



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – CHEMISTRY

SECOND SEMESTER – NOVEMBER 2016

CH 2957 - CATALYSIS

Date: 14-11-2016
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

Part-A

Answer ALL questions.

(10 × 2= 20)

1. What are associative and dissociative adsorptions?
2. What is a catalyst support? Mention its role
3. State Hammett - Zucker hypothesis.
4. Write the role of VPO catalyst in the partial oxidation of n- butane to maleic anhydride.
5. Cite any two examples of organic reactions which are catalysed by TiO₂.
6. The quantum efficiency for the photochemical reactions of H₂-Cl₂ is 10⁵ whereas H₂-Br₂ is 0.01. Substantiate?
7. Write the advantages of biocatalysis.
8. What is Hammett acidity function and mention its significance.
9. What would happen when electrons interact with a sample in electron microscope?
10. Write the significance of Barrett-Joyner-Halenda equation.

Part-B

Answer any EIGHT questions.

(8 × 5= 40)

11. Write a note on turnover number and catalyst deactivation.
12. Write Harkins-Jura equation and its advantages.
13. Write the limitations of catalytic dehydrogenation of ethyl benzene to styrene and explain how it can be overcome by catalytic oxidative dehydrogenation method.
14. Show that Bronsted catalytic law is a special form of linear free energy relationship.
15. Explain the significance of Skrabal plots in acid-base catalysis.
16. Discuss the kinetics of photochemical H₂-Cl₂ reaction.
17. Explain the parameters that affect the photocatalytic activity of metallised semiconductors.
18. Discuss the mechanism of covalent catalysis with a suitable example
19. What are the advantages of using organic solvents in biocatalysis.
20. Write the advantages and limitations of scanning electron microscopy.
21. How is the reducibility of the catalyst determined?
22. Write the differences between AFM and STM.

Part-C

Answer any **FOUR** questions.

(4 × 10= 40)

23. Discuss the Langmuir-Hinshelwood bimolecular surface reaction between molecular adsorbates.
- 24a. The experimental data for the adsorption of nitrogen on alumina at 77.3 K fit in a Brunauer-Emmett-Teller isotherm. The slope and intercept of a plot of $P/V(P_0-P)$ and P/P_0 are $2.88 \times 10^{-2} \text{ cm}^{-3}$ and $9.87 \times 10^{-4} \text{ cm}^{-3}$. The area of cross section of N_2 molecule is $16.2 \times 10^{-20} \text{ m}^2$. Calculate V_{mono} .
- b. Draw and explain the potential energy diagrams for catalytic reactions proceeding through Arrhenius and van't Hoff type intermediates. (5+5)
25. Explain the unique shape selectivity exhibited by zeolites.
26. Describe the various photophysical processes that occur in a molecule as a consequence of light absorption.
- 27a. Write the mechanism of metal ion catalysis with suitable example.
- b. Describe the construction and working of Honda – Fujishima cell for the photoelectrolysis of water. (5+5)
- 28a. Explain the principle of operation of the atomic force microscope.
- b. How are bright and dark field imaging techniques operated in TEM? (5+5)
