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(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 of the following will be the most suitable for heating the round-bottom flask?

(a) Hot plate ()

(b) Heating mantle ()

(c) Bunsen burner ()

(d) Muffle flask ()

2. The group reagent for analytical group IV in systematic qualitative analysis of basic radicals is

- (a) dil. HCl + H₂S ()
- (b) NH₄OH + NH₄Cl ()
- (c) H₂S + (NH₄OH + NH₄Cl) ()
- (d) (NH₄)₂CO₃ + (NH₄OH + NH₄Cl) ()

3. The process of transition of a substance directly from the solid to the gas phase without passing through a liquid phase is

- (a) sublimation ()
- (b) condensation ()
- (c) evaporation ()
- (d) distillation ()

4. The separation technique which is used to separate the compound when the boiling point difference is not large enough is

- (a) steam distillation ()
- (b) fractional distillation ()
- (c) zone refining ()
- (d) evaporation ()

5. Which of the following sets has the same significant figures?

- (a) 1.003 and 0.103 ()
- (b) 320 and 0.32 ()
- (c) 0.0210 and 2.010 ()
- (d) 50.05 and 0.5005 ()

6. Accuracy refers to

- (a) how close the observed value is to the true value ()
- (b) how consistent results are when measurements are repeated ()
- (c) how reproducible is the measurement ()
- (d) how is the measured value differ from each other ()

7. The normality of 3.16 g of KMnO_4 (molecular weight = 158) in 1000 mL of solution will be

- (a) 0.5 N ()
- (b) 0.2 N ()
- (c) 0.1 N ()
- (d) 0.05 N ()

8. An acid-base indicator changes its colour due to a change in

- (a) concentration ()
- (b) temperature ()
- (c) volume ()
- (d) pH ()

9. Dimethylglyoxime is used for the quantitative estimation of

- (a) Cu^+ ()
- (b) Pb^{2+} ()
- (c) Ni^{2+} ()
- (d) Fe^{3+} ()

10. The technique used to separate ions from solution based on their solubility is

- (a) fractional precipitation ()
- (b) coprecipitation ()
- (c) post-precipitation ()
- (d) purification of precipitate ()

(SECTION : B—SHORT ANSWER)

(Marks : 15)

Answer the following questions :

3×5=15

UNIT—I

1. Write the importance of personal protective equipment in chemistry laboratory.

OR

2. Write a note on safe handling of acids.

UNIT—II

3. Write a short note on liquid-liquid extraction.

OR

4. Discuss the method of zone refining for the purification of material.

UNIT—III

5. Describe F-test, the test of significance.

OR

6. Calculate the relative error in parts per thousand. The result of an analysis is 36.97 g compared with the accepted value of 37.06 g.

UNIT—IV

7. Define the following :

- (a) Normality
- (b) Titrant
- (c) Indicator

OR

8. What are primary and secondary standards?

UNIT—V

9. What are coprecipitation and post-precipitation?

OR

10. Write a short note on the uses of dithiazone.

(SECTION : C—DESCRIPTIVE)

(Marks : 50)

Answer the following questions :

10×5=50

UNIT—I

1. (a) Write a note on safe handling and storage of ethers. 3
- (b) Explain the importance of Material Safety Data Sheet (MSDS). 3
- (c) What do you understand by common ion effect? Explain the importance of common ion effect and solubility product principle in systematic qualitative analysis. 1+3=4

OR

2. (a) What is an antidote? Explain physical antidote and give an example. 1+2=3
- (b) Define the following : 3
- (i) Flashpoint
 - (ii) Upper flammability limit
 - (iii) Threshold Limit Value-Time Weighted Average (TLV-TWA)

- (c) What do you mean by interfering anions? Give the procedure for the removal of any one interfering radical. 1+3=4

UNIT—II

3. (a) Discuss the Craig method of multiple extraction. 3
(b) Write the advantages of successive extraction. 3
(c) Explain in detail the principle of steam distillation. 4

OR

4. (a) Describe the uses of crown ethers in the process of extraction. 3
(b) Discuss sublimation method for separation of mixture. 3
(c) Write the theory of fractional distillation. 4

UNIT—III

5. (a) What do you mean by the term 'confidence limit'? How is it determined? 3
(b) Describe *Q*-test for retention or rejection of an anomalous result. 3
(c) What is determinate error? Explain different types of determinate error. 1+3=4

OR

6. (a) Differentiate between accuracy and precision. 3
(b) What do you mean by the test of significance? Explain it with *t*-test. 3
(c) Calculate the mean and standard deviation of the following sets of analytical results : 4

15.67 g, 15.69 g and 16.03 g

UNIT—IV

7. (a) Explain the theory of iodimetric titration with relevant equations. 3
(b) Differentiate between equivalence point and end point of a titration. 3
(c) Write the theory of acid-base indicators giving suitable example. 4

OR

8. (a) Describe briefly redox titration. Give examples. 3
- (b) Explain the theory of iodometric titration by giving relevant equations. 3
- (c) Define molarity. Calculate the molarity of the solution containing 8 g of sodium hydroxide (molar mass = 40) dissolved in water and the solution is made up to the mark in a standard 1000 mL volumetric flask. 1+3=4

UNIT—V

9. (a) Write a short note on purification of precipitate. 3
- (b) Draw the structure and describe the uses of oxine reagent in inorganic analysis. 3
- (c) Describe the separation and estimation of barium and calcium along with relevant reaction involved. 4

OR

10. (a) Write a detailed note on the theory of precipitation. 3
- (b) Explain 1-nitroso-2-naphthol as an organic reagent for inorganic analysis. 3
- (c) Show the method of separation and estimation of iron and copper ions in a mixture. 4

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