

**PART – A**

**I. Select the correct option from the given choices:**

**(15 × 1 = 15)**

1. If the process of dissolution of a solid in liquid is an endothermic, its solubility:
- a) decreases with increase in temperature    b) remains same at all temperature  
c) increase with increase in temperature    d) increase with decrease in temperature

**Ans : c) increase with increase in temperature**

2. When the concentration of electrolytic solution approaches zero, the resulting molar conductivity is known as:
- a) specific conductance    b) resistivity  
b) conductivity    d) limiting molar conductivity

**Ans : d) limiting molar conductivity**

3. During discharging of lead storage battery the correct half-cell reaction is;
- a) At anode, Pb is converted into  $\text{PbO}_2$   
b) At anode, Pb is converted into  $\text{PbSO}_4$   
c) At anode,  $\text{PbO}_2$  is converted into  $\text{PbSO}_4$   
d) At cathode, Pb is converted into  $\text{PbSO}_4$

**Ans : b) At anode, Pb is converted into  $\text{PbSO}_4$**

4. The catalyst in a chemical reaction provides an alternate pathway or reaction mechanism by decreasing ;
- a) Activation energy    b) Kinetic energy  
c) Normal energy of reacting species    d) Potential energy

**Ans : a) Activation energy**

5. Which of the following pair of metal oxides are amphoteric?
- a)  $\text{V}_2\text{O}_5, \text{Cr}_2\text{O}_3$     b)  $\text{Mn}_2\text{O}_7, \text{CrO}_3$     c)  $\text{V}_2\text{O}_5, \text{V}_2\text{O}_4$     d)  $\text{CrO}, \text{V}_2\text{O}_5$

**Ans : a)  $\text{V}_2\text{O}_5, \text{Cr}_2\text{O}_3$**

6. The correct IUPAC name of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  is ;
- a) Diamminedichloridoplatinum (II)    b) Dichloridodiammineplatinum (0)  
c) Dichloridodiammineplatinate (II)    d) Diamminedichloridoplatinate (0)

**Ans : a) Diamminedichloridoplatinum (II)**

7. The stereoisomers related to each other as non-superimposable mirror images are called ;  
a) Enantiomers      b) Diastereomers      c) Anomers      d) Racemic mixture

**Ans: a) Enantiomers**

8. Anisole on treatment with  $\text{CH}_3\text{Cl}$  in the presence of anhydrous  $\text{AlCl}_3$  gives ;  
a) Toluene      b) o – Chloroanisole  
c) ortho and para-methylanisoles      d) p – chloroanisole

**Ans : c) ortho and para-methylanisoles**

9. The enzyme which can catalyse the conversion of glucose to ethanol is ;  
a) Invertase      b) Maltase      c) Zymase      d) Sucrase

**Ans : c) Zymase**

10. Nucleophilic attack on carbonyl carbon atom changes its hybridization from ;  
a)  $\text{sp}$  to  $\text{sp}^2$       b)  $\text{sp}^2$  to  $\text{sp}^3$       c)  $\text{sp}^3$  to  $\text{sp}^2$       d)  $\text{sp}$  to  $\text{sp}^3$

**Ans : b)  $\text{sp}^2$  to  $\text{sp}^3$**

11. Decarboxylating reagent is a mixture of  
a) Alc.  $\text{KOH} + \text{H}_2\text{O}_2$       b)  $\text{NaOH} + \text{CO}_2$   
c)  $\text{NaOH} + \text{CaO}$       d) Conc.  $\text{HCl} + \text{ZnCl}_2$

**Ans : c)  $\text{NaOH} + \text{CaO}$**

12. To prepare p-Nitroaniline as a major product from aniline, the amino group is protected by ;  
a) Acetylation      b) Alkylation      c) Saponification      d) Sulphonation

**Ans : a) Acetylation**

13. The reagent used to separate the mixture of methylamine and dimethylamine are ;  
a)  $\text{CHCl}_3$  and  $\text{HCl}$       b)  $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$  and  $\text{KOH}$   
c)  $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$  and  $\text{HCl}$       d)  $\text{CHCl}_3$  and  $\text{KOH}$

**Ans : b)  $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$  and  $\text{KOH}$**

14. The carbohydrate which is also known as animal starch and stored in animal body is ;  
a) Starch      b) Sucrose      c) Glycogen      d) Cellulose

**Ans : c) Glycogen**

15. Which vitamin deficiency causes the disease cheilosis?  
a) Vitamin  $\text{B}_1$       b) Vitamin  $\text{B}_2$       c) Vitamin  $\text{B}_6$       d) Vitamin  $\text{B}_{12}$

**Ans : b) Vitamin  $\text{B}_2$**

**II. Fill in the blanks by choosing the appropriate word from those given in the brackets : (5 × 1 = 5)**

[ionic charge, Grignard reagent,  $C_6H_5N_2^+Cl^-$ , Collision frequency, Molality, Molarity]

16. The number of moles of solute present in one kilogram of the solvent is called \_\_\_\_\_.

**Ans : Molality**

17. The number of collisions per second per unit volume of the reaction mixture is known as \_\_\_\_\_.

**Ans : Collision frequency**

18. Transition metals form large number of complex compounds due to high \_\_\_\_\_.

**Ans : ionic charge**

19. The common name of alkyl magnesium halide is \_\_\_\_\_.

**Ans : Grignard reagent**

20. The formula of benzenediazonium chloride is \_\_\_\_\_.

**Ans :  $C_6H_5N_2^+Cl^-$**

**PART – B**

**III. Answer any three of the following. Each question carries 2 marks: (3 × 2 = 6)**

21. What type of deviation from Raoult's law is observed, when equal volume of ethanol and acetone are mixed together? Mention the reason for it. (2)

**Ans :**

Positive deviation from Raoult's law.

Because: Force of attraction between ethanol and acetone molecules is less than that of ethanol – ethanol & acetone – acetone molecules.

22. Mention any two differences between order and molecularity of a reaction. (2)

**Ans :**

Molecularity	Order
It can be calculated by adding the molecules of the slowest step in the reaction mechanism	It can be determined experimentally only and cannot be calculated
It cannot be zero or fraction.	It can be zero as well as fraction.

23. a) What is spectrochemical series? (1)

**Ans :**

Arrangements of ligands in a series in the order of increasing field strength.

b) Between  $[Co(en)_3]^{3+}$  and  $[Co(NH_3)_6]^{3+}$  complex ions which is more stable? (1)

**Ans :**

$[Co(en)_3]^{3+}$

24. Write the IUPAC name of product obtained when ethylbromide reacts with sodium iodide in dry acetone. Name the reaction. (2)

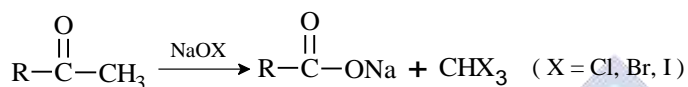
Ans :

Iodoethane, Finkelstein reaction.

25. Explain Haloform reaction with chemical equation. (2)

Ans :

Aldehydes and ketones having at least one methyl group linked to the carbonyl carbon atom (methyl ketones) are oxidised by sodium hypohalite to sodium salts of corresponding carboxylic acids having one carbon atom less than that of carbonyl compound. The methyl group is converted to haloform.



26. Name two hormones which regulate the glucose level in the blood. (2)

Ans :

Insulin

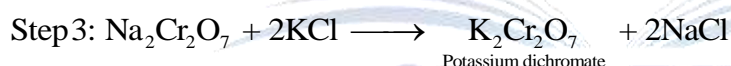
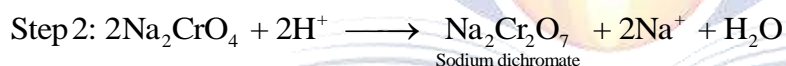
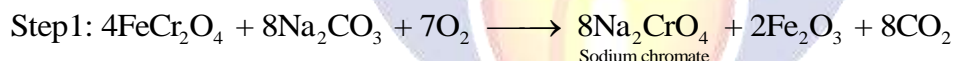
Glucagon

### PART – C

IV . Answer any three of the following. Each question carries 3 marks : (3 × 3 = 9)

27. Write the balanced chemical equations in the manufacture of potassium dichromate from chromite ore. (3)

Ans :



28. a) give a reason for each of the following :

i) The spin only magnetic moment of  $\text{Sc}^{3+}$  is zero. (1)

Ans :

due to the absence of unpaired electrons

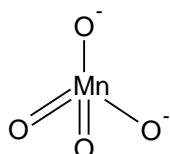
ii) Alloys are readily formed by transition metals. (1)

Ans :

Because of similar radii and other characteristics of transition metals.

b) Write the structure of manganate ion ( $\text{MnO}_4^{2-}$ ). (1)

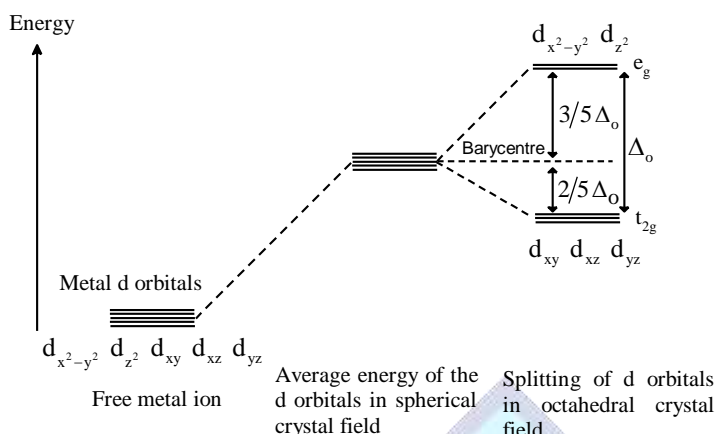
Ans :





32. a) Draw the energy level diagram for the splitting of d- orbitals in an octahedral crystal field. (2)

Ans :



b) If  $\Delta_o < P$ , on the basis of crystal field theory [CFT]. Write the electronic configuration of  $d^4$  - ion in octahedral complexes. (1)

Ans :



V. Answer any two of the following. Each question carries 3 marks. (2 × 3 = 6)

33. a) What is reverse osmosis? Mention one of its application. (2)

Ans :

The direction of osmosis can be reversed if a pressure larger than the osmotic pressure is applied to the solution side. This phenomenon is called **reverse osmosis**.

Reverse osmosis is used in desalination of sea water.

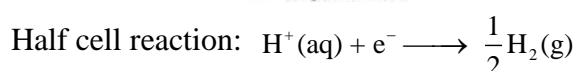
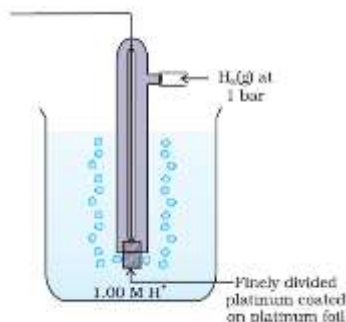
b) State Henry's Law. (1)

Ans :

“The partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution”

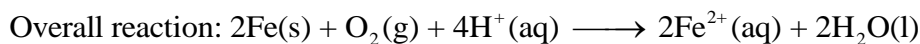
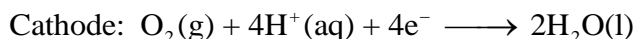
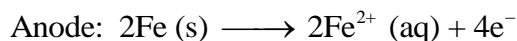
34. Draw a neat labelled diagram of Standard Hydrogen Electrode (SHE). Write its half – cell reaction. (3)

Ans :



35. Write the anodic, cathodic and overall reactions of corrosion of iron occurs in the presence of water and air. (3)

Ans :



36. Derive integrated rate equation for rate constant of a zero order reaction. (3)

Ans :

Zero order reaction means that the rate of the reaction is proportional to zero power of the concentration of reactants.

Consider the reaction,  $\text{R} \longrightarrow \text{P}$

$$\text{Rate} = -\frac{d[\text{R}]}{dt} = k[\text{R}]^0 \quad [\text{R}]^0 = 1$$

$$\text{Rate} = -\frac{d[\text{R}]}{dt} = k$$

$$d[\text{R}] = -kdt$$

Integrating both sides

$$[\text{R}] = -kt + I \text{-----(1)}$$

Where, I is the constant of integration.

At  $t = 0$ , the concentration of the reactant  $\text{R} = [\text{R}]_0$ , Where  $[\text{R}]_0$  is the initial concentration of the reactant.

Equation (1) becomes

$$[\text{R}]_0 = -k \times 0 + I$$

$$I = [\text{R}]_0$$

Substituting value of I in equation (1)

$$[\text{R}] = -kt + [\text{R}]_0 \text{-----(2)}$$

$$kt = [\text{R}]_0 - [\text{R}] \text{-----(3)}$$

$$k = \frac{[\text{R}]_0 - [\text{R}]}{t} \text{-----(4)}$$

Equation (4) is the rate constant expression for zero order reaction.

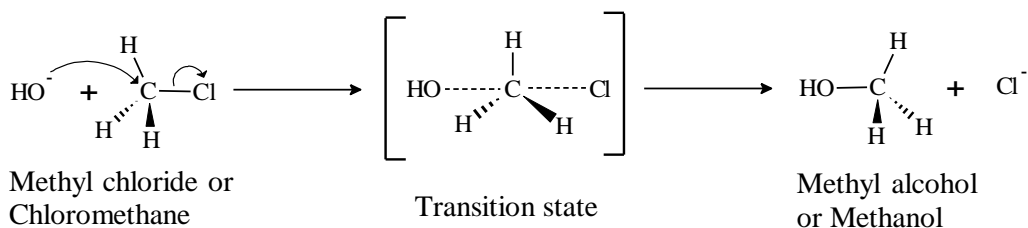
#### PART – D

VI. Answer any four of the following. Each question carries 5 marks: (4 × 5 = 20)

37. a) Write the mechanism for the conversion of methyl chloride to methyl alcohol . Mention the order. (3)

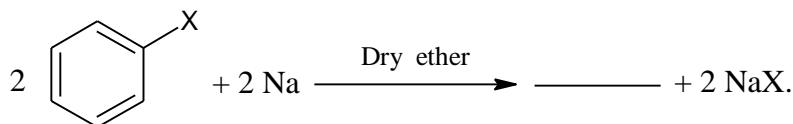
Ans :

It follows second order kinetics.



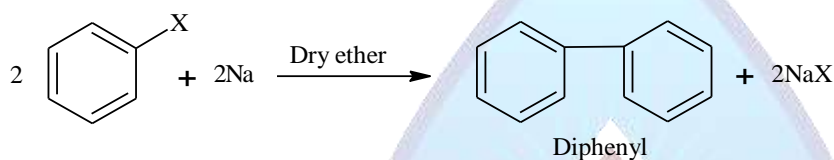
b) complete the following equation :

i)

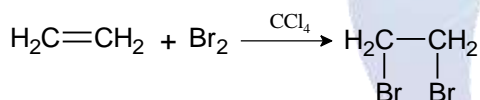


(1)

Ans :



Ans :

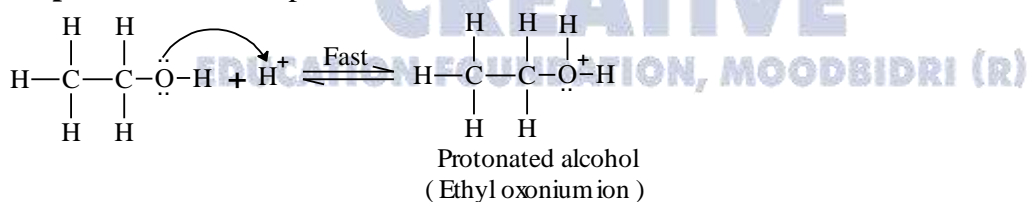


38. a) Write the steps involved in the mechanism of acid catalysed dehydration of ethanol to ethene.

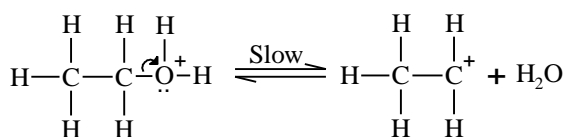
(3)

Ans :

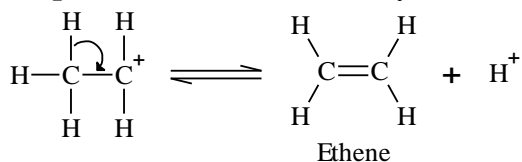
**Step 1:** Formation of protonated alcohol.



**Step 2:** Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.



**Step 3:** Formation of ethene by elimination of a proton.





b) What is Lucas reagent? Which class of alcohols does not produce turbidity with it at room temperature? (2)

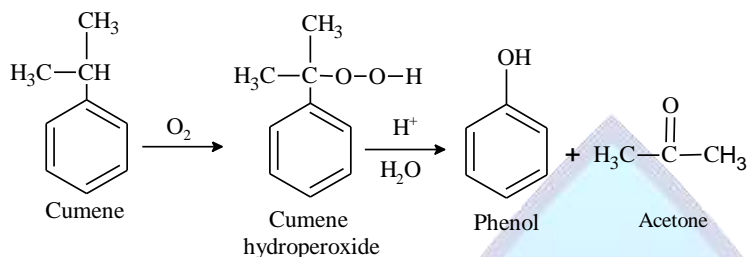
Ans :

Lucas reagent: Mixture of Conc.HCl and anhydrous ZnCl<sub>2</sub>.

Primary alcohols does not produce turbidity with it at room temperature

39. a) Write the chemical equations in the manufacture of phenol by cumene process. (2)

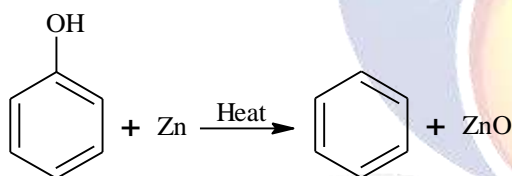
Ans :



b) Complete the equation. (1)



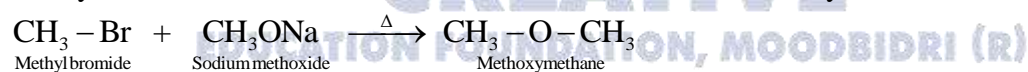
Ans :



c) Explain Williamson's reaction for the preparation of methoxymethane. (2)

Ans :

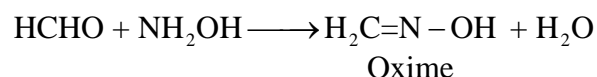
Methyl bromide reacts with Sodium methoxide to form Methoxymethane.



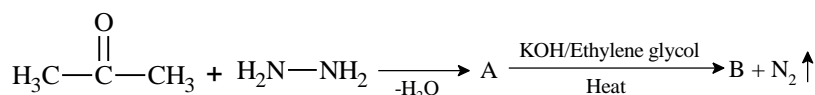
40. a) How does methanal reacts with hydroxylamine? Explain with equation. (2)

Ans :

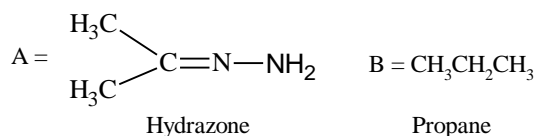
Methanal reacts with hydroxylamine to form oxime.



b) Identify A and B in the following reaction. (2)



Ans:



c) Write any one reagent used to distinguish between aldehyde and ketone. (1)

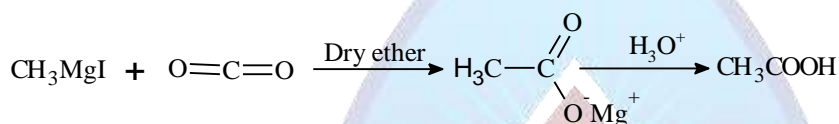
Ans :

Tollens' reagent

41. a) When methyl magnesium iodide reacts with dry ice forms an intermediate, which on acidification gives compound 'A'

i) Write the equation for the above chemical reaction. (2)

Ans:



ii) Write the IUPAC name of compound 'A'. (1)

Ans:

Ethanoic acid

b) Between acetic acid and monochloroacetic acid, which is more acidic? Give reason. (2)

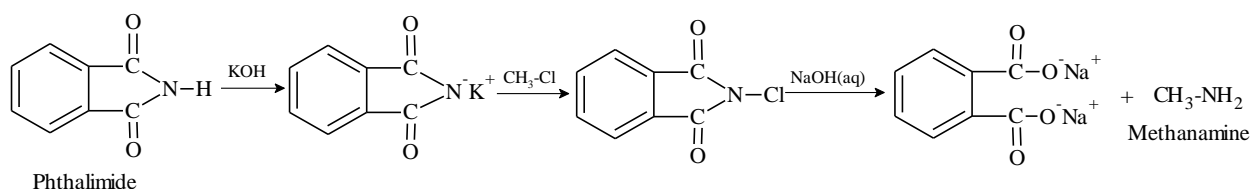
Ans:

Monochloroacetic acid is more acidic

Reason: Chlorine in monochloroacetic acid increases the acidity by stabilising the conjugate base.

42. a) Write the chemical equations involved in the Gabriel phthalimide synthesis of methanamine. (3)

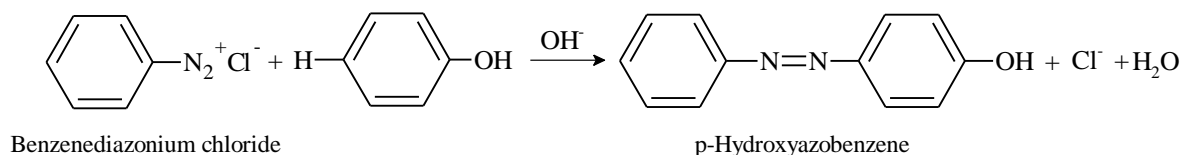
Ans:



b) Explain the coupling reaction of benzene diazonium chloride with phenol using chemical equation. (2)

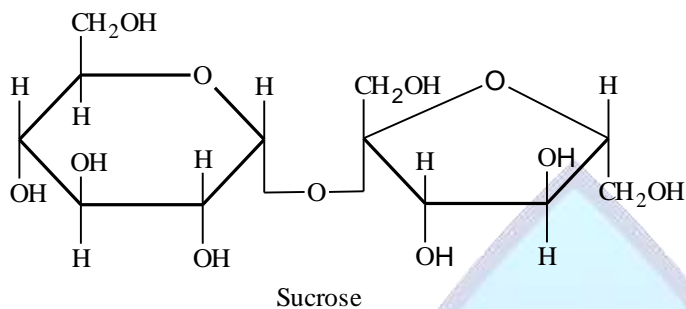
Ans:

Benzene diazonium chloride reacts with phenol to give azo dyes. These reactions are called coupling reactions.



43. a) Write the Haworth structure of sucrose? (2)

Ans:



b) i) What are essential amino acids? (1)

Ans:

Amino acids which cannot be synthesised in the body and must be obtained through diet, are known as **essential amino acids**.

ii) Give an example for fibrous proteins. (1)

Ans:

Keratin, myosin.

c) Name the nitrogenous base present in DNA but not in RNA. (1)

Ans:

Thymine

### PART – E

VII. Answer any three of the following. Each question carries 3 marks: (3 × 3 = 9)

44. Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride.

[Given Molar mass of Benzene = 78 g/mol, Molar mass of carbon tetrachloride = 154 g/mol]

Ans:

$$X_{\text{C}_6\text{H}_6} = \frac{n_{\text{C}_6\text{H}_6}}{n_{\text{C}_6\text{H}_6} + n_{\text{CCl}_4}}$$

$$30 \text{ g benzene} \quad 70 \text{ g CCl}_4$$

$$M_{\text{C}_6\text{H}_6} = 78 \text{ g/mol} \quad M_{\text{CCl}_4} = 154 \text{ g/mol}$$

$$\begin{aligned}
 n_{\text{C}_6\text{H}_6} &= \frac{30}{78} & n_{\text{CCl}_4} &= \frac{70}{154} \\
 &= 0.384 & &= 0.454
 \end{aligned}$$

$$\begin{aligned}
 X_{\text{C}_6\text{H}_6} &= \frac{0.384}{0.384 + 0.454} \\
 &= \frac{0.384}{0.838} = 0.458
 \end{aligned}$$

45. 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. The freezing point depression constant of benzene is 5.12 K kg mol<sup>-1</sup>. Find the molar mass of the solute.

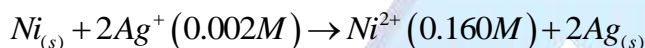
Ans:

$$W_2 = 1.00 \text{ g} \quad W_1 = 50 \text{ g}$$

$$\Delta T_f = 0.40 \text{ K} \quad K_f = 5.12 \text{ K kg mol}^{-1}$$

$$\begin{aligned} M_2 &= \frac{K_f \times W_2 \times 1000 \text{ g kg}^{-1}}{\Delta T_f \times W_1} \\ &= \frac{5.12 \text{ K kg mol}^{-1} \times 1.00 \text{ g} \times 1000 \text{ g kg}^{-1}}{0.40 \text{ K} \times 50 \text{ g}} \\ &= \frac{5120}{20} = 256 \text{ g mol}^{-1} \end{aligned}$$

46. Calculate the emf of the cell in which the following reaction takes place:



Given that  $E_{cell}^{\circ} = 1.05V$  at 298 K.

Ans:

Given,

$$E_{cell}^{\circ} = 1.05 \text{ V}$$

$$\begin{aligned} E_{cell} &= E_{cell}^{\circ} - \frac{0.059}{2} \log \frac{[Ni^{2+}]}{[Ag^+]^2} \\ &= 1.05 - \frac{0.059}{2} \log \frac{(0.160)}{(0.002)^2} \\ &= 1.05 - \frac{0.059}{2} \log \left( \frac{(16 \times 10^{-2})}{(2 \times 10^{-3})^2} \right) \\ &= 1.05 - 0.0710 \\ &= 0.979 \text{ V} \end{aligned}$$

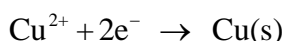
47. A solution of  $CuSO_4$  is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode?

[Molar mass of copper = 63 g/mol. 1F = 96487C]

Ans:

$$Q = I \times t$$

$$I = 1.5 \times 10 \times 60 = 900 \text{ C}$$



$$2 \times 96487 \text{ C} \rightarrow 63 \text{ g}$$

$$900 \text{ C} \rightarrow ?$$

$$= \frac{900 \times 63}{2 \times 96487} = 0.2938 \text{ g}$$

48. A first order reaction has a rate constant  $1.15 \times 10^{-3} \text{ s}^{-1}$ . How long will 5 g of this reactant take to reduce to 3 g?

Ans:

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\begin{aligned} t &= \frac{2.303}{1.15 \times 10^{-3}} \log \frac{5}{3} \\ &= 2.002 \times 10^3 \times 0.2218 \\ &= 0.444 \times 10^3 \\ &= 444 \text{ s} \end{aligned}$$

49. The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. calculate the  $E_a$  of the reaction assuming that it does not change with temperature.

Ans:

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303 R} \left[ \frac{T_2 - T_1}{T_1 T_2} \right]$$

$$\log 4 = \frac{E_a}{2.303 \times 8.314} \left[ \frac{313 - 293}{293 \times 313} \right]$$

$$0.6020 = \frac{E_a}{19.147} \left[ \frac{20}{91709} \right]$$

$$\begin{aligned} E_a &= \frac{0.6020 \times 19.147 \times 91709}{20} = 52854 \text{ J/mol} \\ &= 52.854 \text{ kJ/mol} \end{aligned}$$

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