-1}\left(\cot\left(\frac{\pi}{2} - \frac{\pi}{7}\right)\right) = \frac{7\pi - 2\pi}{14} = \frac{5\pi}{14}$

36.(c) Skew symmetric matrix

37.(c) Inverse of a function exists if it is bijective.

38.(d) Since, $1^2 + (-1)^2 + 1^2 \neq 1$

39.(b)

40.(d) $\frac{dy}{dx} = \frac{d}{dx}\sin\frac{1}{x} = \frac{d\sin\left(\frac{1}{x}\right)}{d\left(\frac{1}{x}\right)}\frac{dx^{-1}}{dx} = -\frac{1}{x^2}\cos\frac{1}{x}$

41.(c) $\int\left(x + \frac{1}{x}\right)dx = \int x\,dx + \int\frac{1}{x}dx = \frac{x^2}{2} + \log x + c$

42.(a) g = a, f = 0, c = 0
Radius $= \sqrt{g^2 + f^2 - c}$
$= a$

43.(b) $x = \frac{t}{4}$
or, $t = 4x$ ... (i)
And, $y = \frac{t^2}{4}$
$y = \frac{(4x)^2}{4}$ $\quad x^2 = \frac{1}{4}y$
It is a parabola

44.(d) Greatest side is 7
The greatest angle is
$\cos\theta = \frac{3^2 + 5^2 - 7^2}{2.3.5} = -\frac{1}{2} = \cos120°$
$\therefore$ $\theta = 120°$
So, it is obtuse angled Δ.

45.(b) f(x) = cos4x + tan3x
$f(x + \pi) = \cos(4(x + \pi) + \tan3(x + \pi)$
$= \cos(4x + 4\pi) + \tan(3x + 3\pi)$
$= \cos4x + \tan3x$
$\therefore$ The period of f(x) is π.

46.(d) $A = \frac{G^2}{H}$

47.(c) (1 – i)
Here, $r = \sqrt{1^2 + (-1)^2} = \sqrt{2}$
$\tan\theta = \frac{x}{y} = -\frac{1}{1} = \tan(-45°)$
$\theta = -45°$
$\therefore$ $(1 - i) = \sqrt{2}\,\{\cos(-45°) + i\sin(-45°)\}$

48.(d) $t_{n/2+1} = {}^nC_{n/2}\, a^{n/2} x^{n/2}$
$= {}^{10}C_5\left(\frac{y}{x}\right)^5\left(-\frac{x}{y}\right)^5 = -252$

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

## Section – II

61.(b) $Cu^{2+} + 2KI \longrightarrow CuI_2 + 2K^+$
$2CuI_2 \rightarrow Cu_2I_2 + I_2$

62.(c) And in presence of acidic $KMnO_4$ alkene is oxidised to form acid.
$CH_3 - CH_2 - CH = CH - CH_2 - CH_3 + (H_2O + O) \rightarrow 2CH_3CH_2COOH$
So the structure of X is
$CH_3 - CH_2 - CH = CH\;\; CH_2 - CH_3$
Since it gives two moles of same carboxylic acid on reaction with oxidizing agent potassium permanganate hence it must be symmetrical alkene. Here the only alkene in option B is symmetrical alkene.

63.(c) $Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + S + SO_2 + H_2O$

64.(a) $Ag_2CO_3(s) \rightarrow 2Ag(s) + CO_2(g) + \frac{1}{2}O_2(g)$
Molecular weight of $Ag_2CO_3$ = 276g
And, molecular weight of Ag = 2 × 108 = 216g
276g of $Ag_2CO_3$ give 216g Ag
Therefore, 2.76g of $Ag_2CO_3$ on heating will give
$\frac{216}{276} \times 2.76\text{g} = 2.16\text{g}$ Ag as residue.

65.(d) For neutral solution, $[OH^-] = \sqrt{Kw} = 10^{-8}$
$pOH = -\log(10^{-8}) = 8$

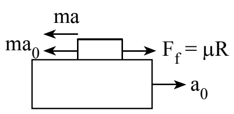
66.(a) Meq of metal = Meq of HCl
$\frac{0.9}{E} \times 1000 = 100 \times 1 \Rightarrow E = 9$

67.(c) The value of the Azimuthal quantum number always lies between 0 to n – 1. If n = 4, then l = 4 not possible.

68.(b) **Up**
$h = -ut_1 + \frac{1}{2}gt_1^2$ ...(1)
**Down**
$h = ut_2 + \frac{1}{2}gt_2^2$ ... (2)
From (1) & (2)
$-ut_1 + \frac{1}{2}gt_1^2 = ut_2 + \frac{1}{2}g_2^2$
or, $\frac{1}{2}g(t_1^2 - t_2^2) = u(t_2 + t_1)$
or, $\frac{g}{2}(t_1 + t_2)(t_1 - t_2) = u(t_2 + t_1)$
or, $x = \frac{2u}{g} = \frac{2 \times 10}{10} = 2$ sec

69.(d) F = PA
$= \frac{2T}{d} \times A = \frac{2 \times 70 \times 10^{-3} \times 10^{-2}}{0.05 \times 10^{-3}} = 28\text{N}$

70.(a)




For block
$ma_0 - F_f = ma_b$
or, $m \times 4 - \mu mg = ma_b$
or, $a_b = 4 - 0.2 \times 10 = 2\ m/s^2$
$S_b = \frac{1}{2}a_bt^2 = \frac{1}{2} \times 2 \times 1^2 = 1$m relative to ground.

71.(d) $T = \frac{1}{f} = 2\pi\sqrt{\frac{l}{g}} \Rightarrow f = \frac{1}{2\pi}\sqrt{\frac{g}{l}}$
$\frac{f_1}{f_2} = \sqrt{\frac{l_2}{l_1}} \Rightarrow \left(\frac{n}{n+1}\right)^2 = \frac{l_2}{l_1}$ $\quad \frac{l_1}{l_2} = \left(\frac{n+1}{n}\right)^2$

72.(d) $Q = nc_p dT$ for A
$Q = mc_v dT$ for B
$\therefore \quad Q = nc_p \times 30 = nc_v \times dT$
or, $\quad dT = \gamma \times 30 = \frac{7}{5} \times 30 = 42K$

73.(b) Minimum frequency will be heard, when whistle moves away from the listener.
$f_{min} = f\left(\frac{v}{v + v_s}\right)$
Where $v = r\omega = 0.5 \times 20 = 10$ m/s
$\Rightarrow \quad f_{min} = 385\left(\frac{340}{340 + 10}\right) = 374$ Hz

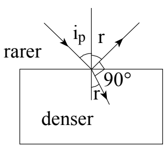
74.(c) $\bullet\rightarrow$ $\quad\bullet\rightarrow$ $\quad\bullet$
Man Bus Catch

$S_{man} - S_{bus} = 16$
or, $\quad vt - \frac{1}{2}at^2 = 16$
or, $\quad 8t - \frac{1}{2} \times 2t^2 = 16$
or, $\quad t^2 - 8t + 16 = 0$
or, $\quad (t - 4)^2 = 0$
$\quad t = 4$ sec

75.(c) 40% of $\frac{1}{2}mv^2 = msd\theta$
or, $\quad d\theta = \frac{0.4 \times 500^2}{2 \times 0.03 \times 4200} = 396°C$

76.(d) <u>1st case</u>
$\frac{I}{I_0} = e^{-\mu x}$
or, $\quad \frac{1}{8} = \frac{1}{e^{\mu x}}$
or, $\quad e^{\mu x} = 8$
or, $\quad \mu x = ln8$
or, $\quad \mu = \frac{ln8}{27}$ ...(i)
<u>2nd case</u>
$\frac{I}{I_0} = e^{-\mu x'}$
or, $\quad \frac{1}{2} = \frac{1}{e^{\mu x'}}$
or, $\quad e^{\mu x'} = 2$
or, $\quad \mu x' = ln2$
or, $\quad x' = \frac{ln2}{ln8} \times 27 = 9$ mm

77.(c) $\mu = \tan ip$
$\quad = \tan r$
$\sin c = \frac{1}{\mu} = \frac{1}{\tan r} = \cot r$
$C = \sin^{-1}(\cot r)$




78.(b) $d\sin\theta_n = n\lambda$
For max order $\sin\theta_n = 1$
$d = n\lambda$
$h = \frac{d}{\lambda} = \frac{700 \times 10^{-9}}{200 \times 10^{-9}} = 3.5 = 3$
Total no. of maxima including central maxima
$\quad = 2n + 1 = 2 \times 3 + 1 = 7$

79.(c) <u>First case</u>
$\frac{hc}{\lambda} = \phi + 6\ eV_0$ ... (1)
<u>2nd case</u>
$\frac{hc}{2\lambda} = \phi + 2eV_0$ ... (2)
From (1) & (2)
$\frac{1}{2}(\phi + 6\ eV_0) = \phi + 2eV_0$
or, $\quad \phi + 6eV_0 = 2\phi + 4eV_0$
or, $\quad \phi = 2eV_0$
From (1)
$\frac{hc}{\lambda} = \phi + 3\phi$
or, $\quad \frac{hc}{\lambda} = 4\frac{hc}{\lambda_0} \quad \therefore \lambda_0 = 4\lambda$

80.(b) $i_c = \frac{90}{100} \times i_E \Longrightarrow 10 = 0.9 \times i_E$
$i_E = 11mA$
Also, $i_E = i_c + i_B = 11 - 10 = 1$ mA

81.(c) $E = E_5 - E_1$
$\quad = -\frac{13.6}{25} + 13.6$
$\quad = 13.056$ eV
Since momentum of photon = momentum of hydrogen atom.
or, $\quad \frac{E}{C} = mv$
or, $\quad v = \frac{13.056 \times 1.6 \times 10^{-19}}{3 \times 10^8 \times 1.67 \times 10^{-27}} = 4.2$ m/s

82.(d) $f(x) = \frac{|x - 2|}{x - 2}$
When $x > 2$, then $|x - 2| = x - 2$
$f(x) = \frac{x - 2}{x - 2} = 1$
When $x < 2$, then $|x - 2| = -(x - 2)$
$4(x) = -\frac{(x - 2)}{(x - 2)} = -1$
Range = {–1, 1}

83.(b) $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$
We have, $\vec{a} + \vec{b} + \vec{c} = 0$
$\vec{b} + \vec{c} = -\vec{a}$
Squaring, $b^2 + 2\vec{b}.\vec{c} + \vec{c}^2 = a^2$
$1^2 + 2bc\cos\theta + 1^2 = 1^2$
$2\cos\theta = -1$
$\therefore \quad \cos\theta = -\frac{1}{2} \qquad$ i.e. $\theta = \frac{2\pi}{3}$

84.(d) $\int \frac{dx}{\cos x\sqrt{\cos 2x}} = \int \frac{\sec x}{\sqrt{\cos^2 x - \sin^2 x}}\, dx$
$= \int \frac{\sec x.dx}{\cos x\sqrt{1 - \tan^2 x}} = \int \frac{\sec^2 x}{\sqrt{1 - \tan^2 x}}.dx$
Let, $\quad y = \tan x$
$\quad dy = \sec^2 x.dx$
$I = \int \frac{dy}{\sqrt{1 - y^2}} = \sin^{-1}(y) + c = \sin^{-1}(\tan x) + c$

85.(d) $\int |x|\,dx$

Let $I = \int |x|.1.dx$

$= |x| \int 1.dx - \int \left[\frac{d|x|}{dx} \int 1.dx\right] dx$

$= |x|.x - \int \frac{x}{|x|} . x\, dx$

$= |x| . x - \int \frac{|x|^2}{(x)} dx \quad [\because x^2 = |x|^2]$

$I = |x|\, x - \int |x|\, dx$

$I = |x|\, x - I \qquad \therefore\ I = \frac{|x|\, x}{2}$

86.(b) Now, area bounded (A) $= \int_0^K x^2 dx$

$= \int_K^{2^{1/3}} x^2 dx$

$\Rightarrow \frac{K^3}{3} = \frac{(2^{1/3})^3}{6} - \frac{K^3}{3}$

$\Rightarrow \frac{2K^3}{3} = \frac{2}{3} \qquad \therefore\ K = 1$

87.(d) Put $\theta - 15 = A$ and $\theta + 15 = B$

i.e. $A + B = 2\theta$ and $A - B = 30$

We have,

$\frac{\tan A}{\tan B} = \frac{3}{1}$

$\frac{\tan A + \tan B}{\tan A - \tan B} = \frac{3+1}{3-1}$ ($\because$ By component & dividend)

$\frac{\sin(A+B)}{\sin(A-B)} = 2$

$\Rightarrow \frac{\sin 2\theta}{\sin 3\theta} = 2$

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

$2\theta = (4n+1)\frac{\pi}{2} \qquad \therefore\ \theta = n\pi + \frac{\pi}{4}$

88.(a) $\cos\frac{A}{2} = \sqrt{\frac{b+c}{2c}}$

or, $\cos^2\frac{A}{2} = \frac{b+c}{2c}$

$\frac{s(s-a)}{bc} = \frac{b+c}{2c}\quad \frac{\left(\frac{a+b+c}{2}\right)\left(\frac{a+b+c}{2} - a\right)}{bc} = \frac{b+c}{2c}$

or, $\frac{(a+b+c)(b+c-a)}{2bc} = \frac{b+c}{c}$

or, $(b+c)^2 - a^2 = 2b(b+c)$

or, $b^2 + 2bc + c^2 - a^2 = 2b^2 + 2bc$

$\therefore\ a^2 + b^2 = c^2$

89.(b) $y = x + x^2 + x^3 + \ldots + \infty$

or, $y = \frac{x}{1-x}$

or, $y - yx = x \Rightarrow x = \frac{y}{1+y}$

90.(b) Let $\alpha$ and $\alpha + 1$ be the roots. Then,

$\alpha + \alpha + 1 = -a \Rightarrow \alpha = \frac{-a-1}{2}$

and $\alpha(\alpha+1) = c$

or, $\alpha^2 + \alpha = c$

or, $\left(\frac{-1-a}{2}\right)^2 + \frac{(-1-a)}{2} = c$

or, $\frac{1+2a+a^2}{4} + \frac{(-1-a)}{2} = c$

or, $\frac{1+2a+a^2-2-2a}{4} = c$

or, $1 + a^2 - 2 = 4c$

$\therefore\ a^2 = 4c + 1$

91.(b) Total number of balls = 2 + 3 + 4 = 9

So, 3 balls can be drawn in ${}^9C_3$ ways.

It black ball is neglected, total = 6 balls and 3 ball can be drawn in ${}^6C_3$ ways.

So, total no. of ways that at least one is black ball $= {}^9C_3 - {}^6C_3$

92.(b) $\frac{(1-i)^3}{1-i^3} = \frac{(1-i)^3}{1^3 - i^3} = \frac{(1-i)^3}{[(1-i)(1+i+i^2)]}$

$= \frac{(1-i)^2}{(1+i-1)} = \frac{(1-i)^2}{i} = \frac{1+i^2-2i}{i}$

$= \frac{(1-1-2i)}{i} = -\frac{2i}{i} = -2$

93.(c) $2p = \left|\frac{1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}}\right| \Rightarrow \frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{4p^2}$

$\Rightarrow \frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{8p^2} \qquad \therefore\ \frac{1}{a^2}, \frac{1}{8p^2}, \frac{1}{b^2}$ are in A.P.

94.(a) Let A(1, 1) in $\Delta ABC$

(–2, 3) is mid-point of AB $\Rightarrow$ B = (–5, 5)

(5, 2) is mid-point of AC $\Rightarrow$ C = (9, 3)

Centroid of $\Delta ABC = \left(\frac{1-5+9}{3}, \frac{1+5+3}{3}\right) = \left(\frac{5}{3}, 3\right)$

95.(b) According to given conditions only internal touch is possible.

Hence, $C_1C_2 = |r_1 - r_2| \quad \Rightarrow \frac{c}{2} = \left|\frac{c}{2} - 2\right|$

Taking +ve, $\frac{c}{2} = \frac{c}{2} - 2$ (Not possible)

Taking –ve, $\frac{c}{2} = -\frac{c}{2} + 2$

$c = 2$

96.(a) Put x = 0

$y^2 - 5y + 6 = 0 \qquad \therefore\ y = 2$ or 3

Parabola intersect of y-axis at (0, 2) or (0, 3)

So, intercept = 1

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

**…The End…**