WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 5th Semester Examination, 2022-23

CEMADSE02T-CHEMISTRY (DSE1/2)

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

Answer any *three* questions taking *one* from each GROUP

GROUP-A
(Units 1 and 2)

1. (a) Why use of premix chamber burner is preferrable than total consumption burner in AAS? 2

    (b) A sample in a 1.0 cm cell in a spectrometer transmit 80% light at a certain wavelength. If the absorptivity of the substance at this wavelength is $2.0\ g^{-1}cm^{-1}L$, what is the concentration of the substance? 2

    (c) Discuss the principle of operation of a single-beam spectrophotometer and a double-beam spectrophotometer. 2

    (d) Name the radiation sources and detectors used in UV, visible and IR regions of the spectrum. 3

    (e) A high concentration of a potassium salt is sometimes added to standards and samples in flame absorption or emission methods — Discuss. 2

    (f) Why a high-temperature nitrous oxide-acetylene flame is sometimes required in AAS? 2

    (g) Calculate the uncertainty in the number of millimoles of chloride contained in 250.0 mL of a sample when three equal aliquots of 25.00 mL are titrated with silver nitrate with the following results: 36.78, 36.82, and 36.75 mL. The molarity of the $AgNO_3$ solution is $0.1167 \pm 0.0002M$. 3

2. (a) The zinc and tin contents of a brass sample are analyzed giving the following results (i) Zn 33.27, 33.37 and 33.34% (ii) Sn 0.022, 0.025 and 0.026%. Calculate the standard deviation and the coefficient of variation for each analysis. 3

    (b) Discuss the principle of spectrophotometric determination of manganese. What kind of flame would you use in the AAS method of determination of metal ions that form refractory oxides and why? 3+2

    (c) 'The UV absorption peaks are usually broader than IR absorption peaks' — Explain. 2

    (d) Atomic absorption is preferable to atomic emission spectrometry for identification of unknown elements. 2

    (e) What are the methods of removal of chemical interferences in AAS? 2

    (f) Good precision does not guarantee accuracy — Why? 2

GROUP-B

(Units 3 and 4)

3. (a) What is thermogram? Mention two sources of errors in TGA.   1+2

   (b) How could you quantitatively analyze calcium carbonate and magnesium carbonate from their mixture using TGA?   3

   (c) Draw to show the first and second derivative potentiometric titration curve for chloride by $AgNO_3$ and indicate the equivalence point in each of them.   2

   (d) Mention one advantage and one disadvantage of glass electrode for pH measurement.   2

   (e) Cite one example where conductometric titration is more advantageous over potentiometric titration.   2

4. (a) What is dilution effect in conductometric titration? How could you avoid it during conductometric titration?   2

   (b) What are the basic requirements of a reference electrode in potentiometric measurements?   2

   (c) Why should the glass electrodes be calibrated using standard buffer solutions before use?   2

   (d) What is liquid-junction potential and residual liquid-junction potential? How can this be minimised?   3

   (e) Discuss pH metric titration curve of a tribasic acid and NaOH. Identify the equivalence point and how pKa can be calculated.   3

GROUP-C

(Unit 5)

5. (a) For a solute with distribution ratio of 25.0, show by calculation which is more effective, extraction of 10 ml of an aqueous solution with 10 ml organic solvent or extraction with two separate 5.0 ml portion of solvent.   3

   (b) Explain the difference between a cation exchange resin and an anion exchange resin.   2

   (c) Why paper chromatography can be considered as a liquid-liquid partition chromatography? Name the spraying agent used for detection of amino acids in paper chromatography.   2+1

   (d) Describe the basic principle of GC instrument. Identify the carrier gas used in GC.   4

6. (a) What is R_f ? On what factor does it depend?   2

   (b) What are synergistic agents and what is their function in solvent extraction process?   2

   (c) How cation and anion exchangers are regenerated?   2

   (d) What do you mean by reversed phase chromatography?   2

   (e) How could you separate Cu^{+2} and Zn^{+2} by ion exchange chromatography?   2

   (f) Mention one application of HPLC technique.   2

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