21ICH1C4L

M.Sc. I Semester Degree Examination, April/May - 2024
INDUSTRIAL CHEMISTRY
DSC-4 : Analytical Chemistry
(NEP)

Time : 3 Hours   Maximum Marks : 70

Note : (i) Answer **any five** questions including **Q.No. 1.**
         (ii) **Q.No.1** is **Compulsory.**

1. (a) What is an error ? Discuss the distribution of random errors.   **4+3+3+4=14**

   (b) What is sampling ? Explain the hazards in sampling with suitable examples.

   (c) A chemist analysed the alkalinity of water sample in term of $CaCO_3$ for replicate measurement and the results are as follows : 24.5, 24.3, 24.6, 24.6 mg. Calculate the standard deviation for the set of measurement.

   (d) A chemist analysed Mg in dolomite ore using a newly developed method and obtained the following results : 49.6; 50.0; 50.2; 50.0 mg. If the theoretical value of iron is 50.6 mg, find whether the newly developed method is having any significant difference from the standard method at 95% confidence level. (Given t value = 3.182).

2. (a) Discuss the principle and application of redox titration in the determination of iron in haematite ore.   **5+5+4=14**

   (b) With the help of chemical reactions, explain the Volhard's method for the determination of chloride.

   (c) (i) Write the structure of EBT. Why it is called as metal-ion indicator ?

      (ii) 1.0g of limestone was dissolved and diluted to 100 mL. A 10 mL of this solution required standardized 0.022 M 5.5 mL of EDTA solution for Eriochrome Black-T endpoint. Calculate the % of $CaCO_3$ present in the given limestone sample. (Given molecular weight of $CaCO_3$=100 amu)

3. (a) Discuss the various phenomena that takes place when electromagnetic radiation interacts with matter.   **5+5+4=14**

   (b) Differentiate between Tyndall scattering and Raman scattering. Explain the principle and factors affecting turbidimetry.

   (c) Enumerate the criteria required for the spectrophotometric determination of Ni in a given sample.

4. (a) Explain the principle and methodology employed in column chromatography.

    (b) State the distribution law. Derive the relationship between distribution coefficient and distribution ratio.   **5+5+4=14**

    (c) Describe the principle and applications of thin layer chromatography in synthetic chemistry.

5. (a) What is the principle of TGA ? Sketch the thermogram of $CuSO_4.5H_2O$ and explain the decomposition products at different temperature ranges. **5+5+4=14**

    (b) With a neat sketch, explain the working of heatflux DSC.

    (c) Discuss the applications of DTA in the study of thermal behaviour and decomposition point.

6. (a) Enumerate the conditions for precipitation. Illustrate the application of oxime as precipitating agent with suitable example.   **5+5+4=14**

    (b) Derive the titration curve for the titration of 50mL 0.1N H_2SO_4 with 0.1N NaOH.

    (c) Discuss the factors affecting the intensity and width of spectral lines.

7. (a) Explain the different types of separation mechanisms observed in chromatography. Classify the chromatographic techniques based on separation mechanism.   **5+5+4=14**

    (b) Write a note on the criteria involved in the selection of stationary phase and mobile phase for a chromatographic analysis.

    (c) (i) State the limitations of Beer Lambert's Law.

        (ii) Determine the concentration of a copper sulphate solution which showed an absorbance of 0.3 when monochromatic visible light radiation of 600 nm is passed through a cell of 0.5cm. (Given molar absorption coefficient of $CuSO_4$ solution at 600 nm is 8.5 $L.M^{-1}cm^{-1}$)

8. (a) Explain the principle and applications of paper chromatography.   **5+5+4=14**

    (b) Discuss the principle and instrumentation involved in direct injection enthalpimetry.

    (c) Account on various factors affecting the results in thermogravimetric analysis.

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