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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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