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MSS 454

II Semester M.Sc. Degree Examination, September/October 2022
(CBCS Scheme)
MATERIALS SCIENCE
Surface Phenomena and Electrochemistry

Time : 3 Hours

Max. Marks : 70

Instruction : Answer all questions.

1. a) Derive an expression for Langmuir adsorption isotherm. Deduce Freundlich adsorption isotherm from it under appropriate conditions.
- b) What is heterogeneous catalysis ? How is it explained by adsorption theory ? Explain the functioning of catalytic promoters and catalytic poisons. **(10+10)**

OR

2. a) Differentiate between physical adsorption and chemical adsorption. Draw and explain Freundlich and BET isotherms and their limitations.
- b) Give the classification of solid state reactions and explain the factors affecting the reactivity of solids. **(10+10)**
3. a) Compare and differentiate between galvanic cells and fuel cells. Explain the working of hydrogen – oxygen fuel cell.
- b) Define hydrogen over voltage and oxygen over voltage. With a suitable example illustrate that hydrogen over voltage facilitates the electro-deposition of metals with negative electrode potentials from their aqueous solutions. **(10+10)**

OR

4. a) Define specific conductance and equivalent conductance of electrolyte solutions. Explain their variation in weak and strong electrolyte with dilution.
- b) Define the following types of electrodes, give examples and write their electrode reactions :
 - i) Metal – metal salt ion electrode
 - ii) Gas electrode
 - iii) Oxidation reduction electrode. **(11+9)**

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5. a) Differentiate between dry corrosion and wet corrosion. Explain electrochemical theory of corrosion with the relevant mechanism.
- b) Explain the following corrosion control methods :
- i) Anodic coating
 - ii) Cathodic coating
 - iii) Chemical conversion coating
 - iv) Cathodic protection by sacrificial anodic method. (10+10)

OR

6. a) Explain the effect of the following on the rate of corrosion :
- i) Ratio of anodic area to cathodic area
 - ii) Nature of the corrosion product
 - iii) pH of the medium
 - iv) Presence of oxidizing agents.
- b) Give an account on the following :
- i) Differential aeration corrosion
 - ii) Anodic protection of metals from corrosion. (10+10)

7. Answer **all** the following questions. **Each** question carries **2** marks. (5×2=10)
- a) Differentiate between adsorption and absorption.
 - b) What is a concentration cell ? Justify that there is no net cell reaction in a concentration cell.
 - c) Justify that EMF of a cell is always negative.
 - d) What are the limitations of cathodic protection by impressed potential method ?
 - e) Out of the two designs of a copper vessel with an iron bolt and an iron vessel with a copper bolt, identify the better one with justification.
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