

✓ Answer ANY FIVE full Questions.

✓ Missing data, if any, may be suitably assumed

- 1A. Describe the construction and working of Daniel cell and standard hydrogen electrode.
- 1B. i) How does the hydrogen bonding effect the boiling point of water and solubility of compounds?
  - ii) Explain VSEPR theory with the examples of CH<sub>4</sub> and NH<sub>3</sub>.
- 1C. Calculate the maximum efficiency of a steam engine operating between 110° and 25°C. What would be the efficiency of the engine if the boiler temperature is raised to 140°C, the temperature of the sink remaining the same.

(8+8+4)

- 2A. (i) Derive a relation between  $K_p$  and  $K_c$ .
  - (ii) The equilibrium constant for the reaction:  $I_2(g) \longrightarrow 2 I(g)$  is 1.06 x 10<sup>-2</sup> atm. At what pressure will the dissociated iodine be 1 %?
- 2B. (i) Describe homolytic and heterolytic fission of a covalent bond. Give examples.
  - (ii) Explain what is meant by rate of a reaction. How is the rate of a reaction measured?
- 2C. Explain metallic bond on the basis of molecular orbital theory

(8+8+4)

- 3A.(i) State the necessary conditions for a compound to show optical isomerism. Illustrate your answer with examples.
  - (ii) Write the half-cell reaction and net reaction of the the following cell: Fe/Fe<sup>2+</sup>//Mn<sup>2+</sup>/Mn, Calculate the E.M.F. generated in when the iron rod is immersed in 1.0 M FeSO<sub>4</sub> solution and the Mn rod is immersed in 0.1 M MnSO<sub>4</sub> solution. (Given Standard electrode potential of iron are -0.40 V and manganese -1.18 V respectively.)
- 3B.(i) Derive expressions for hydrolysis constant, degree of hydrolysis of salts of weak acid and weak base.
  - (ii) Explain the terms
    - (a) Heat capacity at constant volume (b) Heat capacity at constant pressure
- 3C. Explain the term hybridization. Give an account of the sp<sup>3</sup> hybridization with suitable example. (8+8+4)

4A. Give reason for the following statements:

- (i) Calomel electrode is reversible with in nature.
- (ii) Entropy of the universe is increasing
- (iii) Purification of NaCl is done by using the principle of solubility product
- (iv) Ice is less dense than water
- 4B. (i) Discuss the relative stability of primary, secondary and tertiary carbonium ions.
  - (ii) What is meant by bond order? Calculate the bond order of He<sup>+</sup> and  $O_2^{2-}$  molecules.
- 4C. The value of specific rate constant for the decomposition of nitrogen pentoxide is 3.46 x

 $10^{-5} \text{ at } 25^{\circ} \text{ C } N_2 \text{O}_5 \longrightarrow N_2 \text{O}_4 + \frac{1}{2} \text{ O}_2$ 

and 4.87 x  $10^{-3}$  65<sup>0</sup> C. Calculate the energy of activation for the reaction. (R =1.987 kcal K<sup>-1</sup> mol<sup>-1</sup>)

(8+8+4)

5A. Write short notes on:

(a) Resonance (b) Intermolecular forces

- 5B. (i) Define single electrode potential and standard electrode potential? Derive Nernst equation for electrode potential.
  - (ii) What are electrophiles? Explain the mechanism of electrophilic substitution reaction.
- 5C. Calculate the entropy change involved in the isothermal reversible expansion of 5 moles of an ideal gas from a volume of 10 litres to a volume of 100 litres at 300 K.

(8+8+4)

- 6A. What are second order reactions? Give two examples. Derive the expressions for the rate constant of second order reaction i) having only one reactant and ii) having two different reactants
- 6B. (i) Define: Lattice energy. Describe how lattice energy of NaCl is calculated from Born-Haber cycle.?
  - (ii) What is a glass electrode? How is it constructed? Explain the origin of potential of glass electrode.
- 6C. Calculate the concentration of hydrogen ions in a solution containing 1.0 M acetic acid. what percent of acid is dissociated.? ( $K_{diss} = 1.8 \times 10^{-5}$ )

(8+8+4)

- 7A. (i) Define and explain the following terms with example:
  - (a) Structural isomerism (b) Geometrical isomerism
  - (c) Functional isomerism (d) Position isomerism
- 7B. (i) Discuss transition state theory of reaction rates.
  - (ii) Explain the physical significance and calculation of absolute entropy.

7C. 13.5 mL of HI are produced by the action of 8.1 mL of H<sub>2</sub> and 0.106 g of iodine vapours at 444°C. Calculate the equilibrium constant for the reaction

 $H_2(g) + I_2(g) \longrightarrow 2 HI(g).$ 

(8+8+4)

- 8A. (i) What is Hess's law of constant heat summation? Explain giving examples.
  - (ii) Explain the hybridization in  $SF_6$  and  $PCl_5$  molecules.
- 8B. (i) Derive Arrhenius equation for energy of activation of a reaction and explain the methods for determination of E<sub>a</sub>.
  - (ii) Explain the function of salt bridge.
- 8C. Write the structure of following compounds.
  - (a) 2-Butenal (b) 2-Buten-1-ol
  - (c) Iodomethane (d) 2-Bromopropane

(8+8+4)

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