Roll No. ..... Total Printed Pages - 5

F - 761

M.Sc. (Third Semester)
Examination, Dec, - Jan., 2021 - 22
CHEMISTRY
Paper Fourth (CH-16)
(Analytical Techniques and Data Analysis)

Time : Three Hours] [Maximum Marks : 80
[Minimum pass Mark : 16

Note: Attempt all sections as directed.

Section – A 1 each

(Objective/Multiple Choice Questions)

Note: Attempt all questions.

Choose the correct answer:

1. Add 2.8×10^{-7} and 3.3×10^{-6} with due regards to significant figures
   (a) 3.7×10^{-6}
   (b) 3.7×10^{-7}
   (c) 5.1×10^{-6}
   (d) 2.3×10^{-7}
2. Which statistical test is used to compare group means in a sample?
   (a) Correlation
   (b) Regression
   (c) Covariance
   (d) Analysis of variance
3. The test performed to learn whether the result obtained from the new method and the standard method have significant difference is:
   (a) Q-test
   (b) F-test
   (c) t-test
   (d) χ^2-test
4. If the standard deviation of a data is 0.017. Then find its variance
   (a) 0.0289
   (b) 0.00289
   (c) 0.000289
   (d) 0.0000289

5. Cluster sampling, stratified sampling and systematic sampling are types of
   (a) Random sampling
   (b) Direct sampling
   (c) Indirect sampling
   (d) Non random sampling
6. Which of the following is used as spraying reagent for paper chromatography?
   (a) Ninhydrin solution
   (b) Conc. HCl
   (c) NaCl solution
   (d) $CuSO_4$ solution
7. Craig apparatus is used in
   (a) Batch extraction
   (b) Continuous extraction
   (c) Countercurrent extraction
   (d) None of the above
8. In which type of chromatography, the stationary phase is held in a narrow tube and the mobile phase is forced through it under pressure?
   (a) Column chromatography
   (b) Planar chromatography
   (c) Liquid chromatography
   (d) Gas chromatography
9. Thin layer chromatography is based on
   (a) Partition chromatography
   (b) Adsorption chromatography
   (c) Electrical ability of ionic species
   (d) None of the above
10. The simplicity of extraction is decided by
    (a) The dielectric constant
    (b) Electrostatic capacity
    (c) Partition coefficient
    (d) Solvent polarity Sere
11. Which of the following is true?
    (a) The area under a DTA peak represents the enthalpy of the change
    (b) In DTA both the reference and the sample undergo change with temperature
    (c) DTA stands for Direct Thermal Analysis
    (d) None of the above
12. Which of the following option is appropriate for the TGA and DTA?
    (a) TGA and DTA measures only weight
    (b) TGA measures only weight while DTA measures other effects
    (c) TGA and DTA measures only temperature
    (d) TGA measures only temperature while DTA measures other effects
13. DTA can be used for which of the following process.
    (a) Line positions of the crystals
    (b) Mechanical properties of the crystals
    (c) Phase diagrams
    (d) Catalytic properties of enzymes

14. What is used to monitor the temperature in DTA?
    (a) thermobalance
    (b) electrode
    (c) active electrolyte
    (d) thermocouple
15. Which of the following are miniaturization advantage for flow injection analysis?
    (a) Increase the diffusion of the sample into the stream of reagent
    (b) Reduce the volume of reagent and sample
    (c) Reduce volume of waste that could be polluting
    (d) All of the above
16. In polarography, DME is used as..... electrode
    (a) Working electrode
    (b) reference electrode
    (c) non- polarizable electrode
    (d) gas electrode
17. In a cyclic voltametric process, the current is measured between
    (a) The working electrode and the reference electrode.
    (b) The working electrode and the counter electrode.
    (c) The counter electrode and the reference electrode.
    (d) None of the above
18. Polarography is a branch of .....
    (a) Potentiometry
    (b) Amperometry
    (c) Coulometry
    (d) Voltammetry
19. Coulometric techniques result in a plot of:
    (a) Electrochemical potential versus time
    (b) Current versus time
    (c) Current versus electrochemical potential
    (d) Current only
20. The limiting current in a linear sweep voltammogram is related to:
    (a) The reduction potential of the reference electrode
    (b) The point at which concentration polarization begins
    (c) The standard reduction potential for the redox couple under investigation
    (d) The concentration of the analyte of interest

Section – B

2 each

(Very Short Answer Type Questions)

Note: Attempt all questions.

1. Define precision and accuracy.
2. How many significant figures does each of the following numbers have?

   (a) 0.02680 (b) 500.0 (c) 0.0020 (d) 2.38
3. What is distribution coefficient?
4. Which law governs the solvent extraction?
5. What kind of reference material is used in DTA?
6. What is the difference between DTA and DSC?
7. What do understand by the term Half wave potential?
8. Give the equation for diffusion current in polarography and explain the terms involved in it.

Section – C

3 each

(Short Answer Type Questions)

Note: Attempt all questions.

1. Discuss F-Test?
2. Discuss the sample collection procedure for liquid samples. What is the nature of containers for sample collection?
3. Discuss thetheory and applications of HPTLC.
4. Briefly explain counter current extraction.
5. Draw the TG curve of calcium oxalate monohydrate.
6. Explain instrumentation of DSC technique.
7. Write a short note on cyclic voltammetry.
8. Explain the terms migration, residual and diffusion currents in polarography.

Section – D

5 each

(Long Answer Type Questions)

Note: Attempt all questions.

1. Replicate water samples are analyzed for water hardness with the following results: 102.2, 102.8, 103.1 and 102.3 ppm $CaCO_3$. Calculate (a) the standard deviation, (b) the relative standard deviation, (c) the standard deviation of the mean, and (d) the relative standard deviation of the mean.

   Or

   What is digestion? Briefly explain acid, base and microwave digestion.

2. Explain the principle, technique and application of TLC. How it is different from paper and column chromatography?

   Or

   Briefly explain solvent extraction and types of solvent extractions.

3. What do you understand by TGA? Explain its basic principle, types, TG curve and factors affecting the TG curve.

   Or

[5]

Discuss the advantages of automated method over classical method. Explain the principle and instrumentation of Flow injection analysis.

4. Explain the principle of potentiometry. Discuss the instrumentation of potentiometer.

Or

Write short note on Differential pulse polarography and square wave polarography.