FIRST TERM EXAMINATION SESSION
CHEMISTRY THEORY

ROLL NO. ☐☐☐☐☐☐☐☐

Time allowed : 3 Hours   *Maximum Marks: 70*

General Instructions:

(i)   **All** the questions are compulsory

(ii)   Marks for each question are indicated against it.

(iii) Questions number **1** to **8** are very short-answer questions and carry **1** mark each.

(iv)   Questions number **9** to **18** are short-answer questions and carry **2** marks each.

(v)   Questions number **19** to **27** are also short-answer questions and carry **3** marks each.

(vi)   Questions number **28** to **30** are long-answer questions and carry **5** marks each.

(vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.

1   What type of stoichiometric defect is shown by
     i. ZnS   ii. AgBr

2   How does the electrical resistivity of metallic conductors and electrolytic conductors vary with temperature?

3   For a reaction, A + B ⟶ Product, the rate law is given by
                $R = k[A]^{1/2} [B]^2$

     What is the order of reaction?

4   Why a finely divided substance is more effective as an absorbent?

5   Draw the structure of following compounds:
     a. p-Methylbenzaldeyde   b.   Hex-2en-4-ynoic acid

6   Why there are two $-NH_2$ groups in semicarbazide. However, only one is involved in the formation of semicarbazones?

7   Write the IUPAC name for the following compound:
     i. $CH_3CH_2CH(CH_3)CH(C_2H_5)Cl$ ii. m- $ClCH_2C_6H_4CH_2C(CH_3)_3$

8   Why propanol has higher boiling point than that of the hydrocarbon butane?

9   Explain the following terms with suitable example:

    i. Schottky defect   ii.   F- centers

              Or//

i.   Ferromagnetism   ii. 12-16 and 13-15 group compounds

10   Identify the type of intermolecular force in the following example:

      i. I_2 and CCl_4 ii.   Methanol and acetone

11   How much electricity is required in terms of Faraday is required to produce:

      i. 20.0 gm of Ca from molten $CaCl_2$

      ii. 40.0 gm of Al from molten Al_2O_3

12   A reaction is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is:

      i.   Doubled   ii   Reduced to half

13   Adsorption is the surface process and it occurs in two way Physical Adsorption and Chemical Adsorption. What is the difference b/w the Physical and Chemical Adsorption?

14   How will you bring about the following conversion:

      a. Propanone to Propene

      b. Benzaldehyde to 3 Phenlypropan-1-ol

15   Predict the products of electrolysis in each of the following:

      a. An aqueous solution $AgNO_3$ with silver electrode.

      b. An aqueous solution of $CuCl_2$ with platinum electrode.

16   What are the factors which effect rate of reaction? List any four factor in brief.

17   The value of ΔG^0 for formation of Cr_2O_3 is -540 kJmol^{-1} and that of Al_2O_3 is -827 kJmol^{-1}. Is the reduction of Cr_2O_3 is possible with Al?

18   Arrange the compounds of each set in order of reactivity towards S_N2 displacement:

      i. 2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane

      ii. 1-Bromobutane,   1-Bromo-2,2-dimethylpropane,   1-Bromo-2-methylbutane, 1-bromo-3-methylbutane

19   The density of Copper metal is 8.95 gm cm^{-3} If the radius of the Copper atom be 127.8 pm, is the copper unit cell is simple cubic, body centered or face centered?

      (Given: atomic mass of Cu = 63.54 gm mol^{-1} and N_A=6.023x10^{-23})

20   The decomposition of phosphine, PH_3, proceeds according to the following reaction:
$$4 PH_{3 (g)} \longrightarrow P_{4 (g)} + 6H_{2(g)}$$
It is found that the rate of reaction follows the rate equation:
Rate = $k[PH_3]$ The half life of PH_3 is 37.9 s at 120^0C
i.   How much time is required to decompose $3/4^{th}$ of initial of PH_3
ii.   What fraction of the original sample of PH_3 remains behind after 1 minute.

Or//

The rate of reaction increases 4 times when temperature is changed from 300 to 320 K Calculate the energy of activation of reaction assuming that it does not change with temperature $[R=8.314 \ JK^{-1}mol^{-1}]$

21   Describe the following:
i. Tyndall Effect   ii. Shape selective catalysis   iii. Peptization

22   Describe the role of the following:
i.   NaCN in the extraction of Silver from Silver ore.
ii. Iodine in the refining of Titanium
iii. Cryolite in the metallurgy of Aluminum

23   The freezing point of a solution containing 0.2 gm of acetic acid in 20.0 gm of benzene is lowered by 0.45^0 C Calculate the degree of association of acetic acid in benzene (K_f = 5.12 K mol^{-1} kg)

24   A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound C_5H_9Cl in bright sunlight. Identify the hydrocarbon?

25   Explain why:
a. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular mass
b. Propanol has higher boiling point than that of hydrocarbon.
c. Ortho nitrophenol more acidic than ortho methoxyphenol.

26   Carry out the following conversion:
i.   Propene to Propan-1-ol
ii. Ethanol to But-1-yne
iii. Ethanol to propanenitrile

27   Explain the following name reaction:
i.   Williamson synthesis
ii. Wurtz reaction   iii.   Esterification Reaction

28   An organic compound contains 69.77 % of carbon, 11.63 % Hydrogen and rest Oxygen. The molecular mass of the compound is 86. It does not reduce Tollens' reagent but forms an addition compound with sodium hydrogensulphite and give positive iodoform test. On vigorous oxidation it gives ethanoic and propanoic acid. Write the possible structure of the compound and give the reactions involved in support of your answer.

Or//

a. Give the simplest chemical test to distinguish:
   i. Propanal and propanone
   ii. Pentan-2-one and Pentan-3-one
b. An organic compound with the molecular formula $C_9H_{10}O$ forms a 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro reaction. On vigorous oxidation it gives 1,2-bnezenedicarboxylic acid. Identify the compound and write the reactions invovlved.

29   What is meant by Vont Hoff Factor? 2 gm of benzoic acid (C_6H_5COOH) dissolved in 25 gm of Benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant for benzene is 4.9 K kg mol^{-1}. What is the percentage association of acid if it forms dimer in solution?

Or//

What is meant by Positive and Negative deviation? Two elements A and B form compounds having formulae AB_2 and AB_4 When dissolved in 20 gms of Benzene (C_6H_6) 1 gm of AB_2 lowers the freezing point by 2.3 K whereas 1 gm of AB_4 lowers it by 1.3 K. The molar depression constant for benzene is 5.1 K kg mol^{-1} Calculate the atomic masses of A and B respectively.

30   a. Define Kohlrausch law. λ^0m for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm^2 mol^{-1} respectively. Calculate λ^0 for HAc.
      b. Explain the mechanism of Corrosion

Or//

a. Given the standard electrode potentials:
           K^+/K = -2.93 V, Ag^+/Ag = 0.80V, Hg^{2+}/Hg = 0.79V ,
           Cr^{3+}/Cr=-0.74V Mg^{2+}/Mg = -2.37 V , Arrange these metals in their increasing order of reducing power with explanation?
b. Explain the functioning of Fuel Cell.