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Code No. : 5424 **Sub. Code : ZCHM 43**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023.

Fourth Semester

Chemistry – Core

CHEMICAL KINETICS, PHOTO CHEMISTRY AND SURFACE CHEMISTRY

(For those who joined in July 2021 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The temperature of a gas is 100 K it is heated until it is 200K then, what do you understand regarding kinetic energy in this process?
   (a) Halved
   (b) Tripled
   (c) Quadrupled
   (d) Doubled

2. In a single-component system, if degree of freedom is zero, maximum number of phases that can co-exist ————————
   (a) 0 (b) 1
   (c) 2 (d) 3

3. The effect of ionic strength is the kinetics is called as
   (a) Ionic effect
   (b) Electrophoretic effect
   (c) Salt effect
   (d) Solvent effect

4. Explosive reactions are the type of
   (a) Fast reactions (b) Chain reactions
   (c) Slow reactions (d) Surface reactions

5. In any unimolecular reaction ————————
   (a) Only one reacting species is involved in the rate determining step
   (b) The order and the molecularity of slowest step are equal to one
   (c) The molecularity of the reaction is one and order is zero
   (d) Both (a) and (b)

6. Which of the following is true about Michaelis-Menten kinetics?
   (a) K_m, the Michaelis constant, is defined as that concentration of substrate at which enzyme is working at maximum velocity
   (b) It describes single substrate enzymes
   (c) K_m, the Michaelis constant is defined as the dissociation constant of the enzyme – substrate complex
   (d) It assumes covalent binding occurs between enzyme and substrate

7. Radiative process from the following is
   (a) Fluorescence
   (b) Intersystem crossing
   (c) Internal conversion
   (d) All

8. The G-value is the number of molecules formed per ———————— of energy,
   (a) 1 eV (b) 10 eV.
   (c) 100 eV (d) 1000 eV

9. Which property of surfactants depends on the hydrophobic effect?
   (a) CMC (b) Micelle
   (c) Polarity (d) Non-polarity

10. Which of the following lowers the surface tension between two liquids or between a liquid and a solid?
    (a) Reverse micelles
    (b) Surface active agent
    (c) Counter ion
    (d) Catalyst

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Describe a method to calculate the vibrational heat capacity.

Or

(b) State the Phase rule and by using it explain the phase diagram of a system of two solids and a liquid.

[P.T.O.]

12. (a) Explain simple collision theory and obtain an expression for the rate of a bimolecular gas phase reaction $A + B \rightarrow$ Products.

Or

(b) With a neat sketch of potential energy surface, explain the meaning of saddle point and comment on its importance.

13. (a) Illustrate the relaxation method for studying the fast reactions.

Or

(b) Explain the principle and instrumentation of flash photolysis.

14. (a) What do you meant by radiolysis of water? Explain the reactions of hydrated electrons.

Or

(b) Define fluorescence and phosphorescence and explain the mechanisms.

15. (a) Distinguish physisorption and chemisorption.

Or

(b) Discuss the application of B.E.T. equation. How to determine the surface area of solid?

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) (i) Derive an expression for thermal conductivity in a gas.

(ii) Derive Poseuille formula.

Or

(b) (i) State Lever rule. (2)

(ii) What is salting out and explain with example? (3)

(iii) Explain the phase diagram of a system of three liquids consisting of two pairs of partially miscible liquids.

17. (a) What are the various elementary processes in a chain reaction? Discuss the kinetics and mechanism of decomposition of acetaldehyde.

Or

(b) Write notes on H_2O_2 - explosive reaction. Explain the terms first explosion limit and second explosion limit.

18. (a) Explain the salient features of RRK theory of unimolecular reactions and obtain an expression for k_1.

Or

(b) Discuss Michaelis – Mention kinetics of enzyme catalysis.

19. (a) Explain how are excited state (i) pK_a and (ii) red-ox potentials determined.

Or

(b) (i) Explain the Photosensitisation and chemiluminescence. (3)

(ii) Derive Stern-Volmer equation and its applications. (5)

20. (a) Explain Langmuir – Rideal and Langmuir – Hinshelwood mechanisms on surfaces.

Or

(b) (i) What is zeta Potential? (2)

(ii) Explain the kinetics of heterogeneous catalysis with the examples. (6)

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