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- b) What is the general procedure of solid-liquid extraction? How can the Calcium, Strontium and Barium be separated using the solvent extraction technique? 2+1
- c) How is the number of equilibrium important in solvent extraction process? 1
- d) What do you mean by ion pair? What is ion pair extraction? 1

Ex/SC/CHEM/PG/CORE/TH/XIII-A/2023

M. Sc. (CHEMISTRY) EXAMINATION, 2023

(4th Semester)

PAPER: XIII–A

[ANALYTICAL CHEMISTRY SPECIAL]

Time : Two Hours

Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

Unit: A-4131

1. Answer *any four* questions :
- a) Differentiate between accuracy and precision. Write down the general properties of normal error curve. 1+1½
- b) Consider the following set of replicate measurements: 0.972, 0.943, 0.986, 0.937, 0.954. Calculate the (i) median, (ii) spread, (iii) coefficient of variation. 2½
- c) The standard deviation in measuring the diameter d of a sphere is ± 0.02 cm. What is the standard deviation in the calculated volume V of the sphere if d=2.25 cm? 2½
- d) Calculate a pooled estimate of σ from the following analysis of K^+ ion of several plant-food preparations. 2½

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| Sample | Percent K ⁺ |
|--------|------------------------------|
| 1 | 6.02, 6.04, 5.88, 6.06, 5.82 |
| 2 | 7.48, 7.47, 7.29 |
| 3 | 3.90, 3.96, 4.16, 3.96 |

- e) Explain rules for determining the number of significant figures. Round the following answer so that only significant digit is retained:

$$\log 4.000 \times 10^{-5} = -4.3979400 \quad 1\frac{1}{2} + 1$$

- f) Describe confidence interval with an example. Explain, in your own words, why the confidence interval for the mean of seven measurements is smaller than that for a single result. $1 + 1\frac{1}{2}$

2. Answer **any one** question :

- a) i) How does analyte reach the electrode surface and what is next to it? Give detail mechanism. 2

Or

- ii) Explain the role of three electrodes and concentration of supporting electrolyte in cyclic voltammetry. 2
- iii) Draw a cyclic voltammogram of [Ru(bpy)₃]Cl₂. Do you find any correlation between the consecutive positive and negative potential

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difference with MLCT band of the complex? Explain. 4

- iv) A polarogram is drawn from Ni²⁺ solution (C₀ = 10⁻⁴ M) with KClO₄ (0.01 M) as supporting electrolyte and a drop of ethylenediamine (10⁻³ M) is added. Do you find any change in the polarogram in these two cases? Comment on E_{1/2} of Ni^{2+/0} redox couple. 4

- b) Using diffusion current $i_d = 706nD^{1/2}m^{2/3}t_1^{1/6}C$ and Nernst Equation of EMF, calculate stability constant of M-L complexation reaction (consider, complex is stable and is produced in one step). 10

Unit: A-4132

3. a) Write a short note on the elution, frontal and displacement techniques in gas chromatography. 2×3
- b) Discuss briefly the chemical structure of ion-exchange resins. 2
- c) How can you separate cobalt(II), nickel(II) and copper (II) by paper chromatography? Discuss in brief. 2
4. a) What is continuous counter current extraction? How is it efficient than continuous extraction? Describe the general method of continuous counter current extraction. 1+2+2

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