63/1 (SEM–5) DSE2/CHMHE5026

2024

CHEMISTRY

Paper : CHMHE5026

(Instrumental Methods of Chemical Analysis)

Full Marks : 60

Pass Marks : 24

Time : 3 hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer : ***(any five)*** 1×5=5

   (a) UV-visible spectroscopy is based on the principle of

   (i) Stark-Einstein law

   (ii) Newton's law

   (iii) Planck's law

   (iv) Beer-Lambert's law

Contd.

(b) FTIR spectroscopy is also known as

(i) Rotational spectroscopy

(ii) Vibrational spectroscopy

(iii) Microwave spectroscopy

(iv) Mass spectrometry

(c) How many numbers of HNMR signal will be given by cyclobutane ?

(i) 1

(ii) 2

(iii) 3

(iv) 4

(d) The part of electromagnetic spectrum used for NMR is

(i) Ultraviolet

(ii) Infrared

(iii) Far-infrared

(iv) Radiowave

(e) What parameter is measured in Atomic Absorption Spectrophotometer (AAS) ?

(i) Chemical shift

(ii) Number of protons

(iii) Amount of metals present in liquid

(iv) Base peak

(f) The principle of chromatography is based on

(i) Selective retension

(ii) Selective reduction

(iii) Electrochemistry

(iv) Potentiometry

(g) Fast atom bombardment (FAB) is used in

(i) UV-visible spectroscopy

(ii) Mass spectrometry

(iii) Column chromatography

(iv) NMR spectroscopy

(h) Radiochemical method is used to detect

(i) Non-radiative substances

(ii) Plasma

(iii) Chemical Shift value

(iv) Radio active substances

(i) X-ray photoelectron spectroscopy (XPS) is also known as

(i) Electron spectroscopy for chemical analysis (ESCA)

(ii) X-ray diffraction (XRD)

(iii) X-ray fluorescence (XRF)

(iv) Dynamic light scattering (DLS)

(j) Cyclic voltametry is used for the study of

(i) Reaction kinetics

(ii) Detection of non-metallic species

(iii) Reduction and Oxidation processes

(iv) Dctection of functional groups

2. Answer the following questions: ***(any five)*** 2×5=10

(a) Define chromophore and auxochrome with examples.

(b) Name various electrodes used in potentiometry.

(c) What is the light source used in UV-visible spectroscopy? What is the function of a monochromator in it? 1+1=2

(d) Which gas in used as a carrier gas in gas chromatography and why?

(e) What is retardation factor? How is it calculated? 1+1=2

(f) Write the principle of Atomic Abserption Spectrophotometer (AAS).

(g) Write the principle of X-ray Photoelectron Spectroscopy (XPS).

3. Answer the following questions: ***(any five)*** 5×5=25

(a) Describe the various types of electromagnetic spectrum.

(b) Describe the principle of X-ray-diffraction technique. Write Bragg's equation and explain the terms. 2+3=5

(c) What is the principle of NMR spectroscopy? Describe chemical shift with an example. 2½×2=5

(d) Write short notes on— 2½×2=5

(i) Fast Atom Bombardment (FAB) method

(ii) Time of Flight (TF) of mass analyser.

(e) Describe the basic principle of chromatography and its types.

(f) What is the basic principle of UV-visible spectroscopy ? Discuss the types of electronic transition involved in UV-visible spectroscopy. 2+3=5

(g) What types of samples are detected in cyclic voltametry (CV) ? Give example.

(h) What is photomultiplier tube ? What are its functions ? What role does a detector play in spectroscopy ? 1+2+2=5

(i) Describe the process of 'fluorescence' and 'Phosphorescence'.

4. Answer the following questions : ***(any two)*** 10×2=20

I. (a) Write about the basic principle of mass spcetrometry. Describe the instrumentation of it. 2+3=5

(b) Write short notes on— 2½×2=5

(i) Base peak

(ii) Molecular ion peak

II. What are the factors influencing the chemical shift in NMR ? Explain the ^{1}HNMR spcetra of chloroethane and discuss the chemical shift of protons in this case. 5+5=10

III. (a) Write the principle of gas chromatography. Mention its applications. 2+3=5

(b) What are different types of liquid chromatography ? Explain how a sample is separated and detected by using this techniques. 2+3=5

IV. (a) What is potentiometry and how does it work ? Write *two* applications of potentiometry. 3+2=5

(b) What is the basic principle of radiochemical method ? How are isotopes selected for radiochemical analysis ? What type of detectors are used in radiochemical analysis ? 1+2+2=5