B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2014

Sixth Semester

Core Course—EQUILIBRIUM AND KINETICS

(Common for B.Sc. Chemistry Model I and Model II and B.Sc. Petrochemicals and B.Sc. Chemistry—Environment 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. ———— is not a state function.

 2. According to ———— when ideal gas expands in vacuum $q = 0$.

 3. $(\Delta G)_{J, P} = 0$ represent ————.

 4. ———— is an example for endothermic spontaneous reaction.

II. 5. Congruent melting point of the compound formed lies above, below or in between the melting point of ————.

 6. In the phase diagram of sodium sulphate-water system the transition temperature at which decahydrate changes to anhydrous salt is ————.

 7. Triple point of water system is at ———— temperature.

 8. The reduced phase rule equation is ————.

III. 9. In gaseous reaction the rate is expressed in units of ————.

 10. The order of enzymatic reactions are ————.

 11. The rate law expression for the formation of HBr at 500 K is ————.

 12. The enzyme produced in the germinated barley is ————.

IV. Match the following in the following bunch of *four* questions. Match the correct form :

 13. Michael's-Menton equation — $\Sigma\, ni\, d\mu_i = 0$.

 14. Second order rate equation — $k = A\ e^{-Ea/RJ}$.

 15. Gibbs-Duhem equation — $r = \dfrac{k_2 [E]_0\, [S]}{k_m + [S]}$.

 16. Arrhenius equation — $\dfrac{2.303}{(a-b)t}\, \log \dfrac{b\,(a-x)}{a\,(b-x)}$.

$(4 \times 1 = 4)$

Turn over

Section B

Answer any **five** *questions.*

Each question carries a weight of 1.

17. What is inversion temperature ?

18. State third law of thermo dynamics. Give its significance.

19. Derive the relationship between K_p and K_c.

20. Explain the term "degrees of freedom" with regard to phase rule.

21. Give a labelled phase diagram of the water system.

22. What is a eutectic ? Is it a chemical compound ?

23. What is autocatalysis ? Give *one* example.

24. Distinguish between molecularity and order of a reaction.

$(5 \times 1 = 5)$

Section C

Answer any **four** *questions.*

Each question carries a weight of 2.

25. What is meant by a spontaneous process ? Explain the criteria for spontaneity and equilibrium in terms of free energy change.

26. Define chemical potential. What is its physical significance ?

27. Explain the term congruent melting point. Give an example of a binary condensed system involving formation of a compound with congruent melting point.

28. A eutectic mixture has a definite composition and a sharp melting point, yet it is not regarded as a compound. Explain why with suitable example.

29. What is a first order reaction ? Derive an expression for the 1st order reaction.

30. Explain Homogeneous catalysis with suitable examples.

$(4 \times 2 = 8)$

Section D

Answer any two questions.

Each question carries a weight of 4.

31. (a) Using the first law of thermodynamics, show that $\left(\dfrac{\delta u}{\delta p}\right)_v = -C_v \ \dfrac{(\delta v/\delta p)\text{T}}{(\delta v/\delta\text{T})\text{P}} = C_v \left(\dfrac{\beta}{\alpha}\right)$ when

    α, β are the expansivity and compressibility.

    (b) Calculate the entropy change of an ideal gas with change in p, v and T.

32. (a) Draw and explain the phase diagram of $Fe\,Cl_3$–Water system.

    (b) Calculate the number of components, phase and degrees of freedom in the following equilibrium $Ca\,CO_3\,(s) \rightleftharpoons Ca\,O\,(s) + CO_2\,(g)$.

33. (a) Discuss Transition state theory of reaction rate.

    (b) If the rate constant of a reaction is $2.0\ mol^{-1}\ LS^{-1}$ at $700\ k$ and $32\ mol^{-1}\ LS^{-1}$ at $800\ K$; What is the activation energy ?

$(2 \times 4 = 8)$