Question Paper

Exam Date & Time: 02-May-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc, (Applied Sciences) - End Semester Theory Examination - April / May 2019
INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS ICH 241

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) What is spectroscopy? Explain the terms wavelength, wave number, intensity,velocity and energy of electromagnetic radiation (8)

A) Discuss with a suitable example any four kinds of conductometric acid-base titrations (8)

B) Explain the principle of potentiometric method of titration of acidic ferrous solution against standard ceric solution. (4)

C)

2) Give an account of i) Detection of end points in potentiometric titrations ii) Advantages of conductometric titrations over volumetric analysis. (8)

A) Explain the working of the following: i) Photomultiplier tube ii) Golay cell iii) thermocouple (8)

B) The cell SCE | HCl (0.1M) || AgCl(s) | Ag gave an emf of 0.24 V and 0.26 V with a buffer having pH value 2.8 and unknown pH value respectively. Calculate the pH value of unknown buffer solution. Given E_{SCE} = 0.2422 V (4)

C)

3) Explain the construction and working of a glass electrode. What are its advantages? (8)

A) State and obtain the mathematical expressions for the laws of absorption in spectrophotometry. (8)

B) Give reasons for the following: (4)

C)
i) UV absorption bands are broader than the IR absorption bands
ii) The absorption band frequency corresponding to n→ σ* transition for methyl chloride and methyl iodide are not same

4) With a Schematic diagram explain the working of GLC. What are the characteristics of the ideal detector for GLC? (8)

A) Briefly explain (8)
i) Column packing in HPLC
ii) Advantages of TLC over other chromatographic techniques

B)

C) Explain with reasons the no. & types of absorption bands appear for CO2 molecule in the IR and Raman spectrum. (4)

5) Discuss with suitable examples the various instrumental factors affecting the DTA curve. What are the limitations of DTA? (8)

A)

B) Draw and explain the thermograms of i) $MgC_2O_4.2H_2O$ and ii) $CuSO_4.5H_2O$ (8)

C) Explain the factors affecting the column efficiency of liquid chromatography (4)

6) Discuss the following: (8)

A) i) Various types of electronic transitions in organic molecules in the UV region.

ii) Quantum theory of Raman effect.

B) Derive an expression for wave number of harmonically oscillating HCl molecule. Explain the term 'force constant'. (8)

C) Write a note on i) Hypsochromic shift ii) Chromophore (4)

7) Discus with suitable examples the various limitations of Beer's law. Mention any four applications of UV absorption spectroscopy (8)

A)

B) Discuss i) Sources of UV radiation. (8)

ii) Working of a double beam UV-Visible spectrophotometer.

C) The internuclear distance of NaCl molecule is 2.36A˚ Calculate the moment of inertia of the molecule. The atomic masses are: Cl =35 g mol^{-1} and Na = 23 g mol^{-1}; Av.No. = $6.023\times10^{23} mol^{-1}$ (4)

8) Discuss the working of the following types of detectors used in GLC (8)

A) i) Thermal conductivity detector

ii) Flame ionisation detector.

B) i) Draw a schematic diagram of TGA apparatus and indicate its different components (8)

ii) TGA studies reveal that $Cu(NO_3)_2$ exists as CuO above 280^0C and $AgNO_3$ changes to Ag between 480 and 610^0C. A mixture of $Cu(NO_3)_2$ and $AgNO_3$ obtained from 0.1714 g copper-silver alloy weighed 0.2494g at 400^0C and 0.1874 g at 700^0C in a thermo balance. Calculate the % Cu and % Ag in the alloy sample. (At.wts of Cu and Ag are 63.5 and 107.9 respectively)

C) Give reasons for the following: (4)

i) Glass electrode is not suitable for measuring PH of a highly acidic solution.

ii) Paraffin compounds are useful as solvents in UV studies.

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