

(Time: 3 hours)

Total Marks: 100

- N.B.: (1) All questions are compulsory.  
 (2) Figures to the right indicate full marks.  
 (3) Use of log table/ non-programmable calculator is allowed.

Q.1 Attempt any four of the following. 20

- A) Explain the term quality control and quality assurance.  
 B) Calculate mass percent composition of each element in potassium ferrocyanide,  $K_4Fe(CN)_6$   
 (Given: atomic weight of K = 39, Fe = 55.85, C = 12, N = 14)  
 C) Concentrated  $H_2SO_4$  has specific gravity of  $1.71 \text{ g.cm}^{-3}$  and it contains 80% w/w of  $H_2SO_4$ . Calculate 1) Molar concentration 2) Normal concentration  
 (Given atomic weight of H = 1, S = 32, O = 16)  
 D) Explain the importance of quality concept in industry.  
 E) Describe the sampling of immiscible and flowing liquid.  
 F) Discuss different equipment used for sampling of compact solid.

Q.2 Attempt any four of the following. 20

- A) Calculate the potential of the system in the titration when equal volumes of equimolar Fe(II) and Ce(IV) solutions are mixed.  
 ( $E^0_{Pt/Fe^{2+},Fe^{3+}} = +0.771V$ ,  $E^0_{Pt/Ce^{3+},Ce^{4+}} = +1.440V$ )  
 B)  $10.0 \text{ cm}^3$  0.1 M Fe (II) solution is titrated with 0.02 M  $KMnO_4$  at pH = 1. Calculate the potential when  
 i)  $9.9 \text{ cm}^3$  of 0.02 M  $KMnO_4$  added  
 ii)  $10.1 \text{ cm}^3$  of 0.02 M  $KMnO_4$  added  
 Given:  $E^0_{Pt/Fe^{3+},Fe^{2+}} = +0.771V$ ,  $E^0_{Pt/MnO_4^-,Mn^{2+}} = +1.510V$   
 C) What are redox indicators? Explain the use of any one redox indicator.  
 D) What are the factors which increase the selectivity of EDTA as titrant. Explain any two.  
 E) Explain the following types of EDTA titrations:  
 i) Back titration ii) Substitution titration.  
 F) Discuss the theory of metallochromic indicators. What are the requirements of metallochromic indicators?

Q.3. Attempt any four of the following. 20

- A) With the help of a diagram explain the working of hollow cathode lamp.  
 B) Discuss the principle of Atomic Absorption Spectroscopy. Explain the role of rotating chopper in AAS.  
 C) Explain phosphorescence. Give two applications of phosphorimetry.  
 D) Explain Jablonski diagram of energy levels in a molecule.  
 E) Discuss the working of nephelometry with the help a labelled diagram.  
 F) Explain: - 1) Turbidimetric titrations 2) Phase titrations

Q.4

Attempt any four of the following.

20

- A) Explain the principle of solid phase extraction. Give its advantages.  
 B) Discuss any two factors affecting solvent extractions.  
 C) Explain the terms used in HPLC i) isocratic elution ii) gradient elution. Give any three applications of HPLC.  
 D) Explain the principle of HPLC. Discuss UV detector used in HPLC.  
 E) Give applications and limitations of HPTLC.  
 F) Name the steps involved in HPTLC. Write a note on fluorimetric detector used in HPTLC.

Q.5

A)

Select the correct option and complete the following statements: (any five)

05

- a) \_\_\_\_\_ cannot be used for validation of analytical method.  
 i) Reference material ii) Certified-reference material iii) LR grade  
 b) The reagent of highest grade of purity is \_\_\_\_\_ grade.  
 i) AR. ii) GR iii) LR  
 c) 30ppm means \_\_\_\_\_.  
 i) 30 mg ii) 30 mg/cm<sup>3</sup> iii) 30mg/dm<sup>3</sup>  
 d) 1M Al(OH)<sub>3</sub> solution is equivalent to \_\_\_\_\_ N Al(OH)<sub>3</sub> solution.  
 i) 1 ii) 3 iii) 0.1  
 e) \_\_\_\_\_ method is mostly used to draw sample from a cylinder filled with gas at high temperature.  
 i) Flushing ii) Static iii) Displacement  
 f) The process of rolling and quartering is used for decreasing \_\_\_\_\_.  
 i) particle size ii) sample size iii) Bulk ratio  
 g) \_\_\_\_\_ is used for sampling of particulate solid.  
 i) Auger sampler ii) Concentric tube thief iii) Geo sampler  
 h) \_\_\_\_\_ acid is excellent solvent for dissolution of many metal oxides and metals above hydrogen.  
 i) Hydrochloric ii) Sulphuric iii) Perchloric

Q.5

B)

State whether true or false: (any five)

05

- a) Sulphuric acid is added to reduce  $E_{\text{Pu/Fe}^{3+}, \text{Fe}^{2+}}^0$  in the titration between Fe(II) and potassium dichromate.  
 b) Nernst's equation is applicable only at equivalence point in redox titrations.  
 c) Equivalent point potential is independent of concentrations of reactants and products in titration of Fe(II) against  $\text{MnO}_4^-$ .  
 d) Ferroin contains 1,10-phenanthroline.  
 e) EDTA does not form 1:1 complex with most of the metal ions.  
 f)  $K_{\text{MY}} = K'_{\text{MY}}$  when  $\alpha_4 = 0$   
 g) In the titration of  $\text{Ca}^{+2}$  against EDTA, concentration of  $\text{Ca}^{+2}$  is zero at equivalence point.

Q.5 c)

Fill in the blanks with correct alternatives given in the bracket : 05  
(any five)

(alkali & alkali earth metals, phosphorescence, turbidimeter, turbidance, toxic metals, hollow cathode lamp, low, conjugated double)

- a) AAS is used to detect \_\_\_\_\_ like Cu, Ni, Zn and Hg in food products.
- b) Flame photometry is extensively used for the estimation of \_\_\_\_\_.
- c) In AAS the source of radiation is \_\_\_\_\_.
- d) Delayed re-emission of absorbed radiation is called \_\_\_\_\_.
- e) Phosphorimetric experiments are normally carried out at \_\_\_\_\_ temperature.
- f) The instrument used to measure turbidance is known as \_\_\_\_\_.
- g) Molecules having \_\_\_\_\_ bond are suitable for fluorescence and Phosphorescence.
- h) A turbidimeter measures \_\_\_\_\_ as a function of concentration of suspension.

Q.5 D)

Match the columns: (any five)

05

Column A

Column B

- |                          |  |
|--------------------------|--|
| a) Neutral chelate       | (i) Detection of separated component using scanning instrument |
| b) Powder silica         | (ii) Extraction of uranyl nitrate                              |
| c) HPLC                  | (iii) Remove impurities from solvent                           |
| d) Multistage separation | (iv) $pH_{1/2}$  |
| e) HPTLC                 | (v) Reciprocating pump   |
| f) TBP solvent           | (vi) Countercurrent extraction                                 |
| g) Precolumn             | (vii) Solid phase extraction                                   |
|                          | (viii) Easily extracted in water                               |
|                          | (ix) Easily extracted in organic solvent                       |

\*\*\*\*\*