Roll No. .....

E–988

M. Sc. (Fourth Semester) (Main/ATKT) EXAMINATION, May-June, 2021

CHEMISTRY

Paper CH-19

(Instrumental Methods of Analysis)

Time : Three Hours] [*Maximum Marks : 80*

Note : Attempt all Sections as directed.

Section—A 1 each

(Objective/Multiple Choice Questions)

Note : Attempt all questions.

Choose the correct answer :

1. The strongly acidic group (SO_3^-) present on the surface of styrene/divinylbenzene copolymer, which is used for the separation of the following substances from sample solution :
   (a) Anions
   (b) Cations
   (c) Anions or Cations
   (d) Neutral substances

2. The separation of compounds based on molecular mass is done in which of the chromatographies ?
   (a) Ion-exchange chromatography
   (b) High performance liquid chromatography
   (c) Gas chromatography
   (d) Size exclusion chromatography

3. In electrophoresis, the volume of the sample used for injection is :
   (a) 5 to 50 nL
   (b) 5 to 50 μL
   (c) 5 to 50 mL
   (d) 0.5 to 5 mL

4. Which of the following techniques having a higher number of theoretical plate height for separation of compound mixture ?
   (a) HPLC
   (b) TLC
   (c) Capillary electrophoresis
   (d) Paper chromatography

5. The softening of hard water can be done in which of the following chromatographic techniques ?
   (a) Size exclusion chromatography
   (b) Thin layer chromatography
   (c) High performance liquid chromatography
   (d) Ion-exchange chromatography

6. K_β X-ray line is produced from a transition of electron from :
   (a) L to K shell
   (b) M to K shell
   (c) N to K shell
   (d) K to M shell

7. XRF is used to study :
   (a) Crystal structure
   (b) Elemental composition
   (c) Morphology
   (d) Inside structure

8. Which of the following techniques is good for analysis of elemental composition of archaeological materials without destroying the sample ?
   (a) Proton induced X-ray spectroscopy
   (b) Mass spectrometry
   (c) ICP-AES
   (d) AAS

9. The extent of the method that can detect the interest of analyte in the presence of sample matrix is called as a/an :
   (a) Accuracy
   (b) Sensitivity
   (c) Selectivity
   (d) Ruggedness

10. Which of the following is a non-destructive technique for determining the purity of gold in ornaments ?
    (a) AAS
    (b) ICP-MS
    (c) GF-AAS
    (d) XRF

11. Acetylene-nitrous oxide flame is used for analysis of following elements in AAS :
    (a) Al, Mo, Zr
    (b) As, Se, Bi
    (c) Cu, Ni, Zn
    (d) Fe, Co, Hg

12. The deuterium lamp is employed in AAS for removal of :
    (a) Chemical interference
    (b) Spectral interference
    (c) Physical interference
    (d) Optical interference

13. In flame photometry, flame is used as :
    (a) Atomization source only
    (b) Excitation source only
    (c) Atomization and excitation source
    (d) Detecting source

14. In which of the following instruments, the scattered radiation is measured ?
    (a) AFS
    (b) AAS
    (c) ICP-AES
    (d) Flame photometry

15. The presence of BHC in food material can be analyzed in HPCL by which of the detectors showing better sensitivity ?
    (a) FID
    (b) ECD
    (c) TCD
    (d) UV

16. The fuel gas used in FID is :
    (a) Helium
    (b) Neon
    (c) Argon
    (d) Hydrogen

17. What is the effect of temperature programming on retention and resolution of chromatographic peaks in GC, respectively ?
    (a) Decrease and decrease
    (b) Increase and decrease
    (c) Increase and increase
    (d) Decrease and increase

18. The solvent composition of binary solvent (Methanol : Water) system changes to 100 : 0, 80 : 20, 60 : 40, 40 : 60, 20 : 80, 0 : 100 during the separation of compound mixture in HPLC. The elution is called as :
    (a) Iso-gradient
    (b) Quaternary
    (c) Gradient
    (d) Isocratic

19. The compound mixture of phenol, benzene, toluene and hexane are analyzed in normal phase chromatography, what will be the order of elution of compound from this column will be ?
    (a) Hexane, toluene, benzene and phenol
    (b) Toluene, benzene, hexane and phenol
    (c) Phenol, benzene, toluene and hexane
    (d) Phenol, hexane, benzene and toluene

20. Which of the following ionization techniques can be used in GC-MS ?
    (a) Cl
    (b) ESI
    (c) MALDI
    (d) APCI

Section—B 2 each

(Very Short Answer Type Questions)

Note : Attempt all questions in **2-3** sentences.

1. Write the name of sample injection systems which is used in capillary electrophoresis.
2. What do you mean be ‘exclusion limit’ in exclusion chromatography ?
3. Draw schematic diagram to explain the process of XRF in calcium element (Atom).
4. Give the principle of PIXE.
5. Why the elements like carbon, nitrogen, fluorine, chlorine, argon cannot be analyzed in AAS ?
6. In flame-AAS and GF-AAS, which instrument is sensitive and why ?

7. Why the formation of metal hydrides (MH_3) is required in analysis of metals like As, Se, Bi and Sb in AAS ?
8. Write the difference between normal and reverse phase chromatography.

Section—C 3 each

(Short Answer Type Questions)

Note : Attempt all questions. Write answer in < **75** words.

1. Shortly explain the mechanism for separation of compound mixtures in capillary electrophoresis.
2. What are disadvantages of GC and HPLC, which are excluded using supercritical fluid chromatography ?
3. Shortly explain the linear relationship between the square root of the frequency for K and L lines and the atomic number of elements given by Moseley.
4. Draw the different components of proton induced X-Ray Spectroscopy.
5. What are different applications of atomic fluorescence spectrometry ?
6. What is method selectivity and how it is useful in analytical chemistry ?
7. Write the principle for analyzing different chemical substances in HPLC-MS.
8. Shortly describe the formation of 'plasma' in ICP-AES which is used for atomization and emission.

Section—D 5 each

(Long Answer Type Questions)

Note : Attempt all questions. Write answer in < **150** words.

1. Explain the mechanism for separation of compound mixture in Size Exclusion Chromatography (SEC). Write the column packing materials in SEC.

Or

What is ion-exchange chromatography ? Explain the separation of metal ions and proteins in ion-exchange chromatography.

2. Describe the principle behind the working of XRF and shortly write its different applications.

Or

Write short notes on the following :

(a) Radiation source of PIXE

(b) Application of PIXE

3. Explain the chemical and spectral interferences of atomic spectroscopy and how it can be overcome.

Or

Shortly describe the atomization and excitation process in flame photometry and ICP-AES along with some applications using both the instruments.

4. What is the principle of hydride generation AAS ? Shortly describe the instrumentation.

Or

Write short notes on the following :

(a) CV-AAS

(b) GC-MS