

[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 calculators is allowed.

Q.1 Answer any four of the following:**20**

- A) Discuss the various grades of laboratory reagents.
- B) Calculate the molarity and molality of 69.8% (w/w) nitric acid solution.
[Given: molecular weight of nitric acid = 63 and density of nitric acid solution = 1.42 g cm^{-3}]
- C) Discuss the importance of quality concepts in industry.
- D) Calculate the percentage composition of each element present in urea.
[Given: atomic weight of: H=1.008, N= 14.007, O= 15.999 and C= 12.011].
- E) Discuss the different equipments for the sampling of compact solids.
- F) Write a note on: 'Preservation and dissolution of the sample'.

Q.2 Answer any four of the following:**20**

- A) What are redox indicators? Discuss the use of diphenylamine as a redox indicator mentioning the role of acid mixture.
- B) 10.0 cm^3 of 0.2 M Fe (II) solution is titrated with 0.2 M KMnO_4 at pH 2 in acidic medium. Calculate the potential:
a) at half the equivalence point b) at the equivalence point
c) after addition of double the volume of titrant required at the equivalence point.
Given: $E^\circ_{\text{Pt/Fe}^{3+}, \text{Fe}^{2+}} = 0.771 \text{ V}$ and $E^\circ_{\text{Pt/MnO}_4^-, \text{Mn}^{2+}} = 1.510 \text{ V}$,
Comment on the nature of the titration curve.
- C) Discuss the theory of redox indicators.
- D) Calculate the values of pMg when: a) 0.0 cm^3 b) 5.0 cm^3 c) 10.0 cm^3 and d) 11.0 cm^3 of 0.01 M EDTA is added to a 10.0 cm^3 of 0.01 M Mg^{2+} buffered to a constant pH of 10.0.
Draw the nature of titration curve (pMg versus volume of EDTA).
[Given: $K_{\text{MY}} = 4.9 \times 10^8$ and α_4 for EDTA at pH of 10.0 = 0.35].
- E) Discuss the use of EDTA as titrant. Write any three advantages of EDTA as a titrant.
- F) What are the different methods to increase selectivity in EDTA titrations? Discuss any two of them in brief.

Q.3 Answer any four of the following:**20**

- A) Discuss the principle of flame photometric analysis.
- B) With the help of a neat diagram explain an electrothermal atomizer.
- C) Give any three applications and two limitations of AAS.

- D) Derive a mathematical relationship between the intensity of fluorescent radiation and the concentration of the solution.
- E) What is phosphorimetry? What are the factors affecting fluorescence and phosphorescence.
- F) Explain why sample solutions for nephelometry and turbidimetry have to be prepared very carefully. Draw a neat labelled diagram of a nephelometer.

Q.4 Answer any four of the following:

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- A) What are the factors affecting solvent extraction? Explain any one.
- B) What is solid phase extraction? Give any three applications.
- C) What are the requirements for high pressure pump used in HPLC? Name any two pumps.
- D) Draw a neat labelled diagram of a typical HPLC unit and explain the function of degasser and precolumn.
- E) Mention the different detectors used in HPTLC and explain any one.
- F) What are the advantages and limitations of HPTLC?

Q.5A) Answer any five of the following

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- a) What are certified reference materials?
- b) What is the normality of 0.01M sulphuric acid?
- c) Name any one concentration unit independent of temperature.
- d) What is the condition in which the molarity and formality of the solution will be same?
- e) Mention any one difficulty encountered in the sampling of gases.
- f) What is ambient sampling?
- g) Name the equipment used for sampling of flowing liquids.
- h) Define: 'Bulk ratio' with respect to sample size.

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

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- a) During the direct EDTA titrations, _____ is added to metal ion solution to prevent precipitation of hydroxides of metal ion.
 - i) tartarate ii) formaldehyde iii) sodium cyanide
- b) The transition potential of ferroin indicator is _____ V in 1M H₂SO₄.
 - i) 0.76 ii) 1.14 iii) 0.61
- c) During the titration of Fe²⁺ against Ce⁴⁺, the potential of indicator electrode before the equivalence point depends on the ratio of _____.
 - i) $\frac{[Fe^{2+}]}{[Fe^{3+}]}$ ii) $\frac{[Ce^{3+}]}{[Ce^{4+}]}$ iii) $\frac{[Fe^{2+}]}{[Ce^{4+}]}$
- d) EDTA is standardized using standard solution of _____.
 - i) ZnSO₄ ii) NaOH iii) HCl
- e) Of the following, _____ is estimated by indirect EDTA titrations only.
 - i) PO₄³⁻ ii) Cu²⁺ iii) Zn²⁺

- f) Eriochrome Black T indicator exhibits _____ colour between pH of 7 to 11.
i) red ii) blue iii) orange
- g) Ferroin indicator is a complex of with _____ with Fe(II).
i) 1,10-phenanthroline ii) diphenylamine iii) diphenylbenzidine

C) **State whether true or false: (any five)**

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- a) Nitrogen is used as an inert gas in hollow cathode lamp.
- b) Flame photometry gives the information of the molecular condition of the sample.
- c) Flame photometry cannot be used for analysis of non-radiating elements.
- d) Turbidimetry is used to measure the amount of growth of a test bacteria in a liquid nutrient medium.
- e) Fluorescence is delayed phosphorescence.
- f) Phosphorescence of a solution is generally observed at liquid nitrogen temperature.
- g) For molecular weight determination by turbidimetry, a plot of turbidity versus concentration is plotted.
- h) In nephelometric analysis, highly monochromatic radiation is not necessary.

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

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- a) When the separation factor for the two solutes are very close, _____ extraction method is used.
(batch, continuous, counter current)
- b) Partition coefficient is equal to _____ if the molecular state of the solute remains unchanged.
(distribution ratio, separation factor, equilibrium constant)
- c) If the $pH_{1/2}$ values of two metals are _____, excellent separation is achieved by controlling the pH.
(very close, similar, very far)
- d) Due to different _____ of the solutes in between the two liquid phases, separation of the solutes occur in HPLC.
(solubilities, adsorption, absorption)
- e) In HPLC, the _____ at which the peak occurs on the chromatogram is characteristic of the analyte.
(concentration, retention time, peak area)
- f) _____ detector used in HPLC is highly temperature sensitive.
(UV, Refractive index, Fluorescence)
- g) The _____ method of sample injection in HPLC is reliable with respect to reproducibility.
(manual, stop flow, sample loop)
