DAY TWENTY FOUR

Unit Test 5

(Physical Chemistry II)

1 A compound contains atoms of three elements A, B and C. If the oxidation number of A is + 2, B is +5 and that of C is – 2, the possible formula of the compound is

(a) $A_2(BC_3)_2$ (b) $A_3(BC_4)_2$
(c) $A_3(B_4C)_2$ (d) ABC_2

2 A binary solid (A^+B^-) has a zinc blende structure with B^- ion constituting the lattice and A^+ ions occupying 25% tetrahedral holes. The formula of the solid is

(a) AB_2 (b) AB (c) A_2B (d) AB_4

3 hcp ($AB\ AB$.....) and ccp ($ABC\ ABC$.....) structures made up of spheres of equal sizes, the volume occupied per sphere (including the empty spaces) is (a = radius of sphere)

(a) $5.66\,a^3$ (b) $1.33\,a^3$ (c) $2.66\,a^3$ (d) $7.40\,a^3$

4 Cleavage readily occurs along planes in crystals of ionic solids because the ions in the crystal are

(a) arranged in a regular fashion
(b) strongly bonded together
(c) weakly bonded together
(d) separated by a large distance

5 Percentage of free space in cubic close packed structure and in body centred packed structure respectively are

(a) 30% and 26% (b) 26% and 32%
(c) 32% and 48% (d) 48% and 26%

6 A solution contains non-volatile solute of molecular mass M_2. Which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure?

(a) $M_2 = \left(\frac{m_2}{\pi}\right)VRT$ (b) $M_2 = \left(\frac{m_2}{V}\right)\frac{RT}{\pi}$

(c) $M_2 = \left(\frac{m_2}{V}\right)\pi RT$ (d) $M_2 = \left(\frac{m_2}{V}\right)\frac{\pi}{RT}$

7 Latent heat of vaporisation of water is 9.72 kcal mol^{-1} at 373.15 K. Calculate the molal boiling point elevation constant of water.

(a) 5.2° (b) 0.052° (c) 52.2° (d) 0.52°

8 Addition of a non-volatile solute causes lowering in vapour pressure of a solvent from 0.8 atm to 0.2 atm. What is the mole fraction of solvent?

(a) 0.25 (b) 0.75
(c) 0.50 (d) Cannot be predicted

9 What is the boiling point of a solution of NaCl in water if the solution freezes at –0.93° C ?
($K_f = 1.86, K_b = 0.512$)

(a) 100.25°C (b) 100.5°C
(c) 101.02°C (d) 102.04°C

10 The azeotropic mixture of water (bp =100°C) and HCl (bp = 85° C) boils at about 110°C. During distillation of this mixture, it is possible to obtain

(a) pure HCl
(b) pure H_2O
(c) pure HCl as well as H_2O
(d) neither H_2O nor HCl

11 Phenol associates in benzene to a certain extent to form dimer. A solution containing 2.0×10^{-2} kg of phenol in 1.0 kg of benzene has its freezing point decreased by 0.69 K. The degree of association of phenol is (K_f for benzene = 5.12 K kg mol^{-1})

(a) 73.4 (b) 50.1
(c) 42.3 (d) 25.1

12 A solution of 0.4 mole of KI (100% dissociated) in 1000 g of water freezes at T_1° C. Now to this solution, 0.2 mole of HgI_2 is added and the resulting solution freezes at T_2°C. Which of the following is correct?

(a) $T_1 = T_2$ (b) $T_1 < T_2$
(c) $T_1 > T_2$ (d) Cannot be predicted

13 Which of the following is correct increasing order of freezing point for these four solutions?

I. 0.1 M glucose II. 0.1 M Na_3PO_4
III. 0.1 M NaCl IV. 0.1 M $K_4[Fe(CN)_6]$

(a) I < II < III < IV (b) IV < II < III < I
(c) I < III < II < IV (d) IV < I < III < II

14 The van't Hoff factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is

(a) 91.3% (b) 87% (c) 100% (d) 74%

15 The E° for the reaction

$$10Cl^-(aq) + 2MnO_4^-(aq) + 16H^+(aq) \longrightarrow 5Cl_2(g) + 2Mn^{2+}(aq) + 8H_2O(l)$$

is 0.15 V. The K_c for the reaction is

(a) 2.65×10^{25} (b) 4.9×10^{12}
(c) 1.2×10^5 (d) 3.4×10^2

16 The emf (E°) of the following cells are

$Ag | Ag^+ (1M) || Cu^{2+} (1 M) | Cu$; $E^\circ = -0.46$ V

$Zn | Zn^{2+} (1 M) || Cu^{2+} (1 M) | Cu$; $E^\circ = +1.10$ V

emf of the cell $Zn | Zn^{2+} (1 M) || Ag^{2+} (1 M) | Ag$; is

(a) 0.64 V (b) 1.10 V (c) 1.56 V (d) – 0.64 V

17 A current of 2 A was passed for 1 h through a solution of $CuSO_4$.3 g of Cu^{2+} ions were discharged at cathode. The current efficiency is

(a) 42.2% (b) 26.1% (c) 63% (d) 40.01%

18 The conductivity of a saturated solution of AgCl at 298 K is found to be $1.382 \times 10^{-6}\ \Omega^{-1}\ cm^{-1}$. The ionic conductance of Ag^+ and Cl^- at infinite dilution are $61.9\ \Omega^{-1}\ cm^2\ mol^{-1}$ and $76.3\ \Omega^{-1}\ cm^2\ mol^{-1}$ respectively. The solubility of AgCl is

(a) 1.4×10^{-5} mol L^{-1} (b) 1×10^{-2} mol L^{-1}
(c) 1×10^{-5} mol L^{-1} (d) 1.9×10^{-5} mol L^{-1}

19 Two concentration cells of Ag with Ag electrode in $AgNO_3$. In first cell, concentration of one electrode is 1 M and other electrode is 0.1 M and emf is 0.06 V. In second cell, concentration of one electrode is 1 M and other electrode is 0.01 M, calculate the emf of second cell.

(a) 0.12 V (b) 0.06 V
(c) 0.09 V (d) 0.16 V

20 The reduction electrode potential, E of 0.1 M solution of M^+ ions ($E^\circ_{RP} = -2.36$ V) is

(a) –4.82 V (b) –2.41 V
(c) + 2.41 V (d) None of these

21 If hydrogen electrode dipped in two solutions of pH = 3 and pH = 6 and salt bridge is connected, the emf of resulting cell is

(a) 0.177 V (b) 0.3 V
(c) 0.052 V (d) 0.104 V

22 For a cell reaction involving a two electron change, the standard emf of the cell is found to be 0.295 V at 25° C. The equilibrium constant of the reaction at 25° C will be

(a) 1×10^{-10} (b) 29.5×10^{-2}
(b) 10 (d) 1×10^{10}

23 Aluminium oxide may be electrolysed at 1000° C to furnish aluminium metal (atomic mass = 27μ; 1 Faraday = 96,500 C). The cathode reaction is

$$Al^{3+} + 3e^- \longrightarrow Al^\circ$$

To prepare 5.12 kg of aluminium metal by this method would require

(a) 5.49×10^1 C of electricity (b) 5.49×10^4 C of electricity
(c) 1.83×10^7 C of electricity (d) 5.49×10^7 C of electricity

24 3 Faraday of charge is passed through molten Al_2O_3, aqueous solution of $CuSO_4$ and molten NaCl taken in three different electrolytic cells. The amount of Al, Cu and Na deposited at the cathodes will be in the ratio of

(a) 1 mol : 2 mol : 3 mol (b) 1 mol : 1.5 mol : 3 mol
(c) 3 mol : 2 mol : 1 mol (d) 1.5 mol : 2 mol : 3 mol

25 Efficiency of a cell with cell reaction under standard conditions is 80%. The standard electrode potential of the following cell is

$$A(s) + B^{2+} \longrightarrow A^{2+} + B(s);\ \Delta H^\circ = -300\ kJ$$

(a) 1.24 V (b) 0.124 V
(c) 12.4 V (d) 124 V

26 The rate of the reaction $A + B + C \longrightarrow P$, is given by

$$r = -\frac{d[A]}{dt} = k[A]^{1/2}[B]^{1/2}[C]^{1/4}$$

The order of the reaction is

(a) 1 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{5}{4}$

27 For a given reaction of first order, it takes 15 min for the concentration to drop from 0.8 ML^{-1} to 0.4 mL^{-1}. The time required for the concentration to drop from 0.1 ML^{-1} to 0.025 ML^{-1} will be

(a) 60 min (b) 15 min
(c) 7.5 min (d) 30 min

28 In a first order reaction, the concentration of reactant decreases from 800 mol/dm^3 to 50 mol/dm^3 in 2×10^4 s. The rate constant of reaction in s^{-1} is

(a) 2×10^4 (b) 3.45×10^{-5}
(c) 1.386×10^{-4} (d) 2×10^{-4}

29 Unit of frequency factor A in, $k = Ae^{-E_a/RT}$ is

(a) $time^{-1}$
(b) $mol^{-1}\ L^{-1} t^{-1}$
(c) $L\ mol^{-1}\ t^{-1}$
(d) dependent of order of reaction

30 Consider a first order gas phase decomposition reaction given below

$$A(g) \longrightarrow B(g) + C(g)$$

The initial pressure of the system before decomposition of A was p_i. After lapse of time t total pressure of the system increased by x units and became p_t. The rate constant k for the reaction is given as **→ NCERT Exemplar**

(a) $k = \frac{2.303}{t}\log\frac{p_t}{p_i - x}$ (b) $k = \frac{2.303}{t}\log\frac{p_i}{2p_i - p_t}$

(c) $k = \frac{2.303}{t}\log\frac{p_i}{2p_i + p_t}$ (d) $k = \frac{2.303}{t}\log\frac{p_i}{p_i + x}$

31 In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statements is correct?

(a) k is equilibrium constant (b) A is adsorption factor
(c) E_a is energy of activation (d) R is Rydberg constant

32 Catalytic poisons act by

(a) making the products chemically inactive
(b) increasing the rate of the backward reactions
(c) chemical combination with any one of the reactants
(d) preferential adsorption on the catalyst surface

33 The gas which is least adsorbed on charcoal. (under identical conditions) is

(a) HCl (b) O_2 (c) CO_2 (d) NH_3

34 Select the incorrect statements.

(a) Physical adsorption is reversible while chemical is irreversible
(b) High pressure favours physical adsorption while low Pressure favours chemical adsorption
(c) Physical adsorption is not specific while chemical is highly specific
(d) High activation energy is involved in chemical adsorption

35 Which of the following electrolytes will have maximum coagulating value for AgI/Ag$^+$ sol? **→ NCERT Exemplar**

(a) Na_2S (b) Na_2SO_4
(c) Na_3PO_4 (d) NaCl

Direction (Q. Nos. 36-37) *In the following questions more than one of the answers given may be correct. Select the correct answers and mark it according to the codes.*

Codes
(a) 1, 2 and 3 are correct (b) 1 and 2 are correct
(c) 2 and 4 are correct (d) 1 and 3 are correct

36 For the reduction of NO_3^- ion in an aqueous solution, $E°$ is +0.96 V. Values of $E°$ for some metal ions are given below

$$V^{2+}(aq) + 2e^- \longrightarrow V; \quad E° = -1.19\ V$$
$$Fe^{3+}(aq) + 3e^- \longrightarrow Fe; \quad E° = -0.04\ V$$
$$Au^{3+}(aq) + 3e^- \longrightarrow Au; \quad E° = +1.40\ V$$
$$Hg^{2+}(aq) + 2e^- \longrightarrow Hg; \quad E° = +0.86\ V$$

The pairs of metals that are oxidised by NO_3^- in aqueous solutions are

1. V and Hg 2. Hg and Fe
3. Fe and V 4. Fe and Au

(a) 1, 2, 3 (b) 1, 2, 4 (c) 2, 3, 4 (d) 1, 3, 4

37 For the first order reaction,

$$2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$$

(a) the concentration of the reactant decreases exponentially with time
(b) the half-life of the reaction decreases with increasing temperature
(c) the half-life of the reaction depends on the initial concentration of the reactants
(d) the reaction proceeds of 99.6% completion in four half-life duration

38 Match the term used for colloids (in Column I) with related property (in Column II) and choose the correct code.

	Column I		Column II
A.	Coagulation	1.	Scattering of light
B.	Lyophilisation	2.	Washing of precipitate
C.	Peptisation	3.	Purification of collids
D.	Tyndall effect	4.	Electrolyte

Codes

	A	B	C	D		A	B	C	D
(a)	4	2	3	1	(b)	3	1	4	2
(c)	4	3	2	1	(d)	2	3	4	1

Direction (Q. Nos. 39-40) *Each of these questions contains two statements : Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.*

(a) Assertion is true, Reason is true; Reason is a correct explanation for Assertion
(b) Assertion is true, Reason is true; Reason is not a correct explanation for Assertion
(c) Assertion is true, Reason is false
(d) Assertion is false, Reason is true

39 **Assertion** Crystalline solids are anisotropic.

Reason Crystalline solids are not as closely packed as amorphous solids.

40 **Assertion** The decomposition of NH_3 on finely divided platinum surface is first order when the concentration is low, however at higher concentration, the reaction becomes zero order.

Reason In first order reaction, the rate of reaction is proportional to the first power of the concentration of the reactant.

ANSWERS

1 (b)	2 (a)	3 (a)	4 (a)	5 (b)	6 (b)	7 (d)	8 (a)	9 (a)	10 (d)
11 (a)	12 (b)	13 (b)	14 (b)	15 (a)	16 (c)	17 (c)	18 (c)	19 (a)	20 (b)
21 (a)	22 (d)	23 (d)	24 (b)	25 (a)	26 (d)	27 (d)	28 (c)	29 (d)	30 (b)
31 (c)	32 (d)	33 (b)	34 (b)	35 (c)	36 (a)	37 (a)	38 (c)	39 (c)	40 (b)

Hints and Explanations

1 In compound $A_3(BC_4)_2$, the oxidation number of A, B and C are +2, +5 and −2 respectively.

∵ Sum of oxidation-Numbers of all the atoms is equal to zero. i.e. $[3\times(+)2]+[2\times(+)5]+[8\times(-)2]=0$

2 Suppose number of B^- ions constituting the lattice = 100

Number of tetrahedral sites = 200

As 25% are occupied by A^+ ions,

their number = 50

Ratio of $A^+ : B^- = 50 : 100 = 1 : 2$

Formula of solid = AB_2

3 Volume of unit cell in ccp $= \left(\dfrac{4a}{\sqrt{2}}\right)^3$

So, volume per spheric atom

$$= \frac{1}{4}\times\frac{64a^3}{2\sqrt{2}}$$

$$= 5.66a^3$$

4 During a cleavage, the orderly arrangement of the ions, when an ionic solid is destroyed, bringing like charges together due to which repulsion arises.

and the cleavage readily occurs.

5 Packing fraction of ccp $= \dfrac{\pi}{3\sqrt{2}} = 0\cdot74$

⇒ 74% free space in ccp = 26%

Packing fraction of bcc

$$= \frac{\pi\sqrt{3}}{8} = 0\cdot68 = 68\%$$

% free space in bcc = 32%

6 For dilute solution

$$pV = nRT,\ \pi V = nRT,\ \pi V = \frac{m_2RT}{M_2}$$

$$M_2 = \frac{m_2RT}{\pi V}$$

(where, m_2 = mass of solute,

M_2 = molecular mass of solute)

7 $K_b = \dfrac{RT_0^2}{1000 l_V}$

(where, l_V = latent heat of vaporisation per gram of the solvent)

$$= \frac{M_1RT_0^2}{1000\Delta_{vap}H}$$

(where, M_1 = molecular mass of solvent and

$\Delta_{vap}H$ = latent heat of vaporisation per mole of the solvent)

$$= \frac{18\times0.002\times(375.15)^2}{1000\times9.72}$$

$$= 0.52°\text{C kg mol}^{-1}$$

8 From Raoult's law, $\dfrac{p-p_s}{p}$ = mole fraction of solute (χ_A)

$$\therefore\quad \chi_A = \frac{0.8-0.2}{0.8}$$

$$= \frac{0.6}{0.8} = 0.75$$

Hence, mole fraction of solvent

$= 1 - 0.75 = 0.25$

9 As boiling point elevation and depression of freezing point is concerned to the same NaCl solution, i.e. molality is same, so

$$\frac{\Delta T_b}{K_b} = \frac{\Delta T_f}{K_f}$$

$$\Delta T_b = \frac{\Delta T_f}{K_f}\cdot K_b$$

$$= \frac{0.93\times0.512}{1.86}$$

$$\Delta T_b = 0.256$$

$$T_b(\text{solution}) - T_b(\text{solvent}) = 0.256$$

i.e. T_b (solution) − T_b (H_2O) = 0.256

Boiling point,

T_b(solution) = 100.00 + 0.256

= 100. 25

10 Azeotropic mixture forms a constant boiling mixture, that's why at boiling point, mixture components cannot be separated or distilled out.

11 $M\text{ (obs)} = \dfrac{K_f\times w\times1000}{W\times\Delta T_f}$

$$= \frac{5.12\times2.0\times10^{-2}\times1000}{1.0\times0.69} = 148.4$$

Calculated molecular mass of phenol $(C_6H_5OH) = 94$

$$i = \frac{M\text{ (cal)}}{M\text{(obs)}} = \frac{94}{148.4} = 0.633$$

$$2C_6H_5OH \rightleftharpoons (C_6H_5OH)_2$$

At equ. $1-\alpha$ $\qquad \dfrac{\alpha}{2}$

Total species $= (1-\alpha)+\dfrac{\alpha}{2} = 1-\dfrac{\alpha}{2}$

$$i = \frac{1-\frac{\alpha}{2}}{1} \text{ or } \frac{\alpha}{2} = 1 - i$$

$$\alpha = 2(1-i) = 2(1-0.633) = 0.734$$

% degree of association

$= 0.734\times100 = 73.4\ \%$

12 $2KI + HgI_2 \longrightarrow K_2[HgI_4]$

0.4 $\quad$ 0.2 $\quad$ 0.2

Total initial number of moles of species = 0.4 × 2 = 0.8

After the addition of HgI_2

total number of moles of all species

= 0.6

$K^+ = 0.2\times2 = 0.4$

$[HgI_4]^{2-} = 0.2$

∵ Freezing point $\propto \dfrac{1}{i}$

∴ Hence, $T_2 > T_1$.

13 Greater the number of species, higher the depression in freezing point and lower the freezing point.

i.e. freezing point $\propto \frac{1}{i}$

for glucose (I) $i = 1$, for Na_3PO_4(II) $i = 4$

for NaCl (III) $i = 2$

for $K_4[Fe(CN)_6$ for (IV) $i = 5$

$\therefore$ Order of freezing point is

IV < II < III < I

14

$$Ba(NO_3)_2 \rightleftharpoons Ba^{2+} + 2NO_3^-$$

At $t = 0$	0.1 M	0	0
At equ.	$(0.1 - x)$ M	x M	$2x$M

$$i = \frac{(0.1 - 0\,x) + x + 2x}{0.1}$$

$$2.74 = \frac{0.1 + 2x}{0.1},$$

$$2.74 = \frac{0.1 + 2x}{0.1}$$

$0.1 + 2x = 0.274$

$2x = 0.274 - 0.1 = 0.174$

$$x = \frac{0.174}{2} = 0.087$$

$\therefore$ Degree of dissociation

$$= \frac{0.087}{0.1} \times 100 = 87\%$$

15

$$E° = \frac{0.059}{n} \log K_c$$

$$0.15 = \frac{0.059}{10} \log K_c$$

$\log K_c = 25.42$

$K_c = 2.65 \times 10^{25}$

16 $E^\circ_{Cu^{2+}/Cu} - E^\circ_{Ag^+/Ag} = -0.46$ V ...(i)

$E^\circ_{Cu^{2+}/Cu} - E^\circ_{Zn^{2+}/Zn} = -1.10$ ...(ii)

Subtracting Eq. (i) from Eq. (ii),

$E^\circ_{Ag^+/Ag} - E^\circ_{Zn^{2+}/Zn} = 1.56$V

17 $W = Zit$

$$3 = \frac{63.5}{2 \times 96500} \times 2 \times 60 \times 60 \times i$$

$$i = \frac{3 \times 2 \times 96500}{63.5 \times 2 \times 3600}$$

$$= \frac{579000}{457200} = 1.26 \text{ A}$$

Current efficiency

$$= \frac{\text{Current passed actually}}{\text{Current passed experimentally}} \times 100$$

$$= \frac{1.26 \times 100}{2} = 63\%$$

18 $\wedge^\infty_m(AgCl) = \wedge^\infty_{Ag^+} + \wedge^\infty_{Cl^-}$

$= 61.9 + 76.3 = 138.2\ \Omega^{-1}cm^2 mol^{-1}$

$$\wedge^\infty_m = C \times \frac{1000}{M} = C \times \frac{1000}{\text{solubility}}$$

$$\text{Solubility} = \frac{1.382 \times 10^{-6} \times 1000}{138.2}$$

$= 1 \times 10^{-5}$ mol L^{-1}

19 $\because E_{cell} = E° - \frac{0.059}{n}$

$$\log \frac{\text{(product concentration)}}{\text{(reactant concentration)}}$$

$\therefore$ $(E_{cell})_1 = 0 - \frac{0.059}{1} \log \frac{0.01}{1}$ ...(i)

$0.06 = 0 - \frac{0.059}{1} \log \frac{1}{10}$ ...(ii)

$(E_{cell})_2 = -\frac{0.059}{1} \log \frac{0.01}{1}$ ...(i)

$(E_{cell})_2 = -\frac{0.059}{1} \log \frac{1}{100}$ ...(ii)

Dividing Eq. (i) by Eq. (ii), we have

$$\frac{0.06}{(E_{cell})_2} = \frac{\log 1 - \log 10}{\log 1 - \log 100}$$

$$\frac{0.06}{(E_{cell})_2} = \frac{0 - 1}{0 - 2\log 10}$$

$$\Rightarrow \frac{0.06}{(E_{cell})_2} = \frac{-1}{-2} = \frac{1}{2}$$

$(E_{cell})_2 = 2 \times 0.06 = 0.12$ V

20 $E = E°_{RP} + \frac{0.0591}{n} \log[M^+]$

Given, $E°_{RP} = -2.36$ V and $[M^+] = 0.1$ M

$n = 1$ (for $M^+ \to M$)

$\therefore$ $E = -2.36 + \frac{0.0591}{1} \log 0.1$

$= -2.36 + 0.0591 \times (-1)$

$= -2.36 - 0.0591 = -2.419$ V

21 For concentration cells

$$E^\circ_{cell} = \frac{0.0591}{1} \log \left[\frac{\text{anode}}{\text{cathode}}\right]$$

Given, pH = 3 for first solution and

pH = 6 for second solution

$\therefore$ $[H^+]$ for first solution $= 10^{-pH} = 10^{-3}$

and $[H^+]$ for second solution

$= 10^{-pH} = 10^{-6}$

$$\therefore E^\circ_{cell} = -\frac{0.0591}{1} \log \left[\frac{10^{-6}}{10^{-3}}\right]$$

$= 0.0591 \log 10^{-3}$

$= -0.0591 \times (-3 \log 10)$

$= -0.0591 \times (-3 \times 1)$

$= -0.0591(-3)$

$\therefore E^\circ_{cell} = 0.177$ V

22 The standard emf of the cell,

$$E^\circ_{cell} = \frac{2.303\ RT}{nF} \log K_{eq}$$

$$0.295 = \frac{0.0591}{2} \log K_{eq}$$

$\therefore$ $\log K_{eq} = 10$

$\therefore$ $K_{eq} = 1 \times 10^{10}$

23 $Al^{3+} + 3e^\ominus \longrightarrow Al$

$W = ZQ$

Where, W = amount of metal

$= 5.12$ kg

$= 5.12 \times 10^3$ g

Z = electrochemical equivalent

$$= \frac{\text{equivalent weight}}{96500}$$

$$= \frac{\text{atomic mass}}{\text{electrons} \times 96500}$$

$$= \frac{27}{3 \times 96500}$$

$$5.12 \times 10^3 = \frac{27}{3 \times 96500} \times Q$$

$$Q = \frac{5.12 \times 10^3 \times 3 \times 96500}{27} \text{ C}$$

$= 5.49 \times 10^7$ C

24 Equivalent of Al = equivalent of Cu = equivalent of Na

$\frac{1}{3}$ mole Al = $\frac{1}{2}$ mole Cu = 1 mole Na

$\therefore$ Al : Cu : Na ≡ 2 : 3 : 6

= 1 : 1.5 : 3 mole ratio

25 Efficiency $= \frac{\Delta G°}{\Delta H°} = \frac{-nFE°}{\Delta H}$

$$\therefore E° = \frac{\Delta H}{-nF} \times 80\%$$

$$= \frac{-300 \times 10^3 \times 80}{-2 \times 96500 \times 100} = 1.24 \text{ V}$$

26 For a reaction, $A + B \longrightarrow$ product, if rate $= k[A]^m [B]^n [C]^l$, then order of reaction $= m + n + l$.

$\therefore$order of reaction $= \frac{1}{2} + \frac{1}{2} + \frac{1}{4} = \frac{5}{4}$

27 The reactant concentration drop from 0.8 to 0.4

It means 50% reaction takes place in 15 min

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{15} = 0.0462 \text{ min}^{-1}$$

$$t = \frac{2.303}{k} \log \frac{0.1}{0.025}$$

$$= \frac{2.303}{0.0462} \log \frac{0.1}{0.025} = 30 \text{ min}$$

28 $t = \frac{2.303}{k} \log \frac{N_0}{N}$

$$k = \frac{2.303}{2 \times 10^4} \log \frac{800}{50} = 1.386 \times 10^{-4} \text{ s}^{-1}$$

29 Unit of frequency factor A depends on unit of k. Which depends on order of reaction.

30 The rate constant k for the given reaction will be

$$k = \frac{2.303}{t} \log \frac{p_i}{2p_i - p_t}$$

31 By Arrhenius equation

$k = Ae^{-E_a/RT}$,

k = Rate constant

A = pre-exponential, frequency factor

E_a = Activation energy,

R = Gas constant

T = Temperature

32 The catalytic poisons decreases the activity of catalyst due to strong preferential adsorption of the poison on the surface of the catalyst.

33 Permanent gases such as O_2, H_2 are adsorbed to a lesser extent than the-easily liquefiable gases such as NH_3, HCl, CO_2 and SO_2.

34 Physical as well as chemical both the adsorptions are favoured by high pressure. However, the point of difference is that decrease in pressure causes desorption in case of physical adsorption but not in the case of chemical adsorption.

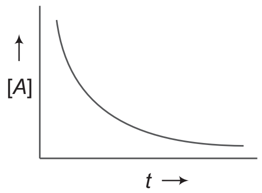
35 Na_3PO_4 has maximum coagulating value for AgI/Ag^+ sol.

36 Metals with $E°$ values less than $+0.96$ V will be able to reduce NO_3^- in aqueous solution. Therefore, metals V($E° = -1.19$ V) Fe($E° = -0.04$ V) and Hg($E° = +0.86$ V) will reduce NO_3^- but Au ($E° = 1.40$ V) cannot reduce NO_3^- in aqueous solution.

37 For a first order reaction, the concentration of reactant remaining after time t is given by

$$[A] = [A_0]e^{-kt}$$

Therefore, concentration of reactant decreases exponentially with time.



(2) With increase in temperature, rate constant increases and therefore, half-life $(t_{1/2})$ decreases as

$$t_{1/2} = \frac{\ln^2}{k}$$

(3) Half-life of a first order reaction is independent of initial concentration.

(4) For a first order reaction, if 100 moles of reactant is taken initially, after n half-lives, reactant remaining is given by

$$\%A = 100\left(\frac{1}{2}\right)^n$$

$$= 100\left(\frac{1}{2}\right)^4 = 6.25$$

$\therefore$ A reacted = 100 − 6.25 = 93.75%

38

S.No.	Term	Property
A.	Coagulation	Electrolyte
B.	Lyophilisation	Purification of colloids
C.	Peptisation	Washing of precipitate
D.	Tyndall effect	Scattering of light

39 Anisotropy is due to different arrangement of constituent particles in different directions. But they closely packed as amorphous solids. e.g. diamond has tetrahedral structure and is most hardest solid. Graphite is hexagonal packed structure. So, they have different shape and size.

40 In a heterogeneous system, the reactant is absorbed on the surface of a solid catalyst. The fraction of the surface of the catalyst covered by the reactant is proportional to its concentration at low values and the rate of reaction is first order. However at higher concentration, the surface of catalyst is fully covered and the reaction rate becomes independent of concentration and it becomes zero order reaction.