Total No. of printed pages = 6

63/2 (SEM-3) CHM 302

2021

(held in 2022)

CHEMISTRY

(Theory Paper)

Paper Code : CHM-302

(Analytical Techniques)

Full Marks – 80

Time – Three hours

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

1. Choose the correct answers : 1×6=6

(i) Mass spectrometers are used to determine which of the following ?

(a) Composition in sample

(b) Concentration of elements in sample

(c) Relative mass of atoms

(d) Properties of sample

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(ii) AFM can be used for imaging

(a) very rough samples

(b) inside of a material

(c) something that cannot be deposited on a solid material

(d) hard nanostructures

(iii) Which is not correct about SE ?

(a) Generated from the collision between the incoming electrons and the loosely bonded outer electrons

(b) Generated close to surface escape

(c) Number of SE is greater than the number of incoming electrons

(d) Deep inside information of material is obtained

(iv) Which is generally used to study thermal transitions in material ?

(a) Differential Scanning Calorimetry (DSC)

(b) Thermogravimetric Analysis (TGA)

(c) Differential Thermal Analysis (DTA)

(d) Evolved Gas Analysis (EGA)

(v) Which is not a characteristic for ideal detector of GC ?

(a) Good stability and reproducibility

(b) A linear response to solutes over several orders of magnitude

(c) Temperature range from room temperature to 100°C

(d) A short response time independent of flow rate

(vi) Find the correct statements

(a) Efficiency is a measure of chemical separation power

(b) Selectivity is a measure of mechanical separation power

(c) Efficiency is a measure of both, mechanical and chemical separation power

(d) Selectivity is a measure of chemical separation power.

2. Answer the following questions : 2×5=10

(a) What is the recommended scan rate for the linear sweep voltammetry and cyclic voltammetry ?

(b) How can we calculate surface area of electrode using cyclic voltammetry ?

(c) What are the different modes of action in AFM ?

(d) Define resolution and contrast.

(e) What is resolution and resolving power ?

3. Answer any *six* of the following questions : 5×6=30

(a) What are the information, those may be obtained from SEM analysis ?

(b) Sketch and explain the TGA pattern for decomposition of calcium oxalate.

(c) Sketch a typical DSC thermogram and show different transitions.

(d) Write briefly about the requirements of a carrier gas used in GC.

(e) What are ion-exchange resins ? Discuss briefly along with the principle of ion-exchange chromatography.

(f) Provide a brief overview of the method of X-ray diffraction and its application.

(g) How does Inductively Coupled Plasma Mass Emission Spectroscopy work ?

(h) How can you determine trace amount of phenol in water ? Give the complete methodology.

(i) Write a short note on "Column" used in GC and HPLC with reference to their size, shape and purpose.

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

(a) Discuss the relevant factors for a sampling programme in the chemical analysis of polluted water and soil.

(b) Explain one method of sample preparation for determining trace elements in the leaves of a plant. What precautions are necessary ?

(c) How separation performance of HPLC column may be enhanced to get better resolution. Explain.

5. Answer any *one* of the following questions : 14×1=14

(a) What are the factors that affect the results of TGA analysis ? Describe.

(b) Discuss the principle of separation, instrumentation and application of gel permeation chromatography.