'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 5th Semester Examination, 2022

DSE-P1-CHEMISTRY

ANALYTICAL METHODS IN CHEMISTRY

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.

GROUP-A

1. Answer any ***five*** questions from the following: $1\times5 = 5$

   (a) What is ion exchange chromatography principle? 1

   (b) Name the source used in absorption spectroscopy. 1

   (c) What is the use of a monochromator? 1

   (d) What is the detector used in UV-visible spectroscopy? 1

   (e) What is the unit of IR and what type of bond is IR active? 1

   (f) What is the principle of ion exchange? 1

   (g) What is standard deviation? 1

   (h) What do you mean by significant figure? 1

GROUP-B

2. Answer any ***three*** questions from the following: $5\times3 = 15$

   (a) (i) What is regression analysis? 2

   (ii) Write down the basic principle of pH metric titration. 3

   (b) (i) Write down the principle of thermogravimetry. 3

   (ii) Define retardation factor (R_f). 2

   (c) (i) What is column partition chromatography? $2\frac{1}{2}$

   (ii) How does pH affect cation exchange capacity? $2\frac{1}{2}$

   (d) (i) What is the difference between precision and accuracy? 2

   (ii) Calculate the mean and median for the following results obtained in analysis of zinc in a brass sample: 64.92, 65.05, 65.09, 65.11, 65.20, 65.22. Can any value be rejected? 3

   (e) (i) What is indeterminate error? 2

   (ii) What is the difference between the F-test and T-test? 2

   (iii) What is elute in chromatography? 1

GROUP-C

3. Answer any ***two*** questions from the following: $10\times2 = 20$

(a) (i) Write the conditions under which the Beer-Lambert's Law is valid. 2

(ii) A 1.0×10^{-3} (M) solution of $K_2Cr_2O_7$ shows an absorbance of 0.200 at 450 nm and an absorbance of 0.050 at 530 nm. A 1.10×10^{-4} (M) solution of $KMnO_4$ shows no absorbance at 450 nm and an absorbance of 0.420 at 530 nm. Calculate the concentration of $K_2Cr_2O_7$ and $KMnO_4$ present in a solution which exhibits an absorbance of 0.370 and 0.710 at 450 and 530 nm respectively. Assume the cuvette path length is constant to 10 mm. 4

(iii) Describe briefly the basic principle of UV-visible spectroscopy. 2

(iv) Explain the technique of paper chromatography. 2

(b) (i) What do you mean by confidence interval and confidence limit? Write their mathematical expressions. 3

(ii) Calculate the correct number of significant figure 1.010 g, 0.00230 g, 46.50 ml. 3

(iii) In solvent extraction, distribution ratio is preferable over partition coefficient — Justify. 2

(iv) Establish the relation between distribution ratio and percentage extraction. 2

(c) (i) Describe the principle and technique of thin-layer chromatography. What are its advantages? 3+2

(ii) Elucidate the principle of gas-liquid chromatography. 3

(iii) What are the characteristics of precipitation best suited for gravimetric analysis? 2

(d) (i) What are the procedures to be followed during the precipitation to avoid supersaturation? 3

(ii) "Multiple washing is better than single washing" —Discuss using suitable example. 3

(iii) Write a short note on deionisation of water. 4

——×——