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B.E./B.Tech. DEGREE EXAMINATION, JANUARY 2006.

First Semester

CY 1101 — CHEMISTRY — I

(Common to all branches except marine Engineering)

(Regulation 2004)

Time : Three hours　　　　　　　　　　　　　　　Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain briefly any one application of Kohlrausch law of Independent migration of ions.

2. What is a secondary reference electrode? Give one example with its electrode potential value.

3. What do you mean by state functions? Give one example.

4. Predict the conditions for spontaneity in terms of entropy and free energy.

5. What is catalytic poisoning? Give one example.

6. Briefly explain chemisorption with an example.

7. Write the general equation for the rate constant of a second order reaction, $A + B \rightarrow$ products, where the initial concentrations of A and B are different. Write its unit also.

8. What is meant by activation energy of a reaction?

9. What happens to a molecule when it is irradiated with

   (a) IR light

   (b) Microwave radiation?

10. Mention the factors that influence the intensity of spectral lines.

PART B — (5 × 16 = 80 marks)

11. (i) What is the difference between order and molecularity of reactions? (3)

(ii) What are the characteristics of a second order reaction? (5)

(iii) A first order reaction has a k value of 4.5×10^3 at $1°C$ and an activation energy of 58 kJmol^{-1}. At what temperature would k be 1.00×10^4 S^{-1}? (8)

12. (a) (i) Explain the terms : Intensive and extensive properties with example. (3)

(ii) What is the significance of Gibbs-Helmholtz equation? (5)

(iii) Derive Maxwell's relations from the fundamental definitions of thermodynamic properties. (8)

Or

(b) (i) Show that $C_p - C_v = R$. (3)

(ii) At 373.6 K and 372.6 K, the vapour pressures of water are 1.018 and 0.982 atm respectively. What is the heat of vaporization of water? (5)

(iii) Derive the relations to find the change in entropy of an ideal gas when it is expanded reversibly. (8)

13. (a) (i) What are the differences between chemisorption and physical adsorption? (3)

(ii) Derive Langmuir's adsorption isotherm. (5)

(iii) Explain in detail, the role of adsorption in catalysis. (8)

Or

(b) (i) What are catalyst promoters? (3)

(ii) Explain the kinetics of acid-base catalysis. (5)

(iii) Derive Michaelis Menten equation. (8)

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14. (a) (i) What are the general characteristics of a standard cell? (3)

(ii) How is emf of a cell measured experimentally? (5)

(iii) Construct the cells in which following reactions are taking place :

(1) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

(2) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

(3) $Fe + SnCl_2 \rightarrow FeCl_2 + Sn$

(4) $\frac{1}{2}H_2 + \frac{1}{2}Cl_2 \rightarrow HCl$. (8)

Or

(b) (i) Define the term standard electrode potential. (3)

(ii) What are ion selective electrodes? Explain briefly the construction of an ion selective electrode. (5)

(iii) Derive Nernst equation :

Calculate the standard electrode potential of Ni^{2+}/Ni electrode if the cell potential of the cell Ni/Ni^{2+} (0.01 M)// Cu^{2+} (0.1)/Cu is 0.59 V, given that $E^0 Cu^{2+}/Cu = 0.34\,V$. (8)

15. (a) (i) State Beer Lamberts' law and write its mathematical form. (3)

(ii) Explain the main features of working of a colorimeter with a neat block diagram. (5)

(iii) Explain an instrumental method for the quantitative determination of sodium ion in its solution. (8)

Or

(b) (i) What are the factors that influence the intensity of spectral lines. (3)

(ii) Write the principle of UV spectroscopy. (5)

(iii) In a cell, the aqueous solution of a substance of known concentration absorbs 10% of the incident light. What fraction of the incident light will be absorbed by the same solution in a cell five times as long? (8)

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