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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, FEBRUARY 2021

Third Semester

Faculty of Science

Branch : III-Pure Chemistry

CH3C11—CHEMICAL KINETICS, SURFACE CHEMISTRY AND PHOTOCHEMISTRY

(2012—2018 Admissions)

Time : Three Hours Maximum Weight : 30

Section A

Answer any **ten** *questions.*
Each question carries a weight of 1.

1. What is free energy of activation $\Delta G^{\ddagger}$? What is its significance in deciding the rate of the reaction ?
2. Explain the use of NMR in the study of fast reactions.
3. What is kinetic isotopic effect ? Explain using a suitable example.
4. Give an example of Fischer-Tropsch reaction. Explain the role of the catalyst used in the reaction.
5. What is primary and secondary salt effect ? Explain giving suitable examples.
6. What are micelles ? Explain its role in cleansing clothes.
7. What is Zeta potential ? How it is related to the stability of colloids.
8. Define
   (a) Number average molar mass.
   (b) Mass average molar mass.
9. Give Gibbs adsorption isotherm. Explain the terms used in the equation.
10. What are surfactants ? Explain their important uses
11. Define the term quantum yield. Explain the significance of low and high quantum yield values seen in some reactions
12. What are excimers and exciplexs ?
13. Explain the use of lasers in studying the kinetics of photochemical reactions.

(10 × 1 = 10)

Turn over

Section B

Answer **five** *questions by attempting not more than three questions from each bunch. Each question carries a weight of* 2.

BUNCH 1

14. Derive an equation for the rate of the $H_2 - Cl_2$ reaction

15. Give the basic postulates of collision theory of reactions' cite the common equation used to calculate the rate based on these postulates.

16. Give a brief account of Skrabal diagrams of acid base catalysis.

17. Deduce Stern-Volmer equation emphasizing the determination of fluorescence life time.

BUNCH 2

18. Consider a bimolecular reaction between like molecules with a collision diameter 200 pm, molar mass 100 g mol^{-1} and the steric factor = 1.00. Calculate the pre-exponential factor at :

    (a) 100°C and (b) 200°C. Also calculate the exponential factor at the two temperatures and comment on the result (activation energy 150 kJ mol^{-1}).

19. For the first order isomerisation of an organic compound at 130°C, the activation energy is 108.4 kJ mol^{-1} and the rate constant is $9.2 \times 10^{-4} s^{-1}$. Calculate the standard entropy of activation for this reaction.

20. Consider the following mechanism for an enzyme catalysed reaction.

$$E + S \underset{k^{-1}}{\overset{k_1}{\rightleftharpoons}} ES \quad ES \xrightarrow{k_2} EP \quad EP \xrightarrow{k_3} E + P$$

E-enzyme S-substrate EP-enzyme product complex

.Using steady state approximation, show that

$$r = \frac{k_2 (E)_o (S)}{\left(k_{-1} + k_2\right) \Big/ k_1 + \left(1 + \frac{k_2}{k_3}(S)\right.}.$$

21. At 0°C and 1 atm pressure, the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be 130 cm^3 g^{-1} of the gel. Calculate the surface area per gram of silica gel. Given that the area occupied by a nitrogen molecule is 0.162 $(nm)^3$.

(5 × 2 = 10)

Section C

Answer any **two** *questions.*

Each question carries a weight of 5.

22. Discuss briefly on the following theories of unimolecular reactions :

    (a) Lindemann theory.

    (b) Rice-Rampsberger-Kassel-Marcus theory.

    (c) Hinshelwood theory.

23. Write briefly on Enzyme catalysis. Give Michelis-Menten equation. Explain the effect of pH and temperature on enzyme catalysis

24. Write notes on :

    (a) ESCA.

    (b) Auger electron spectroscopy.

    (c) SEM.

25. Explain the different ways of utilisation of solar energy with special reference to solar cells and their working.

(2 × 5 = 10)