B. Sc. (Chemistry) Examination, 2022

(3rd Year, 6th Semester, CBCS Syllabus)

Chemistry (DSE)

Paper – DSE/Chem/Th/01

Time : Two hours Full Marks : 40

UNIT: 6011-1

Answer the following questions.

1. a) What do you mean by multistage extraction? How is it different from single stage extraction? Show that the multistage extractions have better efficiency than single stage extraction.

   b) What is continuous extraction? Describe the methods of continuous extraction considering the solvent heavier than water. Can this extraction be considered as a special case of multistage extraction? Give justification in support of your answer.

   c) What are Soxhlet and thimble?

   (2+1+2)+(1+1+1)+2=10

2. a) How does DTG of a sample give more information than TGA?

   b) Which of the following chemical reactions would not be detected by TGA?

I) $CaCO_3 + SO_2 = CaSO_4 + CO_2$

II) $CaCO_3 + SiO_2 = CaSiO_3 + CO_2$

III) $CaCO_3 + Na_2SO_4 = CaSO_4 + Na_2CO_3$

c) On heating a sample of 25 mg hydrated compound (molecular weight = 250 g/mol) in a thermogravimetric analysis, 16mg of dehydrated compound remains. Find out the number of water molecules lost per molecule of the hydrated compound.

d) Describe the principles of DSC?

e) Write a note on Glass Electrode.

f) Define and classify the electroanalytical methods.

$1+1+1\frac{1}{2}+2+2\frac{1}{2}+2=10$

3. a) Explain the different radiative and non-radiative processes in the light of Jablonski diagram when a molecule is excited by a photon.

b) What do you mean by zero-zero spectroscopic energy ($E_{0\text{-}0}$)? How can $E_{0\text{-}0}$ value of chemical species be estimated?

c) Using IR data, how will you prove the occurrence of Jahn-Teller distortion in $[Mn(dmso)_6]^{3+}$ (dmso = dimethylsulfoxide)?

d) Justify the infrared stretching frequencies observed for the isoelectronic species: $[Mn(CO)_6]^+$ (2090 cm^{-1}), $[G(CO)_6]$ (1940 cm^{-1}) and $[V(CO)_6]^-$ (1858 cm^{-1}).

e) Why is monochromatic light used in Beer-Lambert law? In a spectrophotometric cell of 2·0 cm path length, the solution of a substance shows an absorbance value 1·0. If the molar absorptivity of the compound is 2×10^4 L mol^{-1} cm^{-1}, calculate the concentration of the substance in solution. $2\times5=10$

4. a) Discuss the structure and the method of synthesis of any of the resins used in ion exchange chromatography.

b) Write a short note on the role of silica and alumina in TLC.

c) What is meant by liquid-liquid partition chromatography? Discuss the principle of this chromatography in brief. $3\frac{1}{2}+3\frac{1}{2}+3=10$