

Navrachana University
 School of Liberal Studies and Education, B.Sc.
 End-Semester Examination November 2017
 Second Year and Semester V
 CH 302 - Phase equilibria, Chemical Kinetics and Catalysis

Date: 22/11/2017

Time: 1:00 – 3:00 PM

Marks: 40

Question I. Choose the correct answer from the given options [8 Marks]

- The advance Lindemann theory of unimolecular reaction is also known as
 - Rice-Rampersberger-Kassel-Marcus theory
 - Rice-Rampersberger-Kassel-Michael Faraday theory
 - Rice-Robinson-Kassel-Michael Faraday theory
 - Rice-Robinson-Kassel-Marcus theory
- The alternate name of activated complex theory is
 - Absolute reaction rate theory
 - Transition state theory
 - Both a & b
 - None of the above
- The unit of the rate constant of n^{th} order reaction is
 - $(\text{dm}^3)^{1-n} \text{mol}^{n-1} \text{s}^{-1}$
 - $(\text{dm}^3)^{n-1} \text{mol}^{n-1} \text{s}^{-1}$
 - $(\text{dm}^3)^{n-1} \text{mol}^{1-n} \text{s}^{-1}$
 - $(\text{dm}^3)^{1-n} \text{mol}^{n-1} \text{s}$
- Suppose a reaction proceeds via two step processes.
 Step I: $\text{NO}_2 + \text{NO}_2 \rightarrow \text{NO} + \text{NO}_3$ (*slow step*)
 Step II: $\text{NO}_3 + \text{CO} \rightarrow \text{NO}_2 + \text{CO}_2$ (*fast step*)
 Then the rate determining step will be
 - Step I
 - Step II
 - Both of them
 - None of the above
- What is the order of reaction for which the rate equation is, $\text{rate} = k [\text{A}]^2 [\text{B}]^{1/2}$
 - 3/2
 - 1/2
 - 5/2
 - 1
- A reaction involving gaseous reactants requires the presence of a strip of Rhodium in the reaction vessel. This is an example of what kind of catalysis?
 - Homogeneous
 - Autocatalysis
 - Biocatalysis
 - Heterogeneous
- For a four phase system with two component, the degree of Freedom according to Gibbs phase rule is
 - one
 - two
 - zero
 - three
- The order of an enzyme catalyzed reaction at initial concentration of substrate is
 - one
 - zero
 - two
 - None of the above

Question II. Answer the following. [2 Marks]

Explain with suitable examples, how the rate of reaction is important in daily life.

Question III. Answer the following. (Any Two) [6 Marks]

- Give one example from each of opposing, consecutive and chain reactions and explain the mechanism of chain reaction process.
- What is the effect of temperature on the rate of a reaction? Derive the integrated form of Arrhenius equation.
- Derive the relationship between half life and temperature for n^{th} order reaction where $n > 2$.
- Discuss the Lindemann theory of unimolecular reaction.

Question IV. Answer the following. (Any Two) [12 Marks]

- Define Enzyme Catalysis. State at least four characteristics of an enzyme catalyzed reaction. Derive Michaelis-Menten equation to explain kinetics of an enzyme catalyzed reaction. What will be the effect of very high substrate concentration on the rate of an enzyme catalyzed reaction?
- Draw neatly the phase diagram of a simple eutectic system (two component system) and label the regions. Define: Eutectic Point and Eutectic Composition. Explain the significance of this diagram in deciding the composition of mixture of metals for alloy formation.
- What do you understand by Heterogeneous Catalysis? Distinguish between physical adsorption and chemical adsorption. Discuss adsorption theory of heterogeneous catalysis by taking Nickel catalyzed hydrogenation of ethene as an example.

Question V. Justify the following. [9 Marks]

- A catalyst is more efficient in finely divided form.
 - A deactivated catalyst can be regenerated.
- “Copper (Cu) and gold (Au) can form wide range of solid solution whereas tin (Sn) and antimony (Sb) cannot. Justify the statement on the basis of Hume Rothary Rules for substitutional alloy/solid solution.
- Unwanted water/moisture can be removed from the protein/enzyme/drug sample.

Question VI. Answer the following. [3 Marks]

Define the terms adsorption and absorption. Discuss the various applications of adsorption in industry and in everyday life.
