B. Sc. CHEMISTRY EXAMINATION, 2024

(5th Semester)

CHEMISTRY (CORE)

PAPER : CORE 13

Time : *Two Hours* *Full Marks* : 40

(*20 marks for each Unit*)

Use a separate answer scripts for each Unit.

The figures in the margin indicate full marks.

UNIT—5131 – P

Answer ***all*** questions.

1. What is/are the conceptual difference(s) between Freundlich and Langmuir adsorption isotherms? How is BET equation exploited for best utilization of solid catalysts in factories? 1+2

2. How can you determine the area of head group of a fatty acid anchoring on water surface? 2½

3. Discuss whether presence of ions stabilizes or destabilizes a colloid system. 2

4. Discuss the effect(s) of applying an electrical potential on a colloid system. 2½

5. Write a short note on graphene. 2

6. How will you synthesize a silver nanoparticle? Write down about the importance of silver nanoparticles. 2+2

7. What is the degree of polymerization? 1

8. Define functionality. Give an example of a reaction where butadiene may be tetrafunctional. 3

UNIT—5132 – P

9. Answer ***all*** questions :

(a) Why is a difference in electrical potential developed at the phase boundary between metal and electrolyte solution? Show a brief outline to measure such potential difference experimentally. 1½+2

(b) Discuss the following facts with appropriate justifications :

(i) Separation into chemical and electrical terms in the electrochemical potential is possible with gradients but not with quantities.

(ii) The electrochemical cell potential is equal to the electrical potential difference between two half-cells. 2+2

(c) How is the potential difference across the phase boundary of two identical electrolyte solutions of different concentrations connected with the transport numbers of cation and anion of the electrolyte? Represent Nernst equation of the following cell : Zn-amalgam (c_1) / $ZnSO_4$ (c_2) / Zn-amalgam (c_3). 2½+1

(d) Define overvoltage potential for an electrolytic process. Why does hydrogen overvoltage potential play a critical role for electrolytic deposition of metal from metal-salt in aqueous medium? 1+2

(e) Calculate the reversible decomposition potential of water. Does it change with the change of pH of the medium? 2+1

(f) An aqueous solution containing 0·01 (M) $Fe(ClO_4)_3$, 0·01 (M) $Fe(ClO_4)_2$ and 0·01 (M) $HClO_4$ was titrated with a concentrated NaOH solution at room temperature (25 °C), so that changes in volume were negligible. Calculate the redox potential of Fe^{+3}/Fe^{+2} system at pH values 2·2, 4·2, 6·0 and 10 assuming new species formed during titration were $Fe(OH)_3$ and $Fe(OH)_2$ only. [Given : E^0 (Fe^{+3} / Fe^{+2}) = 0·77 V; solubility product of $Fe(OH)_3$ = $10^{-37\cdot1}$ and $Fe(OH)_2$ = $10^{-18\cdot4}$] 3

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