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. The use of log-table/ non-programmable calculator is allowed
4. Answers for the same question as far as possible should be written together.

Q.1 A) Select the correct option & complete the following sentences (any **Twelve**) **(12)**

i) Centrifugation is a _____method of separation.
a) chemical b) mechanical c) physical

ii) Liquid –liquid chromatography is based on _____.
a) sublimation b) adsorption c) partition

iii) Production of liquid fuels is an industrial process which involves_____.
a) distillation b) fractional distillation c) steam distillation

iv) Electrophoresis is based on _____.
a) ion exchange b) solubility c) electrical charge

v) The separation in TLC is because of _____of solute between the two phases.
a) adsorption b) partition c) both adsorption and partition

vi) Separation factor in solvent extraction is the ratio of _____ of two solutes.
a) solubility product b) ionic product c) distribution ratio

vii) _____is used as primary reference electrode.
a) Hydrogen electrode b) Standard Hydrogen Electrode c) Calomel eclectrode

viii) A voltaic cell is also known as _____.
a) galvanic cell b) electrolytic cell c) half cell

ix) Quinhydrone electrode works satisfactorily in the pH range of _____.
a) 1 to 8 b) 8 to 11 c) 11 to 14

x) Glass electrode is an example of _____ electrode.
a) metal-metal ion b) redox c) membrane

xi) Reduction potential of saturated calomel electrode is _____.
a) 0.242 V b) 0.282 V c) 0.338 V

xii) The unit of specific conductance is _____.
a) $S\ cm^{-1}$ b) S cm c) S^{-1} cm

xiii) The Guassian Curve is a _____.
a) bell shape curve b) closed curve c) simple closed curve

xiv) For rejection of a result, the test used is _____.
a) F-test b) Q-test c) Null hypothesis

xv) Method of averages is used for _____.
a) rejection of data b) test of significance c) obtaining best fitting line

xvi) The 4.0 d rule is used for _____.
a) rejection of result b) test of significance c) for comparison of means

xvii) Confidence limits are defined as _____.
a) $\pm ts/\sqrt{n}$ b) $\pm t/\sqrt{sn}$ c) $\pm s/\sqrt{tn}$

xviii) In the expression for confidence limit C_nR, R denotes_____.
a) probability level b) reduced values c) range

Q.1 B) State True or False (any **Three**) **(03)**

i) Solvent extraction is based on Plate theory.
ii) Crystallization is a physical method based on solubility.
iii) pH meter can be used for soil analysis.
iv) Potentiometric titrations involve construction of an electrolytic cell.
v) F-test is also known as variance ratio test.
vi) A test rejected by 2.5 d rule can be retained by 4.0 d rule.

Q.1 C) Match the column (any **Five**) **(05)**

Column A	Column B
i) Least square method	a) Saturated KCl solution
ii) Plot of frequency vs x_i	b) Conductivity cell
iii) Salt bridge	c) Precipitation
iv) Platinum electrode	d) Normal error curve
v) Chemical methods	e) TLC
vi) Chromatogram	f) Best fitting line
	g) Glass electrode
	h) Distribution ratio

Q.2 Attempt the following (any **Four)** **(20)**

A What is the principle involved in separation based on Thin layer Chromatography? Write various steps involved in this technique.
B List the important applications of TLC.
C Explain with respect to paper chromatography : i) Ascending technique
ii) Two dimensional technique of development of chromatogram.
D Explain in brief, the various steps involved in paper chromatography.
E Multi-step extractions with smaller volumes of extractant are more efficient than single step extractions using entire volume of extracting solvent. Explain.
F The distribution ratio D for a solute between an organic solvent and water in favour of organic solvent. Calculate the percentage extraction if the two extractions are carried out with the volume ratio of 1 and 10.

Q.3 Attempt any **Four** **(20)**

A Describe the experimental procedure for carrying out potentiometric titration.
B Discuss the methods of determination of equivalence point from the following curves
a) E vs Volume of titrant b) $\Delta E/\Delta V$ vs Volume of titrant.
C Discuss the pH metric titration curves obtained when a weak acid is neutralized by a strong base.
D Write the important applications of pH measurement in biological and environmental analysis.

E Discuss the conductometric titration curve in the neutralization of strong acid against a weak base.

F List the advantages and limitations of conductometric titrations.

Q.4 Attempt any **Four** **(20)**

A Give the equation for the Gaussian distribution curve. Write the salient features of this curve.

B What is Null hypothesis? Outline a procedure for the application of null hypothesis to data.

C Describe the method of least square for obtaining the best fitting line.

D The results for estimation of mercury in a water sample for 10 replicate measurements are given below:
0.164, 0.175, 0.172, 0.176, 0.152, 0.155, 0.157, 0.166, 0.168, 0.167
Calculate the confidence interval for the mean at 95% level
(Given: t= 2.26 for 95% confidence level).

E The Eight different replicate analysis of a steel sample for cobalt content are given below,
0.071, 0.069, 0.073, 0.072, 0.070, 0.072, 0.076, 0.072
Calculate (i) mean (ii) median (iii) standard deviation (iv) range.

F Using the method of averages, obtain the best fitting standard line of the type y=mx+c for the following spectrophotometric analysis.

Na(conc.) in ppm	0.1	0.2	0.4	0.7	1.0	1.5
Intensity	1.2	2.6	4.4	7.6	10.8	15.6

Q.5 Attempt any **Four** **(20)**

A Discuss the principle of electrophoresis. List its important applications.

B Describe the continuous extraction technique of solvent extraction when the organic solvent is lighter than the water.

C Explain the term "indicator electrode". Describe the construction and working of Quinhydrone electrode.

D List the advantages and limitations of glass electrode.

E Two sets of observations are represented below for the analysis of magnesium content in two samples:

Sample I	Sample II
1.22%	1.31%
1.25%	1.34%
1.26%	1.35%

If the standard deviation is 0.021, determine whether the two means differ statistically or only numerically.
Given: t(tabulated) = 2.78

F In a chemical analysis of a sample of arsenic, the following results were obtained
ppm of As 4.3, 4.5, 4.5, 4.6, 4.7, 5.0,
Decide on the basis of 2.5 d and 4.0 d rule, whether the last measurement can be rejected.

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