

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION , MARCH 2015**Sixth Semester****Core Course—EQUILIBRIUM AND KINETICS**

[Common for B.Sc. Chemistry Model I and Model II and B.Sc. Petrochemicals B.Sc. Chemistry
Environmental and Water Management]

Time : Three Hours

Maximum Weight : 25

Section A

Answer all questions. A bunch of four questions carries a weight of 1.

- I. 1 Thermodynamics helps to lay down the criteria for ———.
 2 ——— is an example for state variable.
 3 Adiabatic expansion of a real gas is called an ———.
 4 At absolute zero, all substances have the same ———.
- II. 5 According to the phase rule $F =$ ———.
 6 The number of components in $\text{NH}_4\text{Cl (s)}$, $\text{NH}_4^+ \text{ (aq)}$, $\text{Cl}^- \text{ (aq)}$, $\text{H}_2\text{O (liq)}$, $\text{H}_3\text{O}^+ \text{ (aq)}$, $\text{H}_2\text{O (g)}$, $\text{NH}_3 \text{ (g)}$, $\text{OH}^- \text{ (aq)}$, $\text{NH}_4\text{OH (aq)}$ is ———.
 7 Solid, liquid and vapour will co-exist, such a point is known as ———.
 8 Eutectic solid is a mixture and not a ———.
- III. 9 ——— is Michaelis-Menton equation.
 10 Consecutive reactions are examples for ———.
 11 Thermodynamic formulation of the transition state theory of a bimolecular reaction of A and B is ———.
 12 ——— is an example for pseudo unimolecular reaction.

IV. Match the following :

In the following bunch of four question, match the correct form.

13 Eyring equation — $\frac{d \ln k_p}{dJ} = \frac{\Delta H^\ddagger}{RT^2}$

14 Gibb's Helmholtz equation — $K_2 = \frac{K_B T}{h} e^{\Delta S^\ddagger / R}$

15 Van't Hoff equation — $K = A \cdot e^{-E_a / R\theta}$

16 Arrhenius equation — $\Delta G = \Delta H + T \left(\frac{\partial (\Delta G)}{\partial T} \right)_p$

(4 × 1 = 4)

Turn over

Section B

Answer any five questions. Each carries a weight of 1.

- 17 How is half life related to rate constant for :
(a) A first order reaction. (b) A second order reaction.
- 18 What is meant by "activated complex" ?
- 19 How does a catalyst help in speeding up a chemical reaction ?
- 20 Is it possible that a one component system may have more than one triple point ? Illustrate with a suitable example.
- 21 Determine the number of components for the following system :
(a) $S(\text{rhombic}) \rightleftharpoons S(\text{monoclinic}) \rightleftharpoons S(\text{Liquid})$.
(b) $NH_4Cl(\text{solid}) \rightleftharpoons NH_3(g) + HCl(g)$.
- 22 State and explain second law of thermodynamics.
- 23 What are the criteria for reversible and irreversible processes ?
- 24 Explain the application of Clausius-Clapeyron equation.

(5 × 1 = 5)

Section C

Answer any four questions. Each carries a weight of 2.

- 25 What is Joule-Thomson coefficient ? Explain Joule-Thomson experiment.
- 26 Show that $C_p - C_v = R$ for one mole of an ideal gas.
- 27 Give an example for a simple eutectic system and briefly discuss its salient features with the help of its phase diagram.
- 28 Distinguish between true equilibrium and meta stable equilibrium with suitable example.
- 29 Briefly write on Lindman theory of unimolecular reaction.
- 30 Deduce the expression for Van't Hoff reaction isotherm.

(4 × 2 = 8)

Section D

Answer any two questions. Each carries a weight of 4.

- 31 (a) Describe different methods of determining the order of a chemical reaction.
(b) Suggest an experimental method for finding Δ and E_a in Arrhenius equation.
- 32 (a) Draw the phase diagram of the water system and discuss the application of phase rule to the system.
(b) Explain what do you mean by incongruent melting point.
- 33 (a) What is meant by a spontaneous process ? What is the entropy criteria for a spontaneous process ? Explain.
(b) For the reaction $A_2(g) + B_2(g) \rightarrow 2AB(g)$ $\Delta H = 75.0 \text{ kJ}$ and $\Delta S = 125 \text{ J/K}$ at 300K. Also calculate the minimum temperature above the reaction is spontaneous.

(2 × 4 = 8)