

(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 importance of quality concepts in industry.  
 B) Calculate mass percent composition of each element in copper pyrites ( $\text{CuFeS}_2$ ) molecule.  
 (Given: atomic mass of Cu = 63.54, Fe = 55.85, S = 32)  
 C) 30 g of glucose are dissolved in 250 g of water. Calculate the mole fraction of glucose in the solution.  
 (Given: atomic mass of C = 12, O = 16, H = 1)  
 D) What is purpose of sampling? Explain any one method used for reduction of sample size in sampling of solid.  
 E) Discuss various grades of laboratory reagents.  
 F) Explain any one method of sampling of stack gases, with a labelled diagram.

**Q.2 Attempt any four of the following. 20**

- A) Mention any three desired properties of metallochromic indicators used in EDTA titrations. Give any two examples.  
 B) Discuss the use of diphenylamine indicator in redox titration, explaining the reactions involved and role of  $\text{H}_3\text{PO}_4$  in such titrations.  
 C) Explain direct titration and back titration with respect to EDTA titrations.  
 D)  $10.0 \text{ cm}^3$   $0.01 \text{ M}$  Fe (II) solution is titrated with  $0.01 \text{ M}$  Ce (IV) in acidic medium Calculate the potential  
 i) on addition of  $5.0 \text{ cm}^3$   $0.01 \text{ M}$  Ce (IV)  
 ii) on addition of  $10.5 \text{ cm}^3$   $0.01 \text{ M}$  Ce (IV)  
 Given:  $E^0_{\text{Pt/Fe}^{3+}, \text{Fe}^{2+}} = 0.771 \text{ V}$   
 $E^0_{\text{Pt/Ce}^{4+}, \text{Ce}^{3+}} = 1.44 \text{ V}$   
 E)  $10.0 \text{ cm}^3$   $0.1 \text{ M}$  Fe (II) solution is titrated with  $0.02 \text{ M}$   $\text{KMnO}_4$  at pH = 2, Calculate the potential at equivalence point.  
 Given:  $E^0_{\text{Pt/Fe}^{3+}, \text{Fe}^{2+}} = 0.771 \text{ V}$   
 $E^0_{\text{Pt/MnO}_4^-, \text{Mn}^{2+}} = 1.510 \text{ V}$   
 F) Name different methods to increase selectivity of EDTA. Describe any two in details.

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

- A) With the help of a diagram explain the working of hollow cathode lamp.  
 B) Describe the standard addition method for the estimation of a sample solution in FES.  
 C) Explain Jablonski diagram of energy levels in a molecule.  
 D) With the help of a neat diagram explain the working of phosphorimeter.  
 E) Draw a schematic diagram of nephelometer and explain its working.  
 F) What are the important factors affecting the scattering of radiation? Explain any two.

**Q.4 Attempt any four of the following. 20**

- A) Explain  $[pH]_{1/2}$  and discuss its importance using a graph of percentage extraction versus pH.
- B) What is solid phase extraction? Give any two advantages of solid phase extraction over solvent extraction.
- C) Explain the refractive index detector used in HPLC and give any two of its advantages.
- D) Explain the role of precolumn used in HPLC. Give any two applications of HPLC.
- E) What are the different types of detectors used in HPTLC? Explain any one in detail.
- F) What are the advantages and limitations of HPTLC.

**Q.5 A) Select the correct option and complete the following statements: (any five) 05**

- a) \_\_\_\_\_ concerns operational techniques and activities to fulfil quality requirements.
  - i) Quality management    ii) quality assurance    iii) quality control
- b) The material which carries certificate of purity is \_\_\_\_\_.
  - i) RM    ii) CRM    iii) LR
- c) The normality of 0.05 M  $H_2SO_4$  is \_\_\_\_\_ N.
  - i) 0.2    ii) 0.1    iii) 0.01
- d) 1 mg of solute dissolved in 1 litre of solution is \_\_\_\_\_.
  - i) 1 ppm    ii) 1 ppb    iii) 1 ppt
- e) \_\_\_\_\_ is used for sampling of cement and granular material.
  - i) Geo sampler    ii) Concentric tube thief    iii) Auger sampler
- f) Multiple tube sampler is used for sampling of \_\_\_\_\_ liquid.
  - i) Static    ii) Flowing    iii) immiscible
- g) \_\_\_\_\_ is used for dissolution of silicates.
  - i) Hydrochloric acid    ii) Acetic acid    iii) Hydrofluoric acid
- h) In sampling of solid, bulk ratio should be as \_\_\_\_\_ as possible.
  - i) large    ii) small    iii) minimum

**Q.5 B) State whether true or false: (any five) 05**

- a) The plot of electrode potential of the system versus volume of titrant is called titration curve for redox reaction.
- b) Demasking is the process in which masked substance does not regain the ability to enter into reaction.
- c) Stability of M-EDTA complex depends on temperature of the ligand.
- d) Redox titrations involve transfer of electrons between reactant and titrant.
- e)  $KMnO_4$  acts as self-indicator in  $Fe^{2+}$  versus  $KMnO_4$  titration.
- f) Eriochrome black T indicator exhibits blue colour between pH 7 to 11.
- g) Calcium can be directly titrated with EDTA.

**Q.5 C) Fill in the blanks with correct alternatives given in the bracket: (any five) (UV light, singlet, delayed, right, acetylene, Turbidity, Nephelometer, colorimeter, AAS) 05**

- \_\_\_\_\_ is used to detect toxic metals like Cu, Ni, Zn and Hg in food products.
- For most molecules, the electrons are paired in the ground state, such a state is called the \_\_\_\_\_ state.
- The fuel used in a premix burner in FES is \_\_\_\_\_.
- Secondary filter in fluorimetry absorbs \_\_\_\_\_.
- Phosphorescence is the \_\_\_\_\_ reemission of light absorbed by molecules.
- In nephelometry, the detector is usually, but not necessarily, placed at \_\_\_\_\_ angle to the incident radiation.
- A turbidimeter measures \_\_\_\_\_ as a function of concentration of suspension.
- The instrument used to measure scattered light is known as \_\_\_\_\_.

**Q.5 D) Match the columns: (any five) 05**

- | <b>Column A</b>                                | <b>Column B</b>  |
|--|--|
| a) Partition coefficient                       | (i) Retention time                                       |
| b) Extraction by Chelation                     | (ii) Retention factor                                    |
| c) Parameter for quantitative analysis in HPLC | (iii) Applicable to solute exists in same molecular form |
| d) Parameter for Qualitative analysis in HPTLC | (iv) 8- hydroxy quinoline                                |
| e) Degasser in HPLC                            | (v) Silica gel   |
| f) Parameter for qualitative analysis in HPLC  | (vi) Peak area   |
| g) Pre coated plates in HPTLC                  | (vii) To remove dissolved gases                          |

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