

[Time: 3 Hours]

[Marks:100]

Please check whether you have got the right question paper.

- 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 Answer **any four** of the following:

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- A) Explain the term quality & quality control.
- B) Concentrated H_2SO_4 (MW=98) has density of 1.84 g cm^{-3} and contains 86% (w/w) of H_2SO_4 . Calculate its concentration in molarity, and convert it into normality.
- C) Calculate the percentage composition of each element in sodium hydrogen phosphate. [Given atomic weight of; H=1, P=31, O=16, Na= 23].
- D) Discuss the importance of quality concepts in industry.
- E) Discuss the sampling of homogeneous and heterogeneous liquid.
- F) Describe displacement method for the sampling of gases, with a neat labelled diagram.

Q.2 Answer **any four** of the following:

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- A) Discuss the theory of redox indicators and explain the criteria for selection of an indicator in redox titrations.
- B) What are metallochromatic indicators? Mention any four desired properties of a good metallochromic indicator.
- C) $10. \text{cm}^3$ of 0.1M Fe(II) solution is titrated with 0.1M Ce(IV) in acidic medium. Calculate the potential:
 - (i) at the equivalence point.
 - (ii) on addition of two times the volume of titrant required at the equivalence point.
 Given: $E^\circ_{\text{pt/Ce}^{4+}, \text{Ce}^{3+}} = 1.44 \text{V}$
 $E^\circ_{\text{pt/Fe}^{4+}, \text{Fe}^{3+}} = 0.771 \text{V}$
- D) 25.0cm^3 of 0.1M Fe(II) is titrated with 0.02M KMnO_4 at pH 1.5. Calculate the potential at the equivalence point.
 Given: $E^\circ_{\text{pt/Fe}^{3+}, \text{Fe}^{2+}} = 0.771 \text{V}$
 $E^\circ_{\text{pt/MnO}_4^-, \text{Mn}^{2+}} = 1.510 \text{V}$
- E) "EDTA is a reagent of choice in many analytical laboratory, in spite of its low selectivity" – discuss.
- F) Explain direct titrations and back titration w.r.t. EDTA titrations.

Q.3 Answer **any four** of the following:

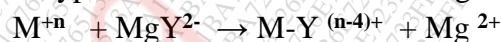
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- A) Discuss the principle of AAS.
- B) Explain the use of hollow cathode lamp, with a labelled diagram, giving one disadvantage.
- C) Derive a mathematical relationship between the intensity of fluorescent radiation and concentration of the solution.
- D) Draw a schematic diagram of turbidimeter and explain turbidimetric titrations, using turbidimetric titration curve.
- E) With the help of a diagram, describe premix burner mentioning any two of its advantages.
- F) What is phosphorescence? Draw a schematic diagram of phosphorimeter and discuss its working explaining the role of shutter.

- Q.4 Answer **any four** of the following: 20
- Explain the various factors affecting solvent extraction.
 - Define $[pH]_{1/2}$ and explain its significance, with a graph of percentage extraction versus pH.
 - What are the applications, advantages and limitations of solid phase extraction?
 - Explain the function of pump in HPLC. Name any two pump used in HPLC, giving one advantage and limitation of each type.
 - What is the role of detector in HPLC? Discuss UV detector used in HPLC, mentioning its advantages.
 - Mention various steps involved in HPTLC. Write any two advantages and limitations of HPTLC.

- Q.5 A) Answer **any five** of the following, in one sentence: 05
- What are analytical reagent?
 - What is the molarity 0.1N HCl solution?
 - What is the milliequivalents of 20cm³ in 1NaOH?
 - Name the most commonly used reagent for dissolution of silicate rocks.
 - Name any one equipment used for sampling of compact solids.
 - Name any one most common flux used in the analysis of compounds of alkali metals.
 - Give the relationship between sampling error and square root of the number of samples averaged.
 - Name any one method for size reduction w.r.t. sampling of solids.

- B) Answer **any five** of the following in one sentence: 05
- What is the role of phosphoric acid in the redox titration of Fe⁺² versus Cr₂O₇²⁻ using diphenylamine indicator?
 - Give the reversible reaction of diphenylbenzidine indicator in redox titration of Fe⁺² vs Cr₂O₇²⁻.
 - Name the most commonly used indicator in the redox titration of Fe⁺² versus Ce⁺⁴ in acidic medium.
 - Give any one advantage of EDTA as titrant.
 - Give a mathematical expression for absolute stability constant, for the reaction involving fully ionized form of EDTA and Mⁿ⁺.
 - Give an example of indirect titration with respect to EDTA titrations.
 - Name the type of EDTA titration involving the following reaction.



- What is tris(1,10-phenanthroline)iron(II)sulphate commonly known as?
- C) Fill in the blanks (**any five**) 05
- Nephelometry involves measurement of intensity of _____ light as a function of concentration of dispersed phase.
 - In AAS, the steady light from hollow cathode lamp is converted in to pulsating light by _____.
 - In nephelometry, the detector is usually, but not necessarily, placed at _____ angle to the incident radiation.

- d) A calibration curve, in flame photometry, is a plot of _____ against concentration.
- e) The commonly used radiation source in fluorimeter is _____ lamp.
- f) In the expression w.r.t. turbidimetry, $S = Ktc$, 'K' stands for _____.
- g) Increase in viscosity of the solution, will _____ the intensity of emitted light in FES.

D) State true or false (any five)

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- a) In HPLC, role of precolumn is to remove impurities from the sample solution.
- b) UV detector is used in HPTLC.
- c) Immiscible solvent pairs can be used for HPTLC separations.
- d) Separation of solute in HPTLC takes place by phenomenon of partition.
- e) Development time in HPTLC is same as that of TLC.
- f) Refractive index detector is highly temperature sensitive.
- g) Degasser system is used in HPLC, to remove dissolved gases from the solvent.
