

This question paper contains 3 printed pages]

NA—03—2023

FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(New/CBCS Pattern)

CHEMISTRY

Paper-XV

(Physical and Inorganic Chemistry)

(Friday, 01-12-2023)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

N.B. :— (i) Attempt all questions.

(ii) Use of logarithmic table and calculator is allowed.

1. Answer any *three* of the following :

3×5=15

- (a) Give names of *three* essential trace elements and *three* ultratrace elements.
- (b) Write the main reaction for biological nitrogen fixation and name the enzyme involved.
- (c) What are metalloboranes ? Explain the preparation of metalloboranes.
- (d) What are boranes ? How are they classified ?
- (e) What are carboranes ? Explain properties of carboranes.

P.T.O.

WT

(2)

NA—03—2023

2. Attempt any *three* of the following : 3×5=15

- (a) Write a note on chemical potential. Derive an expression to show variation of chemical potential with pressure.
- (b) Derive relation between ΔG° (change in standard free energy) and K_P (equilibrium constant).
- (c) Derive an expression relating the freezing point depression of a solution with molecular weight of dissolved solute.
- (d) What are the types of concentration cell ? Derive an equation for emf of concentration cell with transport.
- (e) What is oxidation potential ?

A copper rod is placed in 0.011 m solution of copper sulphate at 25°C. Assuming that the salt is dissolved almost completely at this dilution, calculate the oxidation potential of the electrode at this temperature.

$$[E^\circ <cu, cu^{++}> = - 0.34 \text{ v}]$$

3. Answer any *two* of the following : 2×5=10

- (a) What is free energy ? Derive an expression for variation of free energy with pressure and temperature. Hence show that $\left(\frac{dG}{dP}\right)_T = V$.
- (b) The equilibrium constant for a reaction at 620 K and 670 K are 6.80×10^{-4} and 1.60×10^{-4} respectively. Calculate heat of the reaction. $[R = 8.314 \text{ JK}^{-1} \text{ mole}^{-1}]$.

WT

(3)

NA—03—2023

- (c) Explain the method of determination of pH of unknown solution by using glass electrode.
- (d) An aqueous solution containing 0.25 gm of a solute dissolved in 20 gm water froze at -0.42°C , calculate the molar mass of the dissolved solute ($k_f = 1.851 \text{ k kg}^{-1}$).

NA—03—2023

3