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1. (3)
If electric field due to charge $|q|$ at origin is $E$ then electric field due to charges $|2q|$, $|3q|$, $|4q|$ and $|5q|$ are respectively $2E$, $3E$, $4E$ and $5E$

![Diagram]

(i) $E_{(i)} = \sqrt{(5E)^2 + (5E)^2} = 5\sqrt{2}E$
(ii) $E_{(ii)} = \sqrt{(3E)^2 + (3E)^2} = 3\sqrt{2}E$
(iii) $E_{(iii)} = 4E + 2E = 6E$
(iv) $E_{(iv)} = 3E + E = 4E$

$\Rightarrow E_{(i)} > E_{(iii)} > E_{(ii)} > E_{(iv)}$

2. (3)
Flux coming out of the cube $\varphi_1 = \frac{\lambda \cdot a \sqrt{3}}{\varepsilon_0}$ ......(i)

and from sphere $\varphi_2 = \frac{\lambda \cdot 2a}{\varepsilon_0}$ ......(ii)

$\therefore \frac{\varphi_1}{\varphi_2} = \frac{\sqrt{3}}{2}$

3. (3)
$E_1 = \frac{\eta q}{4\pi\varepsilon_0 a^2}$, $E_2 = \frac{\eta q}{4\pi\varepsilon_0 a^2}$. Therefore $E = E_1 + E_2$

$= \sqrt{E_1^2 + E_2^2 + 2E_1E_2 \cos 60^\circ} = \sqrt{\frac{5\eta q}{4\pi\varepsilon_0 a^2}}$

Since $\eta^{-1} < \sqrt{3}, 1 < \sqrt{3\eta}, \sqrt{3\eta} > 1$.

$\Rightarrow \frac{\sqrt{5\eta q}}{4\pi\varepsilon_0 a^2} > \frac{q}{4\pi\varepsilon_0 a^2} \Rightarrow E_3 > E_0 \left( E_0 = \frac{q}{4\pi\varepsilon_0 a^2} \right)$

4. (3)
The time required to fall through distance $d$ is $d = \frac{1}{2} \left( \frac{qE}{m} \right) t^2$ or $t = \sqrt{\frac{2dm}{qE}}$

Since $t^2 \propto m$, a proton takes more time.

5. (2)
Total potential at the centre $V = \frac{6q}{4\pi\varepsilon_0 r}$

Required work done $= qV = \frac{6q^2}{4\pi\varepsilon_0 r}$
6. (4)

7. (3)

\[ E = \frac{V}{d} \Rightarrow \frac{\sigma}{2\varepsilon_0} = \frac{V}{d} \Rightarrow d = \frac{V \times 2\varepsilon_0}{\sigma} = \frac{50 \times 2 \times 8.85 \times 10^{-12}}{0.1 \times 10^{-6}} \]

= \( 8.85 \times 10^{-3} \) m = 8.88 mm

8. (4)

The surface of the conductor is an equipotential surface since there is free flow of electrons within the conductor. Thus potential at \( Q \) is the same as that at \( P \). That is \( V_p = V_Q = V \). The electric field \( E \) at a point on the equipotential surface of the conductor is inversely proportional to the square of the radius of curvature \( r \) at that point. That is \( E \propto \frac{1}{r^2} \)

Since point \( Q \) has a larger radius of curvature than that at point \( P \), the electric field at \( Q \) is less than that at \( P \). That is \( E_Q < E_P = E \)

9. (3)

Suppose the field vanishes at a (distance \( x \)), we have \( \frac{kq}{x} = \frac{kq/2}{(x-a)^2} \) or \( 2(x-a)^2 = x^2 \) or \( \sqrt{2}(x-a) = x \)

or \( (\sqrt{2}-1)x = \sqrt{2}a \) or \( x = \left( \frac{\sqrt{2}a}{\sqrt{2}-1} \right) \)

10. (1)

Suppose the balls having charges \( Q_1 \) and \( Q_2 \) respectively.

Initially:

Finally:

\[ \frac{Q_1 + Q_2}{2} \]

\[ \frac{Q_1 + Q_2}{2} \]

\[ \frac{F'}{r^2} = \frac{k\left( \frac{Q_1 + Q_2}{2} \right)^2}{\left( \frac{r}{2} \right)^2} = \frac{k(Q_1 + Q_2)^2}{r^2} \]

It is given that \( F' = 4.5F \) so \( \frac{k(Q_1 + Q_2)^2}{r^2} = 4.5k \cdot \frac{Q_1Q_2}{r^2} \)

\[ (Q_1 + Q_2)^2 = 4.5Q_1Q_2 \]

On solving it gives \( \frac{Q_1}{Q_2} = \frac{2}{1} \).

11. (1)

In the direction of electric field, potential decreases.
12. (2)
Work done by the field \( W = q(-dV) = -e(V_B - V_A) \)
\( = e(V_B - V_A) = e(V_C - V_A) \) \( \therefore V_B = V_C \)
\( \Rightarrow (V_C - V_A) = \frac{W}{e} = \frac{6.4 \times 10^{-19}}{1.6 \times 10^{-19}} = 4V \)

13. (4)
Electric field is directed right ward (higher potential of \(-200\) V to lower potential of \(-400\) V). When electron left free in an electric it accelerates opposite to the electric field. Hence in the given case electron accelerates left ward.

14. (3)
Point \( P \) lies at equatorial positions of dipole 1 and 2 and axial position of dipole 3.

Hence field at \( P \)
due to dipole 1
\( E_1 = \frac{kq}{r^3} \) (towards left)
due to dipole 2
\( E_2 = \frac{kq}{r^2} \) (towards left)
due to dipole 3 \( E_3 = \frac{kq}{r^3} \) (towards right)
So net field at \( P \) will be zero.

15. (3)
Given circuit can be redrawn as follows capacitors, \( 9\mu F, 9\mu F \) and \( 7\mu F \) are short circuited. So they are deleted.
\( V_1 + V_2 = 40V \)

\[
\begin{align*}
V_1 &= \frac{36}{18} = 2 \\
V_2 &= \frac{40}{3} \text{ V}
\end{align*}
\]
Hence \( V_1 = \frac{80}{3} \text{ V and } V_2 = \frac{40}{3} \text{ V} \)
Charge on \( 8\mu F \) capacitor \( = 8 \times \frac{80}{3} = 213.3\mu F \approx 214\mu F \)

16. (4)
Initial charge on sphere of radius \( R = q \)
Charge on this sphere after joining \( q' = \frac{(q - 2q) \times R}{R + 2R} = \frac{-q \times R}{3R} = \frac{-q}{3} \)

Now charge flowing between them = \( q - \left( \frac{-q}{3} \right) = \frac{4q}{3} \)

17. (3)

Length of the arc \( = r\theta = \frac{r\pi}{3} \)

\[
\text{Charge on the arc} = \frac{r\pi \times \lambda}{3}.
\]

\[\therefore \text{Potential at center} = \frac{kq}{r} = \frac{1}{4\pi\varepsilon_0} \times \frac{r\pi \lambda}{3} = \frac{\lambda}{12\varepsilon_0} \quad ***
\]

18. (3)

There are 10 electrons and 10 protons in a neutral water molecule. So it's dipole moment is \( p = q \times (2l) = 10e \times (2l) \)

Hence length of the dipole \( i.e. \) distance between centres of positive and negative charges is

\[
2l = \frac{p}{10e} = \frac{6.4 \times 10^{-20}}{10 \times 1.6 \times 10^{-19}} \approx 4 \times 10^{-12} \text{m} = 4 \mu m
\]

19. (1)

Metal plate acts as an equipotential surface, therefore the field lines should enter normal to the surface of the metal plate.

20. (4)

Charge required to reach the capacitor upto 10 \( V \) is

\[
Q = 500 \times 10^{-6} \times 10 = 5 \times 10^{-3} \text{C}
\]

Now required time = \( \frac{5 \times 10^{-3}}{100 \times 10^{-6}} = 50 \text{ sec} \)

21. (4)

All capacitor lying in left side of line \( XY \) are short circuited so circuit can be reduced as follows

\[
C_{AB} = 2C
\]

22. (2)

Given system is a spherical capacitor
So capacitance of system \[ C = K \times 4\pi\varepsilon_0 \left[ \frac{r_2}{r_2 - r_1} \right] \]
\[ = \frac{6}{9 \times 10^{10}} \left[ \frac{9 \times 10}{1} \right] \times 10^{-2} = 6 \times 10^{-10} \text{ Farad} \]

Now potential of inner sphere will be equal to potential difference of the capacitor. So \[ V = \frac{q}{C} = \frac{18 \times 10^{-9}}{6 \times 10^{-10}} = 30 \text{V} \]

23. (4)

In steady state current flows through 4Ω resistance only and it is \[ i = \frac{10}{(4 + 1)} = 2\text{amp} \]. Potential difference across 4Ω resistance is \[ V = 2 \times 4 = 8 \text{volt} \]
Hence, potential difference across each capacitor is 4V
So charge on each capacitor \[ Q = 3 \times 4 = 12\mu\text{C} \].

24. (1)

When key is open, charge in steady state will be \[ q_i = CE \].

When key is closed, potential difference across capacitor will be \[ V = \frac{2R}{R + 2R} \text{E} = \frac{2}{3} R \]
Charge in steady state will be \[ q_2 = \frac{2}{3} CE \Rightarrow \frac{q_1}{q_2} = \frac{3}{2} \].

25. (3)

\[ K = \frac{t}{t - d'} \Rightarrow 2 = \frac{1}{1 - d'}, \Rightarrow d' = \frac{1}{2} \text{mm} \]
So new distance = \( 3 + \frac{1}{2} = 3.5 \text{mm} \)

26. (1)

In equilibrium, along x-axis,
\[ T \sin \theta = qE \]
\[ \Rightarrow T \sin \theta = q \frac{\sigma}{2\varepsilon_0} \] ... (1)

Where \( T \) is the tension in the string.
Along y-axis in equilibrium, \( T \cos \theta = mg \) ... (2)
From (1) and (2) we obtain,
\[ \tan \theta = \frac{q\sigma}{2\varepsilon_0 \text{mg}} \Rightarrow \theta = \tan^{-1} \left( \frac{q\sigma}{2\varepsilon_0 \text{mg}} \right) \]
\[ \therefore (1) \]

27. (4)

Due to charge +q negative charge will be induced on the surface near to the external charge. Positive charge will shift on the other side of the cube.
Being metal conductor, the interior will remain charge free.

28. (2)

The work done is independent of the path followed and is equal to \( (q \vec{E}) \cdot \vec{r} \), where \( \vec{r} \) = displacement vector \( \vec{PS} = -ai - bj \), while \( \vec{E} = E\hat{i} \)
\[ \therefore \text{Work} = q \vec{E} \cdot \vec{r} = -qaE \]

29. (1)
Potential at $R = \frac{1}{4\pi \varepsilon_0} \left[ \frac{Q}{R} + \frac{q}{R} \right]$

Potential at $r = \frac{1}{4\pi \varepsilon_0} \left[ \frac{Q}{r} + \frac{q}{r} \right]$

Potential difference $= \frac{q}{4\pi \varepsilon_0} \left[ \frac{1}{R} - \frac{1}{r} \right]$

30. (4)

The net force on $q$ at origin is

$\mathbf{F} = \mathbf{F_1} + \mathbf{F_2} = \frac{1}{4\pi \varepsilon_0} \left( \frac{q^2}{r^2} \mathbf{i} + \frac{1}{4\pi \varepsilon_0} \frac{q^2}{r^2} (-\mathbf{i}) \right) = 0$

The P.E. of the charge $q$ in between the extreme charges at a distance $x$ from the origin along +ve x axis is

$U = \frac{1}{4\pi \varepsilon_0} \left( \frac{q^2}{(a-x)} + \frac{1}{4\pi \varepsilon_0} \frac{q^2}{(a+x)} \right) = \frac{1}{4\pi \varepsilon_0} q^2 \left[ \frac{1}{a-x} + \frac{1}{a+x} \right]$.

$\frac{dU}{dx} = \frac{q^2}{4\pi \varepsilon_0} \left[ \frac{1}{(a-x)^2} + \frac{1}{(a+x)^2} \right]$

For $U$ to be minimum, $\frac{dU}{dx} = 0$, and $\frac{d^2U}{dx^2} > 0$,

$\Rightarrow (a-x)^2 = (a+x)^2$

$\Rightarrow a + x = \pm (a-x)$

$\Rightarrow x = 0$, because other solution is relevant.

Thus, the charged particle at the origin will have minimum force and minimum P.E.

$\therefore$ (4).

31. (3)

The potential on the surface of the sphere 1 is given by

$V_1 = \frac{1}{4\pi \varepsilon_0} \frac{q_1}{a} + \frac{1}{4\pi \varepsilon_0} \frac{q_2}{b}$ \hspace{1cm} (1)

The potential on the surface of the sphere 2 is given by,

$V_2 = \frac{1}{4\pi \varepsilon_0} \frac{q_1}{b} + \frac{1}{4\pi \varepsilon_0} \frac{q_2}{b}$

$V = V_1 - V_2$

$\Rightarrow V = \frac{1}{4\pi \varepsilon_0} \frac{q_1}{a} - \frac{1}{4\pi \varepsilon_0} \frac{q_1}{b}$

$\Rightarrow V = \frac{q_1}{4\pi \varepsilon_0} \left( \frac{1}{a} - \frac{1}{b} \right)$

$\therefore$ (3)

32. (2)

Charge distribution will be as shown

Field at point $B$

$= \frac{q-q'}{2\Lambda \varepsilon_0} - \frac{q'}{2\Lambda \varepsilon_0} - \frac{q'}{2\Lambda \varepsilon_0} - \frac{q'}{2\Lambda \varepsilon_0} = \frac{q}{2\Lambda \varepsilon_0}$

$\therefore$ (2)

33. (3)
\[ C = \frac{2 \times 4}{2 + 4} = \frac{4}{3} \text{ \( \mu \)F} \text{ in one loop.} \]

\[ q = 12 \times \frac{4}{3} = 16 \text{ \( \mu \)C} \text{ across one set of 2 \( \mu \)F & 4 \( \mu \)F capacitors.} \]

\[ \therefore V_p = 12 - \frac{16}{4} = 8 \text{ V} \]

\[ V_Q = 12 - \frac{16}{2} = 4 \text{ V} \]

\[ \therefore V_p - V_Q = 8 - 4 = 4 \text{ V} \]

\[ \therefore (3) \]

34. \( (4) \)

Equivalent circuit is shown in figure

\[ C_{eq} = C + \frac{C \times 2C}{C + 2C} \]

\[ = C + \frac{2}{3}C = \frac{5}{3}C = \frac{5\epsilon_0}{3d} \]

\[ \therefore (4) \]

35. \( (2) \)

\[ a_{avg} = \frac{\Delta v}{\Delta t} = \frac{2v}{R} \left( \frac{\pi R}{V} \right) = \frac{2v^2}{\pi R} \]

36. \( (1) \)

Taking moment about A,

\[ mg \times \frac{l}{2} + mgl = I_A \alpha \]

\[ \alpha = \frac{3}{2} \frac{mg}{m^2 + ml^2} \]

\[ \alpha = \frac{9g}{8l} \]

37. \( (4) \)

\[ \vec{r} = \vec{r} \times \vec{F} = (-\vec{i} + \vec{j}) \times (-10\vec{k}) \]

\[ = -10\vec{i} - 10\vec{j} \]

38. \( (1) \)

\[ v = \frac{ds}{dt} = 6t + 6 \]

\[ a_t = \frac{dv}{dt} = 6 \]

\[ a_c = \frac{v^2}{r} = \frac{12^2}{12} = 12 \]

\[ \Rightarrow a = \sqrt{a_c^2 + a_t^2} = 6\sqrt{5} \text{ m/s}^2 \]

39. \( (2) \)

\[ I = m(0) + m \left( \frac{a}{2} \right)^2 + m \left( \frac{a}{2} \right)^2 ; I = \frac{ma^2}{2} \]

40. \( (3) \)
Heat given = heat taken
∴ \( n_1C_{v1} \Delta T = n_2C_{v2} \Delta T \)

\[
\left( \frac{1}{2} \right) \left( \frac{5}{2} R \right) (T - 300) = \left( \frac{1}{2} \right) \left( \frac{5}{2} R \right) (310 - T)
\]

∴ \( T = 32^\circ C \)

41. (3)
\[
a = \frac{4g - 0.2(4g)}{8} = 4 \text{ m/s}^2
\]

\[
4g - T = 4a \Rightarrow T = 24 \text{ N}
\]

42. (2)

43. (3)

44. (3)

Force constant of spring is inversely proportional to length of spring.

Time period of mas suspended from spring,

\[
T = 2\pi \sqrt{\frac{m}{k}}
\]

...(i)

Now we know that ,

spring constant \( k \propto \frac{1}{\text{length}} \)

or \( k \propto \frac{1}{x} \)

...(ii)

Since, spring is cut into four equal parts, hence force constant of each part becomes four times the previous, So \( k' = 4k \)

So, new time period of same mass suspended from one of the parts,

\[
T' = 2\pi \sqrt{\frac{m}{4k}} = \frac{1}{2} 2\pi \sqrt{\frac{m}{k}} = \frac{T}{2}
\]

45. (4)

From the Free Body Diagram
\[
qE + kx_0 = mg
\]

\[
x_0 = \frac{mg - qE}{k}
\]

∴ (4)

CHEMISTRY

46. (3)

47. (2)

\( \text{Na}^+ \) lies in OVs formed by \( \text{Cl}^- \) (\( \text{Na}^+ \) touches six \( \text{Cl}^- \) ions)

48. (2)
On the basis of stability of resonating structures.

49. (2)
A TV in fcc is formed by 3 face center atoms and one corner atom.

50. (1)
   i. Edge length = AB = AD = BC = CD = a
   ii. \( AC = \sqrt{(AB)^2 + (BC)^2} = \sqrt{a^2 + a^2} = \sqrt{2a} \)
   iii. \( AG = \sqrt{(AC)^2 + (CG)^2} = \sqrt{2a^2 + a^2} = \sqrt{3a} \)

51. (4)
hcp has 12 nearest neighbours.

52. (3)
   \( \ln K = \ln \frac{-E_a}{RT} \) is Arrhenius equation. Thus plots of \( \ln K \) vs \( 1/T \) will give slope = \( -E_a / RT \) or \( -E_a / 2.303R \).

53. (1)
\( \alpha = 0.6 ; h = 0.1 \)
\[
\text{NH}_2\text{Cl} \rightleftharpoons \text{NH}_4^+ + \text{Cl}^-
\]
Initially
\[
\begin{array}{ccc}
\text{C} & 0 & 0 \\
\end{array}
\]
At equilibrium:
\[
\begin{array}{ccc}
\text{C} & \alpha & \alpha \\
(1-\alpha) & & \\
0.4C & 0.6C & 0.6C \\
\end{array}
\]
\[
\text{NH}_4^+ + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4\text{OH} + \text{H}^+
\]
Initially
\[
0.6C \\
0.6C \\
0.6C \\
\]
At equilibrium:
\[
\begin{array}{ccc}
0.6C & (1-h) & 0.6C \\
0.6Ch & 0.6Ch & \\
0.4C + 0.6C + 0.6C(1-h) + 0.6Ch + 0.6Ch & C \\
\end{array}
\]
i = 2.26

54. (3)
\[
k_{eq} = \frac{X \times Y}{[XY]^2} ; [X_2Y_2] = k_{eq}[XY]^2
\]
Rate of overall reaction = Rate of step (ii)
\[
= k_i[X_2Y_2][O_2] \\
= k_i k_{eq}[XY]^2[O_2] \\
\frac{-d[O_2]}{dt} = 2 \text{ [rate of overall reaction]} = 2 k_i k_{eq}
\]

55. (2)
For zero order reactions \( \frac{dx}{dt} = K(A) \)

56. (4)
\( \pi = iCRT \)
\( i(5 \times 10^{-3}) RT = (0.01) RT \)
\[
\frac{[K_{SO_4}]}{[\text{urea}]} = (\text{mm})
\]
i = 2
Total particles = \( 1 + 2\alpha \)
i = 1 + 2\alpha = 2
\( \alpha = 0.5; \) 50% Dissociation

57. (1) 

58. (2) 

\( \text{XY}_2(g) \rightleftharpoons \text{XY}(g) + \frac{1}{2} \text{Y}_2(g) \)

Initially 
\[ \begin{array}{ccc} \text{XY}_2 & \text{XY} & \text{Y}_2 \\ 1 & 0 & 0 \end{array} \]

Moles at equilib: 
\[ (1-\beta) \quad \beta \quad \frac{\beta}{2} \]

Moles(Total) = 1 - \beta + \beta + \frac{\beta}{2} = 1 + \frac{\beta}{2}

\[ K_p = \frac{\left( \frac{\beta}{1+\frac{\beta}{2}} \right)^2 \left( \frac{\frac{\beta}{2}}{1+\frac{\beta}{2}} \right)^{\frac{1}{2}}}{\left( \frac{1-\beta}{1+\frac{\beta}{2}} \right)^2} \]

\[ K_p = \frac{\beta P}{2 \left( 1 + \frac{\beta}{2} \right)^{1/2}} \quad \beta = \left( \frac{2K_p}{P} \right)^{\frac{1}{3}} \]

59. (3)

60. (3) 

For following reaction, \( 2\text{NO}_2(g) + \text{O}_2(g) \rightarrow 2\text{NO}_2(g) \)

When the volume of vessel change into \( \frac{1}{3} \) then concentration of reactant become three times.

The rate of reaction for first order reaction \( \propto \) concentration. So rate of reaction will increase three times.

61. (2)

62. (4)

\( \text{ClO}_2^- \) and \( \text{ClF}_2^- \) contain 34 electrons each hence they are isoelectronic.

63. (1)

64. (2)

65. (2) 

15 ppm (by mass) means 15 g chloroform in \( 10^6 \) g of the solution.

Mass of solvent \( \approx 10^6 \) g

Molar mass of \( \text{CHCl}_3 \) = 12 + 1 + 3 \times 35.5

\[ = 119.5 \text{ g mol}^{-1} \]

Number of moles of solute
\[ = \frac{\text{Mass of solute}}{\text{Molar mass of solute}} = \frac{15}{119.5} = 0.126 \text{ mol} \]

\[ \therefore \text{Molality} = \frac{\text{Mass of solute}}{\text{Molar mass of solute}} \times 1000 \]

\[ = \frac{0.126}{10^6} \times 1000 = 1.26 \times 10^{-4} \text{ m} \]

66. (1) 

\( \text{(CH}_3\text{COOH)}_1 \rightleftharpoons \text{CH}_3\text{COO}^- \text{H}^+ \)

\( \text{(CH}_3\text{COOH)}_2 \rightleftharpoons \text{CH}_3\text{COO}^- \text{H}^+ \)

\[ \text{Ka} = (\text{H}^+)_1 = \left( \frac{\text{CH}_3\text{COO}^-}{\text{CH}_3\text{COOH}} \right)_1 = (\text{H}^+)_2 \left( \frac{\text{CH}_3\text{COO}^-}{\text{CH}_3\text{COOH}} \right)_2 \]
\[\left(\text{H}^+\right)_1^x = \left(\text{H}^+\right)_2^y \]

\[\left(\text{H}^+\right)_5 = \text{Ka} \times \frac{y}{x}, \left(\text{H}^+\right)_2 = \text{Ka} \times \frac{x}{y}\]

\[-E_{1-} = \frac{0.0591}{1} \log \left(\frac{\text{Ka} \times \frac{y}{x}}{\frac{x}{y}}\right), \quad E_2 = \frac{0.0591}{1} \log \frac{\text{Ka} \times \frac{x}{y}}{\frac{y}{x}}\]

\[E_2 + E_1 = -0.0591 \left(\log \frac{\text{Ka} \times \frac{y}{x}}{\frac{x}{y}} + \log \frac{\text{Ka} \times \frac{x}{y}}{\frac{y}{x}}\right)\]

\[E_4 + E_2 = -\log \text{Ka}^2\]

\[\therefore \ p\text{Ka} = \frac{E_4 + E_2}{0.0591}\]

Hence (1)

67. (1)
Sucrose will give minimum value of \(\Delta P\).
\[\Delta P = P^0 - P_s\]
\[P_s = P^0 - \Delta P\] is maximum.

68. (1)
The half cell reaction for hydrogen half cell acting as cathode is
\[2\text{H}^+ + 2e^- \longrightarrow \text{H}_2\]

\[\therefore E'_{\text{H}^+/\text{H}_2} = E''_{\text{H}^+/\text{H}_2} - \frac{0.059}{2} \log \frac{P_{\text{H}_2}}{[\text{H}^+]^2} \quad [E''_{\text{H}^+/\text{H}_2} = 0.0 \text{ V}]\]

\[E_{\text{H}^+/\text{H}_2} = -\frac{0.059}{2} \log \frac{1}{[\text{H}^+]^2}\]

Now, when the pressure of \(\text{H}_2\) gas is changed to 100 atm without changing \([\text{H}^+]\), the reduction potential becomes

\[\therefore \ E'_{\text{H}^+/\text{H}_2} = -\frac{0.059}{2} \log \frac{100}{[\text{H}^+]^2}\]

\[\therefore \ \text{Change in reduction potential} = E'_{\text{H}^+/\text{H}_2} - E_{\text{H}^+/\text{H}_2}\]

\[= -0.059 V\]

69. (2)
70. (3)
\[
\begin{align*}
\text{Ag}^+ + e^- & \longrightarrow \text{Ag} \\
\text{Ca}^{2+} + 2e^- & \longrightarrow \text{Ca} \\
\text{Al}^{3+} + 3e^- & \longrightarrow \text{Al}
\end{align*}
\]

3 faradays liberate 1 mol of Al, 3 moles of Ag and 3/2 moles of Cu. Thus, molar ratio of Ag : Cu : Al is 3 : 3/2 : 1 or 6 : 3 : 2.

71. (2)
For HCP = \(z = 6\), So no. of \(Q^{-2}\) is = 6
THV are = \(2 \times z = 12\)
But only half of the THV are occupied by \(P^{+x}\)
\[\Rightarrow 6 \ \text{THV occupied}\]
\[\therefore \ \text{Total +ve charge} = \text{total –ve charge}\]
72. \( \Delta T_i = \frac{i \times K_i \times 0.5}{74.5 \times 100} \times 1000 \)
\( i = 1 + \alpha (n - 1) \)
\( i = 1.92, \alpha = 0.92 \)

73. (3)

74. (1)
Electrode on which oxidation occurs is written on L.H.S. and the other on the R.H.S. as represented by
\[ \text{Zn} \mid \text{Zn}^{2+} \parallel \text{Cu}^{2+} \mid \text{Cu} \]

75. (2)
For bcc \( \sqrt[3]{3a} = 4r \)
\[ 2r = \frac{\sqrt[3]{3a}}{2} \]

76. (4)

77. (1)
NaCl structure \[ \begin{array}{c}
\text{(6.6 co.-ord.)} \\
\text{High pressure} \\
760 \text{ K}
\end{array} \]
CsCl structure \[ \begin{array}{c}
\text{(8.8 co.-ord.)} \\
\text{High pressure}
\end{array} \]

78. (2)
Chloroform & acetone form a non-ideal solution, in which A....B type interaction are more than A....A & B....B type interaction due to H-bonding. Hence, the solution shows, negative deviation from Raoult’s Law i.e.,
\[ \Delta V_{\text{mix}} = -\text{ve} ; \Delta H_{\text{mix}} = -\text{ve} \]
\( \therefore \) total volume of solution = less than (30 + 50 ml)
or \( < 80 \text{ ml} \)

79. (1)
80. (4)
81. (1)
\[ \pi = CRT = \frac{n}{V}RT = \frac{342}{150} \times 0.0821 \times 290 \]
\[ = 0.8095 \approx 0.81 \text{ atm} \]

82. (2)
Weight of Cu = Eq. weight of Cu
Weight of H = Eq. weight of H
\[ \frac{\text{Weight of Cu}}{0.504} = \frac{63.6}{2} = 1 \]
Weight of Cu = 15.9 gm.

83. (1)
More negative is the reduction potential, higher will be the reducing property, i.e. the power to give up electrons.

84. (4)
For the cell reaction, \( Fe \) acts as cathode and \( Sn \) as anode. Hence,
\[ E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} = -0.44 - (-0.14) = -0.30V \]
The negative \( EMF \) suggests that the reaction goes spontaneously in reversed direction.
(5) \[ \text{KOH} \]

\[ \text{EtO}^- \]

1

2 Cis & Trans

2 Cis & Trans

88. (3)

89. (4)

90. (3)