SET A

Unique Paper Code : 32177904

Name of the Paper : DSE: Analytical Methods in Chemistry

Name of the Course : B. Sc. (Prog.)

Semester : V

Duration : 3 hours

Maximum Marks : 75

Instruction for Candidates

Following details to be written on first page:

    University Roll. No.
    Name:
    Class:
    Course:
    Semester:
    Paper Name:
    Unique paper code:

(a) Put page numbers on every page of the answer script.
(b) Attempt **FOUR** questions in all.
(c) Each question carries equal marks.
(d) First part of each question carries 0.75 marks.
(e) Remaining parts of each question carry 6 marks.
(f) Attempt all parts of a question together.

Q1.

(a) A material whose constituents part can be distinguished visually or with the help of a microscope is known as _____ material (homogeneous / heterogeneous).

(b) What is sampling. Explain the various steps in sampling with the help of a suitable example. What is the importance of sampling in chemical analysis?

(c) A sample of silver alloy was analyzed to determine the amount of silver present in it. The weights were found to be 198.7, 197.6, 198.1, 197.3, and 196.4 g of Ag. Calculate the (i) mean, (ii) median, (iii) range, (iv) the standard deviation, (v) the standard deviation of the mean, and (vi) the relative standard deviation of the mean (in percent) of the individual results.

(d) What do you understand by term 'Confidence interval' in a set of measurements? Explain 'F' test in detail. What is its significance?

Q2.

(a) Give one word for the solution prepared from all the reagents but no analyte.

(b) (i) What is the principle involved in solvent extraction? Give its significance. Also explain how solvent extraction obeys Gibb's phase rule.

(ii) Describe the extraction of organic species from the aqueous solution with the help of an example.

(c) What are three basic techniques of solvent extraction. Describe with the help of a diagram the method of solvent extraction by continuous process when the extractant is lighter than water with the help of a diagram.

(d) 5 g of compound 'S' is dissolved in 100.0 mL of water. The partition coefficient for compound 'S' between hexane and water is 5.2. (i) How much of compound 'S' will be extracted in hexane if it is extracted from aqueous solution with 90 mL of hexane? (ii) How much of compound A will be extracted in hexane if three consecutive extractions are performed using 30 mL of hexane each time and then combine the hexane extracts?

Q3.

(a) What do you understand by 'adjusted retention time' in column chromatography.

(b) Give how chromatography methods are classified on the basis of: (i) Physical state; (ii) Mobile and stationary phase and (iii) Mechanism involved between mobile and stationary phase.

(c) How does the column chromatography technique serve as a useful analytical technique? How to increase the efficiency of the column chromatography technique? Explain the principle and mechanism involved in adsorption chromatography.

(d) (i) What are the mechanisms of weight gain and weight loss in TGA? Explain the principle of null-point thermobalance?

(ii) What is thermogravimetric analysis? A thermogram of a magnesium compound shows a loss of 123.0 mg from a total of 207.0 mg used for analyte. Identify the compound either as MgO, $MgCO_3$ or MgC_2O_4 .

Q4.

(a) Define dark current.

(b) Differentiate between *any three* of the following:

      (i) Hydrogen and Deuterium discharge lamps
      (ii) Photometers and spectrophotometers
      (iii) Single beam and double beam instruments of absorption measurements
      (iv) Molecular and atomic spectroscopy

(c) Describe the role and working of prism and grating monochromators in UV-visible spectrophotometry? Which material is used to make cuvettes? Give a reason.

(d) The peak absorbance of 3.16×10^{-3} M $KMnO_4$ at 555 nm in a 1.000-cm pathlength cell is 6.54. **(a)** Find the molar absorptivity and percent transmittance of this solution. **(b)** What would be the absorbance if the pathlength were 0.100 cm? **(c)** What would be the absorbance in a 1.000-cm cell if the concentration were decreased by a factor of 4?

Q5.

(a) Define asymmetric potential.

(b) Draw a well-labeled diagram of glass electrode. Explain the type of errors that may occur while measuring the solution with pH<1 and pH>12.

(c) Draw and explain the conductometric curve for the following titrations:
      (i) mixture of HCl and CH_3COOH versus NaOH
      (ii) HCl versus NH_4OH

(d) Give the classification of electroanalytical methods. Write the advantages of potentiometric titrations over conventional volumetric titrations

Q6.

(a) Define Plasma.

(b) Differentiate between:

      (i) Laminar flow burner and total consumption burner
      (ii) Atomic absorption and atomic emission spectroscopy
      (iii) Hollow cathode lamp and graphite furnace

(c) Show the atomization of sodium chloride solution with the help of a schematic diagram. Discuss any two nebulization methods in detail.

(d) Explain the working of flame atomic absorption spectrophotometer with the help of a well-labelled diagram. Mention any two its applications.