'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 5th Semester Examination, 2021

DSE-P1-CHEMISTRY

ANALYTICAL METHODS IN CHEMISTRY

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
All symbols are of usual significance.

Answer any *four* questions from the following 10×4 = 40

1. (a) Define distribution coefficient and distribution ratio. $1\frac{1}{2}+1\frac{1}{2}=3$

   (b) The distribution coefficient for iodine between an organic solvent and H_2O is 85. Find the amount of iodine remaining in the aqueous layer after extraction of 50 ml of 1.00×10^{-3} M I_2 with the following quantities of organic solvent: 3

   (i) 50.0 ml and (ii) five 10.0 ml portions

   (c) Write down the factors influencing the formation of metal chelates. 2

   (d) What kind of solvent is used for solvent extraction? 2

2. (a) Explain the terms absolute error and relative error. 2

   (b) "High degree of precision may not imply accuracy". — Justify. 2

   (c) Analysis of a sample of steel gave the following percentage values of chromium content: 3

   16.23 , 16.28 , 16.22 , 16.30 , 16.25 , 16.26 , 16.16

   Calculate standard deviation of the analysis.

   (d) Discuss Dixon Q-test for outliers. 3

3. (a) Write Beer-Lambert's law. Explain the meaning of various terms involved in it. What are its limitations? $1\frac{1}{2}+1\frac{1}{2}$

   (b) Write down the selection rule for IR spectroscopy. $1\frac{1}{2}$

   (c) What is the stationary and mobile phase in Column Chromatography? 2

   (d) What information do you get from the retardation factor (R_f) value? 2

   (e) What is the detectors used for IR spectroscopy? $1\frac{1}{2}$

4. (a) What are the important characteristics of a good ion-exchanger? 2

   (b) Explain the principle of demineralisation of water using ion-exchange resin. 3

   (c) Explain what is ion-exchange equilibrium? 2

   (d) Explain what is ion-exchange capacity? How ion-exchange capacity of a cation exchange resin can be determined? 1+2

5. (a) Discuss how separation process occur by ion-exchange chromatography. 4
   (b) Compare TLC and paper chromatography. 3
   (c) Write down the theory of thermogravimetry. 3

6. (a) What are the advantages of potentiometric titration? 2
   (b) Can you perform conductometric titration for mixture of strong and weak acids with a strong base? If yes, how do you find equivalence points? 3
   (c) How are determinate errors minimized? — Discuss. 3
   (d) What is 'T'-test? — Explain. 2

7. (a) What are the main differences between single beam and double beam spectrophotometer? 2
   (b) Discuss the theory of determination of composition of metal complexes by mole ratio method. 3
   (c) What are the electrodes used in potentiometric titration? 2
   (d) Draw and explain the conductometric titration curve for the titration of strong acid vs. weak base. 3

8. (a) Describe (with necessary diagram) the working principle of continuous process of solvent extraction. 3
   (b) Explain the term synergic extraction. 2
   (c) Give one example each for cation exchange resin and anion exchange resin. 2
   (d) Discuss the importance of isotope substitution in structural illustration in IR spectroscopy. 3

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