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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.

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^o (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^o <cu, cu^{++}> = – 0.34 *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 JK^{-1} $mole^{-1}$].

(*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 k kg^{-1}).