

ICP 458: ELECTROANALYTICAL TECHNIQUES

Course Objectives:

- To establish broad knowledge of Physical Chemistry.
- To determine the concentration of analytes by electrochemical methods conductometry and potentiometry.

Electrochemistry:

A. Conductometry (At least 5 experiments to be carried out)

1. Determination of hydrolysis constants (aniline hydrochloride etc.).
2. Titration of a mixture of acetic acid, monochloro and trichloroacetic acids with NaOH.
3. Determination of concentrations/amounts of sulphuric acid, acetic acid and copper sulphate using sodium hydroxide.
4. Measurements of the conductance of a weak acid, HOAc and of the strong electrolytes NaOAc, HCl and NaCl and to calculate the ionization constant of the acid.
5. Analysis of the mixture of HCl and NH_4Cl .
6. Determination of activity coefficient of Zinc ions in 0.002 M ZnSO_4 .
7. Determination of equivalent conductance's and dissociation constants of weak acids.

B. Potentiometry (At least 7 experiments are to be carried out)

8. Determination of pK values of phosphoric acid by potentiometric titration with sodium hydroxide using glass electrode.
9. Determination of acidic & basic dissociation constants and isoelectric point of an amino acid.
10. Determination of the potential of an electrochemical cell and mean ionic activity coefficient.
11. Determination of activity coefficient of an electrolyte at different molalities.
12. Determination of pH of buffer solutions with a pH meter & evaluation of pK_a of acids.
13. Determination of thermodynamics of a cell reaction.
14. Determination of pK_a values of mono, di and tri-acid base.
15. Determination of solubility of insoluble silver halide and the standard electrode potential using quinhydrone electrode.
16. Determination of degree of hydrolysis of CH_3COONa and NH_4Cl .
17. Determination of hydrolysis constant of aniline hydrochloride.
18. Verification of Nernst equation for Ag^+ , Cu^{2+} and Zn^{2+} species.
19. Determination of transport number of ions by emf method (Ag^+ , Cd^{2+} , NO_3^- , SO_4^{2-}).
20. pH titration of (a) HCl versus NaOH, (b) CuSO_4 versus NaOH and (c) HOAc versus NaOH and (d) lead nitrate versus potassium chromate.
21. Potentiometric titration of halides in mixtures (Cl^- , Br^- and I^-) with silver nitrate.
22. Potentiometric determination of dissociation constants of weak acids.

Course Outcome:

Students will be able to

- Think critically and analyze chemical problems.
- Present scientific and technical information resulting from laboratory experimentation in both written and oral formats.
- Accounts on potentiometric and conductometric titrations.

References

8. B. P. Levitt, Longman, Findlay's Practical Physical Chemistry, J Wiley, London, 1954.
9. Experimental Physical Chemistry, Das & Behera, Tata McGraw Hill, New Delhi, 1983.
10. J.B. Yadav, 16th edition of Advanced Practical Physical Chemistry, Goel publishers, 1989.
11. Experiments in Physical Chemistry, J.C. Ghosh, Bharathi Bhavan, 1974.
12. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, IV Edition, Old Reinhord& Winston, Publication, 1982.
13. B.K. Sharma, Instrumental methods of Chemical analysis, Goel Publishing House, 24th Edition, 2005
14. Gurdeep R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publication, 1979.

