Sr. No. of Question Paper : 1607      C      Roll No.............

Unique Paper Code      : 217203

Name of the Course      : B.Sc. (H) Chemistry

Name of the Paper      : Analytical Methods in Chemical Analysis (CHHT–204)

Semester      : II

Duration      : 3 Hours      Maximum Marks : 75

## Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt **six** questions in all including Q. No. 1, which is compulsory.

3. Use of scientific calculators is allowed.

4. Log tables to be provided to the candidates.

1. (a) Attempt any **five** of the followings :

     (i) Differentiate between accuracy and precision.

     (ii) Give the mathematical expression for Beer-Lambert law and give the significance of all the terms in it.

     (iii) Define the term analyte.

     (iv) What do you understand by nebulization ?

     (v) What are the four basic components of an analytical instrument.

     (vi) How does paper act as stationary phase in paper chromatography ?

                   (2×5)

(b) Give the full form of the following :

     (i) EDTA

(ii) R

(iii) SHE

(iv) HPTLC

(v) SPE (1×5)

2. (a) Define the term analytical chemistry.

(b) What is sampling ? Why is it considered the most difficult part of chemical analysis ? Give a block diagram showing stages in chemical analysis.

(c) What are systematic and random errors ? How can the systematic errors be removed ? (4×3)

3. (a) Give the principle of "null point" thermobalance. Draw a neatly labelled diagram of a thermobalance.

(b) Give a schematic diagram of a glass electrode and explain its function.

(c) Draw a typical arrangement for a potentiometric titration. Give any two advantages of potentiometric titrations over the conventional volumetric titrations. (4×3)

4. (a) How does a double beam spectrophotometer differ from a single beam spectrophotometer ? Draw a schematic diagram for a double beam spectrophotometer.

(b) What is the function of a monochromator in UV-Vis spectrometry ? Give the advantages of diffraction gratings over prisms and optical filters.

(c) An aqueous solution of a substance x shows 80% transmittance at 500 nm. If the molar absorptivity of this substance at this wavelength is 40000, what is the concentration of the solution ? (4×3)

5. (a) How are gaseous metal atoms produced in FES (flame emission spectrometry) ? Show with the help of a suitable diagram.

(b) Explain how the composition of the flame affects the production of gaseous atoms using suitable examples.

(c) What is the requirement for a molecule to IR active ? Explain by taking $N_2$, HCl and CO molecules as examples. (4×3)

6. (a) Describe the various equilibrium process in the solvent extraction of metal ion from an aqueous phase by complexation.

(b) What are the fundamental requirements for a resin used in the ion exchange chromatography ?

(c) Explain the action of a cation exchange resin for the separation of two cations. (4×3)

7. (a) State the Nernst distribution law.

Derive **one** of the following expressions :

$$W_n = W_1 \left( \frac{Kr}{Kr + s} \right)^n$$

Where $r$ mL. of the aqueous solution contains $W_0$ grams of the solute. $W_n$ grams remain in the aqueous layer after the $n^{th}$ extraction with s mL. portions of organic solvent. $K$ = distribution coefficient ($C_{aq}/C_{org}$).

**OR**

$$W_n = W_0 \left( \frac{r}{Ks + r} \right)^n$$

Where $r$ mL of the aqueous solution contains $W_0$ grams of the solute, $W_n$ grams remain in the aqueous layer after the $n^{th}$ extraction with s mL portions of organic solvent. $K$ = distribution coefficient ($C_{org}/C_{aq}$).

(b) What is the basis of chromatographic separations ? Name the different sorption mechanisms in the chromatographic technique. Describe any one mechanism.

(c)  Give the advantages of thin layer chromatography over the other commonly used chromatographic techniques ?                                        (4·3)

8.   (a)  A pure compound may be either MgO, $MgCO_3$ or $MgC_2O_4$. A thermogram of the compound shows a loss of 91.0 mg from a total of 175.0 mg used for analysis. What is the formula of the compound ?

(b)  What is size exclusion chromatography ? Differentiate between gel filtration and gel permeation chromatography.

(c)  How can chemical interferences be removed in atomic absorption spectroscopy ?                                        $(4 \times 3)$