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Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2016

Sixth Semester

Core Course—EQUILIBRIUM AND KINETICS

(Common for B.Sc. Chemistry Model I, Model II, B.Sc. Petrochemicals, B.Sc. Chemistry Environment and Water Management)

[2013 Admissions]

Time : Three Hours

Maximum Marks : 60

Part A

Answer all the eight questions.

Each question carries 1 mark.

1. State Zeroth law of thermodynamics.
2. What is meant by state function ?
3. Explain the term partial molar free energy.
4. Write Van't Hoff equation.
5. Explain the term congruent melting point.
6. What is triple point ?
7. What is pseudo-order reaction ?
8. Write Eyring equation ?

(8 × 1 = 8)

Part B

Answer any six questions.

Each question carries 2 marks.

9. What is a spontaneous process ? Explain.
10. Derive the relation between C_p and C_v for an ideal gas.
11. What are the conditions for the chemical equilibrium to exist.
12. Differentiate between extensive properties and intensive properties.
13. Sketch and label the phase diagram for water system.
14. Discuss tie line and lever rule in the phase diagram of two component system.
15. Discuss the effect of a catalyst on the rate of a reaction. How can the action of catalyst can be explained.

Turn over

16. Write a short note on consecutive reaction.
17. The rate constant for the second order reaction is $8 \times 10^{-5} \text{ M}^{-1} \text{ min}^{-1}$. How long it will take for a 0.1 M solution to be reduced to 0.05 M.
18. Integrate the rate expression for a first order reaction.

(6 × 2 = 12)

Part C

*Answer any four questions.
Each question carries 4 marks.*

19. Explain the phase diagram of ferric chloride-water system.
20. Derive the rate law for the Hydrogen-Bromine reaction using steady state approximation.
21. Explain Lindemann theory.
22. Describe Carnot heat engine and calculate its efficiency.
23. Deduce Gibbs-Helmoltz equation. What are its applications?
24. Obtain the expressions for the entropy changes of an ideal gas in :
 - (a) An isothermal process.
 - (b) An isobaric process.

(4 × 4 = 16)

Part D

*Answer any two questions.
Each question carries 12 marks.*

25. Describe the Van't Hoff reaction isotherm.
26. Write short notes on :
 - (i) Internal energy.
 - (ii) Heat energy.
 - (iii) Equilibrium constant.
 - (iv) Gibbs free energy.
 - (v) Inexact differentials and path functions.
 - (vi) Criteria for spontaneity.
27. (a) Explain the transition state theory.
 (b) The rate constant of a second order reaction is $5.7 \times 10^{-5} \text{ dm}^3/\text{mol/s}$ at 25°C and $1.64 \times 10^{-4} \text{ dm}^3/\text{mol/s}$ at 40°C . Calculate the activation energy and the Arrhenius pre exponential factor.
28. Two components A (melting point 0°C) and B (melting point -25°C) form two compounds X and Y melting congruently. X melts at -49.5°C and contains 40 mole percent B while Y melts at -39°C and contains 60 mole percent B. There are three eutectic points at -51°C , 28 mole percent B ; -63.5°C , 48 mole percent B and -49.4°C , 66 mole percent B. Construct phase diagram and determine the formula of X and Y.

(2 × 12 = 24)