



Date: 27-04-2016

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

PART-A

Answer ALL questions.

(10 x 2= 20 marks)

1. Define any two parameters used to compare the activity of catalysts.
2. What is the difference between catalytic poison and catalytic inhibitor?
3. Distinguish between protropic and protolytic mechanisms.
4. Write the limitations of catalytic dehydrogenation of ethyl benzene to styrene.
5. Depict the processes that take place on the surface and bulk of photoexcited semiconductors.
6. What are photoelectrochemical devices? Mention their limitations.
7. Write the advantages of biocatalysis.
8. Mention the application of lyases in biocatalysis with an example.
9. How are electron microscopes useful as a characterization technique?
10. Write de Boer equation and its significance.

PART-B

Answer any EIGHT questions.

(8 x 5= 40 marks)

11. How is BET constant 'C' calculated? What is the significance of C?
12. The decomposition of NH₃ on Mo surface follows Langmuir-Hinshelwood mechanism. The decomposition was carried out at low pressure. The initial pressure of NH₃ was 10⁻² torr. Pressure of NH₃ was reduced to 10⁻⁴ in 10 min. Calculate the rate constant of decomposition of NH₃
13. Derive an expression for the rate constant of a homogeneous catalytic reaction using steady state treatment.
14. Write a note on Hammett acidity function.
15. Explain the mechanism for the production of isotactic and syndiotactic polymers using Ziegler-Natta catalyst.
16. Describe the construction and working of Honda – Fujishima cell for the photoelectrolysis of water.
17. Explain the kinetics of photochemical H₂-Cl₂ reaction in detail.
18. Write the mechanism of metal ion biocatalysis with suitable example.
19. What are the advantages of using organic solvents in biocatalysis?
20. What are the limitations and applications of scanning electron microscope?
21. Calculate the crystallite size and d-spacing in nanometer for the following intense XRD peaks (2θ in deg) 38.10, 44.23 and 64.32. The FWHM value for the three peaks is 0.00418 radians. Wavelength of X-rays is 0.1540598 nm.
22. Write the differences between AFM and STM.

PART-C

Answer any **FOUR** questions.

(4 x 10= 40 marks)

- 23 a. The experimental data for the adsorption of CO on charcoal at 273 K confirm that they fit the Langmuir isotherm. The slope and intercept of the graph between P/V and P are 0.9 cm^{-3} and 9.0 mmHgcm^{-3} respectively. Calculate V_{mono} and ΔG_{ads} . (7)
- b. How is the specific surface area of solid adsorbents determined using BET equation? (3)
- 24 a. Discuss the interpretation of the Langmuir adsorption isotherm. (5)
- b. Show that Bronsted catalytic law is a form of linear free energy relationship. (5)
- 25 a. Explain the unique shape selectivity exhibited by zeolites. (6)
- b. Quenching of fluorescence depends on the concentration of fluorescent substance - Justify. (4)
26. What are metallised semiconductors? Discuss the parameters that affect the photocatalytic activity of them.
- 27 a. Describe the various photo physical processes that occur in a molecule as a consequence of light absorption. (5)
- b. Discuss the mechanism of covalent biocatalysis with suitable example (5)
28. Explain the optional microanalysis techniques available in TEM to characterize the catalyst.
