VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY(VSSUT), ODISHA

Odd Mid Semester Examination for Academic Session 2024–25

COURSE NAME: **B.Tech.** SEMESTER: **1st**

BRANCH NAME: **All B.Tech. (Section: A, B, C, K, L, M, & N)**

SUBJECT NAME: **Chemistry**

FULL MARKS: **30** TIME: **90 Minutes**

Answer **All** Questions.

The figures in the right-hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer All Questions. [2 × 3]

a) What is the influence of charge on polarizability of cations and anions? - CO1

b) What is the physical significance of work function (ΔA) and free energy function (ΔG)? - CO2

c) What is the region of rotational and vibrational spectrum (in cm^{-1})? - CO3

Q2. *[4+4]*

a) Name any two factors that influence ionization energy? Why does oxygen have a lower ionization enthalpy than nitrogen, despite having a greater atomic number? - CO1

b) Write down the formula for electronegativity in Mulliken scale. Also, calculate the electronegativity of the following elements in Mulliken scale. - CO1

Element	Ionization energy ($KJmol^{-1}$)	Electron affinity ($KJmol^{-1}$)
Na	495	–53
Cl	1251	–141

OR

c) What is electron gain enthalpy? Why does electron gain enthalpy increase across a period and decrease down a group in the periodic table? - CO1

d) Calculate the percentage of ionic character for C–H bond and state whether it is ionic or covalent. Given $\chi_C = 2.5$ and $\chi_H = 2.1$ - CO1

Q3. [4+4]

a) What are the factors affecting entropy of a system? - CO2

b) The equilibrium constant for the formation of ammonia from its isolated reactants is 1.064×10^{-4} at 500 °C. Calculate the mean heat of formation of 1 gm of ammonia in this temperature range. - CO2

OR

c) What are the criteria for spontaneity of a chemical reaction? - CO2

d) The equilibrium constant for the reaction $H_{2(g)} + S_{(s)} \leftrightharpoons H_2S_{(g)}$ is 18.5 at 925 K and 9.25 at 1000 K. Calculate the standard enthalpy of the reaction. Also, calculate ΔG_0 and ΔS_0 at 925 K. - CO2

Q4. *[4+4]*

a) Which of the following molecule will show rotational spectra and why? - CO3
i) CO_2, ii) HF, iii) N_2, and iv) CO

b) The pure rotational spectrum of CN^- in gaseous phase shows series of equally spaced spectral lines with interspacing 3.8 cm^{-1}. Calculate the internuclear distance of CN^-. Given molar masses: $^{12}C = 12.011$ and $^{14}N = 14.007$ - CO3

OR

c) How the intensity of rotational lines varies with rotational quantum number? Draw the corresponding diagram. - CO3

d) How moment of inertia is related to bond length of a diatomic molecule? Derive the corresponding equation. - CO3