2025

(FYUGP)

(4th Semester)

CHEMISTRY

(MINOR)

Paper : CHEM.M–4 (T)

(Physical Chemistry—II : Phase Equilibria and Chemical Kinetics)

Full Marks : 75 *Pass Marks* : 40%

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* What is a phase diagram? Define the term 'component'. 2+1=3

(b) Write the desilverization of argentiferous lead. 3½

(c) Discuss the phase diagram of sulphur system. 3½

OR

2. *(a)* Derive Gibbs' phase rule from thermodynamics consideration. 4

(b) Discuss the phase diagram of ferric chloride-water system. 4

(c) Write a note on metastable equilibrium. 2

3. *(a)* Derive an expression for rate constant of a first-order reaction. 3

(b) What is meant by half-life period of a reaction? Prove that half-life of a first-order reaction does not depend on the initial concentration of reactant. 1+3=4

(c) Derive the integrated rate law for first-order reaction. 3

OR

4. *(a)* Discuss the limitations of collision theory. 3

(b) What do you understand by pseudo-order reaction? Discuss with suitable example. 1+2=3

(c) Write short notes on the following : 2×2=4

(i) Transition state theory on reaction rate

(ii) Parallel reaction

5. *(a)* Explain hydrogenation of ethene (ethylene) in presence of nickel. 2

(b) What is acid-base catalysis? Give example. 2

(c) Write some characteristics of enzyme catalysis. 3

(d) What are the functions of catalytic promoter and inhibitor in chemical reactions? 3

OR

6. *(a)* Define catalyst. Explain the types of catalyst with suitable example. 1+3=4

(b) Write a note on the poisoning of catalyst. Give example. 2

(c) Discuss the theories of catalysis. 3

(d) Define negative catalysis. 1

7. *(a)* What are colloids? Discuss the difference between lyophilic sols and lyophobic sols. 1+3=4

(b) Discuss the preparation of sols by Bredig's arc method. 2

(c) Discuss in detail the application of adsorption. 2

(d) Write some characteristic features of adsorption of gases by solid. 2

OR

8. (a) Derive Freundlich adsorption isotherm. 3

(b) Write an application on adsorption. 3

(c) Discuss on Langmuir's adsorption isotherm. 4

9. (a) Define rate constant of a reaction. Calculate the unit of rate constant for zero-, first- and second-order reactions. 1+3=4

(b) Explain the effect of the particles size and efficiency of nanoparticles as catalyst. 3

(c) Determine the order of reaction using half-life period. 3

OR

10. (a) Discuss the collision theory of bimolecular reaction. What are the limitations of this theory? 2+2=4

(b) Explain the phase diagram of water system. 3

(c) Write a note on acid-base catalysis. 3

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Paper : CHEM.M–4 (T)

(Physical Chemistry—II : Phase Equilibria and Chemical Kinetics)

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×12=12

1. A system containing liquid water and water vapour has the number of phases equal to

(a) 0 ( )

(b) 1 ( )

(c) 2 ( )

(d) 3 ( )

2. At a triple point, the number of phases in equilibrium is

(a) 0 ( )

(b) 1 ( )

(c) 2 ( )

(d) 3 ( )

3. For one-phase and one-component system, the degree of freedom is equal to

(a) 1 ( )

(b) 2 ( )

(c) 3 ( )

(d) 4 ( )

4. Which three factors affect the rate of a chemical reaction?

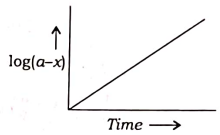
(a) Temperature, pressure and humidity ( )

(b) Temperature, reactant concentration and catalyst ( )

(c) Temperature, reactant concentration and pressure ( )

(d) Temperature, product concentration and container volume ( )

5. The nature of plot of first-order reaction is

(a) 

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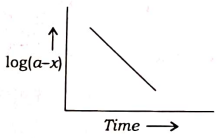
(b) 

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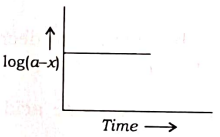
(c) 

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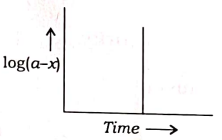
(d) 

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6. As temperature increases, the reaction rate

(a) decreases then increase ( )

(b) decreases ( )

(c) increases ( )

(d) stays the same ( )

7. A catalyst will affect the rate of the forward reaction by changing the

(a) activation energy ( )

(b) heat of reaction ( )

(c) heat of formation ( )

(d) potential energy of the product ( )

8. Enzymes are

(a) substances synthesized by chemist to decrease the reaction rate ( )

(b) highly porous substances to activate acid and bases ( )

(c) extremely poor in catalytic activity ( )

(d) catalysts found in organism ( )

9. The type of reaction in which one of the products itself acts as a catalyst is known as

(a) negative catalysis ( )

(b) enzyme catalysis ( )

(c) positive catalysis ( )

(d) auto-catalysis ( )

10. ____ does not show Tyndall effect.

(a) True solution ( )

(b) Colloidal solution ( )

(c) Suspension ( )

(d) None of the above ( )

11. Fog is an example of colloidal system of

(a) liquid dispersed in a liquid ( )

(b) solid dispersed in a solid ( )

(c) gas dispersed in a liquid ( )

(d) liquid dispersed in a gas ( )

12. Freundlich isotherm is not applicable at

(a) high pressure ( )

(b) low pressure ( )

(c) 273 K ( )

(d) room temperature ( )

Fill in the blanks of the following : 1×3=3

13. Chemisorption generally ..... with temperature.

14. For one-component system, at triple point the number of degrees of freedom is ..... .

15. In lyophobic sols, the dispersed phase has no ..... for the medium or solvent.

Answer the following questions in short : 2×5=10

1. Define molecularity of a reaction. Give example.

2. Define degrees of freedom.

3. What is promoter? Give example.

4. Differentiate between chemical adsorption and physical adsorption.

5. Write a note on electrophoresis.

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