2024

(CBCS)

(4th Semester)

CHEMISTRY

FOURTH PAPER

(Analytical Chemistry—I)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. Which one of the following is an interfering ion?

(a) NO_3^- ( )

(b) $C_2O_4^{2-}$ ( )

(c) CO_3^{2-} ( )

(d) SO_4^{2-} ( )

2. The solubility product is a kind of equilibrium constant and its value depends on

(a) volume ( )

(b) energy ( )

(c) temperature ( )

(d) heat ( )

3. The completely immiscible solution mixture can be separated by

(a) separating funnel ( )

(b) sublimation ( )

(c) condensation ( )

(d) evaporation ( )

4. Why is zone refining carried out in an inert atmosphere?

(a) To prevent reduction of metal ( )

(b) To reduce the external pressure ( )

(c) To prevent oxidation of metal ( )

(d) To reduce the external temperature ( )

5. The sum of the numbers 436·32, 227·2 and 0·301 in appropriate significant figures is

(a) 663·821 ( )

(b) 664 ( )

(c) 663·82 ( )

(d) 663·8 ( )

6. The property of a measuring instrument to give the output very close to the actual value is termed as

(a) sensitivity ( )

(b) precision ( )

(c) repeatability ( )

(d) accuracy ( )

7. Which of the following is not an acid-base indicator?

(a) Methyl orange ( )

(b) Phenolphthalein ( )

(c) Methylene blue ( )

(d) Methyl red ( )

8. The pH of titration mixture for strong acid-strong base titration at equivalence point is

(a) 4 ( )

(b) 7 ( )

(c) 2·7 ( )

(d) 9·2 ( )

9. Name the process that contaminates the precipitates and also carries the precipitate solution containing soluble impurities.

(a) Coprecipitation ( )

(b) Supersaturation ( )

(c) Reprecipitation ( )

(d) Solution ( )

10. The analytical reagent used to separate and precipitate metals such as copper, iron and thorium is

(a) alizarin ( )

(b) cupferron ( )

(c) oxine ( )

(d) dimethylglyoxime ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer the following : 3×5=15

UNIT—I

1. Write the advantage of hot plate over Bunsen burner for heating.

OR

2. Write the importance of personal protective equipment (PPE) in the laboratory.

UNIT—II

3. Explain solvent extraction.

OR

4. Explain liquid-liquid extraction.

UNIT—III

5. Write a short note on reporting of analytical data.

OR

6. What is meant by the term 'confidence limit'? What is its significance?

UNIT—IV

7. Explain 'acid-base titration' with an example.

OR

8. Explain 'redox titration' with one example.

UNIT—V

9. Discuss the application of 1-nitroso-2-naphthol in inorganic analysis.

OR

10. Write a brief note on purification of precipitates.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer the following : 10×5=50

UNIT—I

1. *(a)* Write a brief note on safe handling and storage of ethers. 3

(b) Write a brief note on MSDS. 3

(c) Define the following terms : 1×4=4

(i) Acute toxicity

(ii) Lower flammability limit

(iii) Auto-ignition temperature

(iv) Physical antidote

OR

2. *(a)* Explain the importance of segregation of incompatible chemicals during storage. 3

(b) Discuss the use of common-ion effect and solubility product principle in the separation of analytical groups I and II in inorganic salt analysis. 4

(c) Describe the process of removal of any one interfering anion in qualitative analysis. 3

UNIT—II

3. *(a)* Discuss the method of zone refining for the purification of material. 3

(b) Describe the uses of crown ethers in the process of extraction. 3

(c) Explain in detail the principle of steam distillation. 4

OR

4. *(a)* Describe the Craig method of multiple extraction. 3

(b) What does enrichment factor mean? 3

(c) Write the theory of fractional distillation. 4

UNIT—III

5. *(a)* Distinguish between accuracy and precision. 3

(b) What are the different types of determinate error? How are these errors detected and corrected? 2+2=4

(c) What is meant by the term 'confidence limit'? How is it determined? 3

OR

6. *(a)* What are the different ways of expressing precision? Write the mathematical expression and explain the terms involved. 3

(b) Compute the result of the following expressions : 2+2=4

(i) $(23 \cdot 4 \pm 0 \cdot 1)(17 \cdot 7 \pm 0 \cdot 05)$

(ii) $(16 \cdot 6 \pm 0 \cdot 1) - 2(16 \cdot 7 \pm 0 \cdot 2) + 3(7 \cdot 3 \pm 0 \cdot 01)$

(c) Describe *Q*-test which is applied for rejection or retention of an anomalous result. 3

UNIT—IV

7. *(a)* Differentiate between end point and equivalence point. 3

(b) Explain the following terms : 1×3=3

(i) Titration

(ii) Analyte

(iii) Standard solution

(c) Calculate the molarity and normality of a solution containing 60 g of oxalic acid crystal ($H_2C_2O_4 \cdot 2H_2O$, mol. wt. = 126) dissolved in 1000 ml of the solution. 4

OR

8. *(a)* What are primary and secondary standards? Give example of each. 3

(b) What are iodometric and iodimetric titrations? Discuss with example. 4

(c) Write a note on the theory of acid-base indicators giving suitable example. 3

UNIT—V

9. *(a)* Differentiate between coprecipitation and post-precipitation. 3

(b) Describe the separation of calcium and barium in a mixture with relevant equations. 3

(c) Write the structures and uses of the following reagents in inorganic analysis : 2+2=4

(i) Rhodamine-B

(ii) Dithiazone

OR

10. *(a)* Draw the structure of oxine and explain its application in inorganic analysis. 3

(b) Write the theory of precipitates. 3

(c) How would you separate iron and copper ions present in a mixture? 4

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