

Unique Paper Code : 32177904
Name of the Paper : DSE: Analytical Methods in Chemistry
Name of the Course : B.Sc. Program
Semester : V
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 **Four** questions in all. All questions carry **18.75** marks each.

Q1.

- I. Define following terms in detail with appropriate examples: (a) analytical chemistry (b) confidence interval (c) Sampling
- II. Explain types of determinate errors in detail. Differentiate between qualitative and quantitative analysis. List the number of significant figures in the following numbers:
(a) 12.548, (b) 0.00335, (c) 504.70, (d) 4000
- III. Explain “Q” test in detail. What is its significance? Calculate the mean and the standard deviation of the following set of analytical results: 45.47, 43.69, and 46.03 g

(6, 6, 6.75)

Q2.

- I. 100-400nm wavelength region of electromagnetic spectrum is called_____.
- II. Write the unit of molar absorption coefficient. Lambert Beer’s law does not follow at high analyte concentration. Comment. How can we use UV-Visible spectrometer to differentiate between keto-enol tautomer?
- III. In a Beer-Lambert law cell, the aqueous solution of a substance of known concentration absorbs 10% of the incident light. What fraction of the incident light will be absorbed by the same solution in a cell 10 times as long? Write short note on use of Hydrogen discharge lamp as source of ultra violet (UV) radiations in UV-Visible spectrophotometer?
- IV. Explain the working of double beam UV-Visible spectrophotometer with the help of labelled diagram. Write any one advantages of double beam instrument over single beam instrument. Which type of instrument is more appropriate to avoid error due to mismatched cuvette and why?

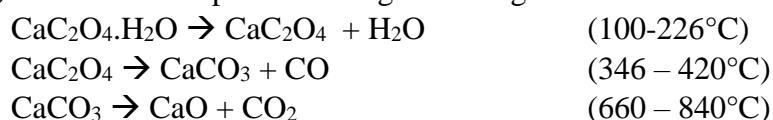
(0.75, 6, 6, 6)

Q3.

- I. Colour of flame observed for lithium is_____.
- II. Explain the working of flame atomic absorption spectrophotometer with the help of labelled diagram. Write down some of its applications.
- III. What is the role of a monochromator? Write down the name of few commonly used monochromators and explain any one in detail. Specify the function of atomiser.
- IV. Differentiate between electrodeless discharge lamp and Hollow Cathode Lamp (HCL) as source of radiation in flame atomic absorption spectrometer. What is ionization interference? How it can be avoided?

Q4.

- I. What are the mechanisms of weight gain and weight loss in TGA (thermogravimetry analysis). What do you understand by null balance principle?
- II. Draw the TGA curve for decomposition of calcium oxalate monohydrate ($\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$) at different temperature using following data:



Also calculate the percentage loss at each step. (atomic masses: Ca(40.078 u), O(15.999 u), H(1.00784 u), C(12.0107 u)):

- III. Write down few applications of TGA. Discuss any one technique used for the determination of pKa values.

(6.75, 6, 6)

Q5.

- I. Draw and explain the conductometric curve for the following titrations:
 - a) HCl versus NH_4OH
 - b) CH_3COOH versus NaOH
- II. Write down the cell notation of glass electrode. What are its advantages and limitations? How will you use conductometer to check water quality? What is the safe range of pH for drinking water?
- III. Why detector is an integral part of any UV-Visible spectrophotometer. Explain the working of photomultiplier tube as detector with the help of labelled diagram. What are its advantages over other type of detectors?

(6, 6.75, 6)

Q6.

- I. What are the fundamental requirements for a resin used in the ion exchange chromatography? Explain the action of a cation exchange resin for the separation of two cations.

- II. Define Nernst distribution law and state under what conditions this law held valid. Discuss elution development and frontal analysis mode of chromatographic separation.
- III. When 0.76g of succinic acid was shaken with 100ml each of water and ether, the water layer was found to contain 0.60g of acid. Calculate the quantity of the acid that can be extracted from 1000ml of ether solution containing 1g of the acid using 100ml water: (1) in two equal instalments (2) in a single stage extraction.

(6, 6.75, 6)