

21000270



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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 ΔG^\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





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Section B

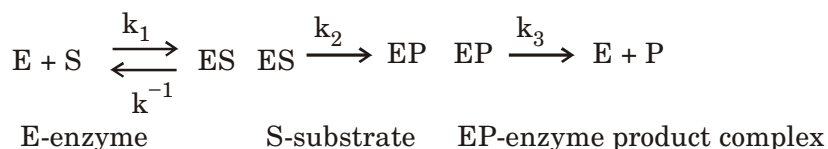
Answer **five** questions by attempting not more than three questions from each bunch.
Each question carries a weight of 2.

BUNCH 1

14. Derive an equation for the rate of the $\text{H}_2 - \text{Cl}_2$ 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 $108.4 \text{ kJ mol}^{-1}$ and the rate constant is $9.2 \times 10^{-4} \text{ s}^{-1}$. Calculate the standard entropy of activation for this reaction.
20. Consider the following mechanism for an enzyme catalysed reaction.



.Using steady state approximation, show that

$$r = \frac{k_2(\text{E})_0(\text{S})}{(k_{-1} + k_2) \left/ k_1 + \left(1 + \frac{k_2}{k_3}(\text{S}) \right) \right.}$$

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 $130 \text{ cm}^3 \text{ g}^{-1}$ 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)^2 .

(5 × 2 = 10)





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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)

