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**M.Sc.(Fourth Semester)
EXAMINATION, May-June, 2022
CHEMISTRY
Paper CH-19
(Instrumental Methods of Analysis)**

*Time : Three Hours]**[Maximum Marks:80***Note - Attempt all sections as directed.**

**Section - A
(Objective/Multiple Choice Questions)
(1 mark each)**

Note- Attempt all questions.**Choose the correct answer :**

1. Which statement is incorrect about the supercritical fluid chromatography.
- (A) Hyphenation of GC and HPLC
 - (B) Helium is used as a mobile phase
 - (C) Resolution of peaks better than GC
 - (D) FID can be used as a detector

2. Which of the following sample injection systems are used in capillary electrophoresis instrument.

- (i) Spitless injection
- (ii) Electro kinetic injection
- (iii) Pressure injection
- (iv) Split injection

The correct answer is:

- (A) (i)&(ii)
- (B) (ii)&(iii)
- (C) (iii)&(iv)
- (D) (ii)&(iv)

3. In anion exchange chromatography:

- (A) The column contains negatively charged beads where positively charged proteins bind
- (B) The column contains either positive and negatively charged beads where proteins bind depending on their net charge
- (C) The column contains both positive and negatively charged beads where proteins bind depending on their net charge
- (D) The column contains positively charged beads where negatively charged proteins bind

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4. For gel filtration column chromatography, which two of the following has linear relationship?
- (i) Amount of protein
 - (ii) Relative elution volume of a protein (void volume over elution volume of a protein)
 - (iii) Logarithm of protein molecular mass
- (A) (i) & (ii)
(B) (ii) & (iii)
(C) (i) & (iii)
(D) None of these
5. The ion exchange capacity of a resin is determined by:
- (A) The total molecular weight of the resin
(B) Length of the ion exchange resin
(C) The total number of ion active groups
(D) Solubility of the ion exchange resins
6. Which of the following technique leads to GENOMIC project.
- (A) Capillary electrophoresis
(B) Ion exchange chromatography
(C) Size exclusion chromatography
(D) Super critical fluid chromatography

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7. The separation of compounds based on molecular weights is done in which of chromatography?
- (A) Ion-exchange
(B) Size exclusion chromatography
(C) Gas chromatography
(D) High performance liquid chromatography
8. Which of the following statement is incorrect about the atomic absorption spectroscopy?
- (i) The gaseous atoms in the ground state absorb the radiation which is measured
 - (ii) The tungsten lamp is used as a radiation source
 - (iii) The gaseous atoms in the excited state absorb the radiation which is measured
 - (iv) Hollow cathode lamp of the same element is used as a radiation source
- (A) (i)&(ii)
(B) (ii)&(iv)
(C) (i)&(iv)
(D) (ii)&(iii)

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9. Which of the following is not a part of Flame Photometry?

- (A) Entrance slit
- (B) Fuel gas
- (C) Chopper
- (D) Atomizer

10. Which of the following explains the "sputtering" process that occurs inside the hollow cathode lamp?

- (A) The positive ions collide negative charged cathode and ions are ejected from cathode
- (B) The negative charge organ gas strike to cathode surface and atoms from the cathode are ejected
- (C) The positive ions collide with negative charged atoms and ions are ejected from cathode
- (D) The positive charge orgran gas strike to cathode surface and atoms from the cathode are ejected

11. What is the function of flame in flame photometry?

- (i) Nebulization
- (ii) Atomization
- (iii) Excitation
- (iv) Ionization

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(A) (i),(iii),(iv)

(B) (ii),(iii),(iv)

(C) (i),(ii),(iii)

(D) All of above

12. The refractory compounds are formed in the flame during AAS analysis which is prevented by the use of following fuel:

- (A) Acetylene-nitrous oxide flame
- (B) Acetylene-oxygen flame
- (C) Acetylene-air flame
- (D) Acetylene-carbon dioxide flame

13. Atomic absorption spectroscopy can be used for quantitative analysis of following elements:

- (i) Metals
- (ii) Metalloids
- (iii) Noble gases
- (iv) Halogens

(A) (i),(ii)

(B) (i),(iii)

(C) (i),(iv)

(D) All the above

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14. Which of the following is benefits of XRF spectroscopy.

- (A) Destructive technique used for testing the purity of ornaments
- (B) Non-destructive technique used for testing the purity of ornaments
- (C) Destructive technique used for testing the trace elements in water samples
- (D) Non-destructive technique used for microbes from biological samples

15. The intensity of emitted X-ray radiation from sample surface depends upon the:

- (A) Atomic Number of element and amount of sample
- (B) Atomic Number and concentration of element
- (C) Mass number and amount of sample
- (D) Mass number and amount of element

16. The elements such as Cu, Ni, Zn, Pb, Fe, Mo, Mn, etc. can be simultaneously analyzed using following technique?

- (A) ICP-AES
- (B) GF-AAS
- (C) HG-AAS
- (D) GF-AFS

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17. The temperature programming in GC affects the retention and resolution of the chromatographic peaks?

- (A) Decrease, Decrease
- (B) Increase, Decrease
- (C) Increase, Increase
- (D) Decrease, Increase

18. Which of the following ionization techniques can be used in LC-MS?

- (A) CI
- (B) ESI
- (C) MALDI
- (D) APCI

19. The higher resolution of compound mixture will be obtained in the following column.

- (A) Guard
- (B) Packed
- (C) Open tubular
- (D) Closed

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20. The molecule weight of cytochrome p-450 protein can be detected using following MS: analyzer?

- (A) QIT
- (B) Q
- (C) TOF
- (D) Magnetic sector

Section - B

(Very Short Answer Type Questions)

(2 marks each)

Note : Attempt all questions in 2-3 sentences.

1. Write the application of ion-exchange chromatography in purification of water.
2. Define relative elution volume and its significance in size exclusion chromatography.
3. Give the application of zirconium filters in XRF analysis.
4. Write the function of collimators in PIXE.
5. What is ionization interference and how it can be overcome?

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6. Write the principle of AFS.
7. What are the advantages of hyphenating the chromatographic techniques such as GC, LC, IC with MS?
8. Which technique is better for analysis of mercury from drinking water sample?

Section-C

(Short Answer Type Questions)

(3 marks each)

Note- Attempt all questions. Write answer in <75 words.

1. Write the difference between capillary electrophoresis and capillary electrochromatography.
2. What are limitations of GC and HPLC instruments that is overcome using supercritical fluid chromatography.
3. Shortly explain the formation of different X-ray lines ($K\alpha$, $K\beta$ and $K\gamma$) in X-ray tube.
4. Write the working principle of Si-Li semiconductor detector in XRF spectroscopy.
5. Shortly explain the radiation source used in ICP-AES.

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6. How the selectivity and sensitivity are useful in analytical evaluation for newly developed methods?
7. Why the non-metals like C,N,P,S,Cl and Rn not analyzed by AAS.
8. Write the methodology for determination of arsenic using HG-AAS.

Section-D

(Long Answer Type Questions)

(5 marks each)

Note- Attempt all questions. Write answer in <150 words.

1. Describe the application of ion-exchange chromatography for analysis of anions from water samples.

OR

Explain the mechanism for separation of compound mixture in capillary electrophoresis(CE) and shortly explain the different components of CE.

2. What is the principle of PIXE and shortly discuss the different components of this instrument.

OR

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Write short notes on:

(a) WL-XRF

(b) Application of XRF in ornamental and geological samples analysis

3. Draw the block diagram of ICP-AES and shortly describe the use of this technique for analysis of food, soil and environmental samples.

OR

Write short notes on:

(a) Ionization interference

(b) HG-AFS

4. Write the working principle of LC-MS along with different application in biological, clinical, pharmaceutical and chemical analysis?

OR

Write short notes on:

(a) IC-MS

(b) Application of HG-AAS