

3 hrs

(100 Marks)

Note: All questions are compulsory
Figures to right indicate full marks

Q 1. A. Fill in the blanks with suitable option and rewrite the statement (any **TWELVE**) (12)

- i. Chemical analysis is called semi-micro scale analysis, when sample taken per test is _____.
 - a. 1 to 0.1 g
 - b. 10 to 100 mg
 - c. 1 to 10 mg
- ii. By calibration of apparatus _____ errors can be minimized.
 - a. Instrumental
 - b. operational
 - c. personal
- iii. Blowing of a pipette is _____ error.
 - a. Operational
 - b. instrumental
 - c. methodic
- iv. Spectrophotometric measurements belong to _____ method of analysis.
 - a. electroanalytical
 - b. titrimetric
 - c. optical
- v. DTA is a _____ method of analysis.
 - a. Titrimetric
 - b. electro-analytical
 - c. Thermal
- vi. Sample is a small representative replica of the _____.
 - a. universe
 - b. error
 - c. analytical sample
- vii. For Acetic acid vs NaOH titration _____ is used as indicator.
 - a. Phenolphthalein
 - b. Methy Orange
 - c. Crystal Violet
- viii. Ostwald's ripening refers to _____ of precipitate.
 - a. Drying
 - b. Filtration
 - c. Digestion
- ix. The neutralization of weak acid and strong base titration will be at pH _____.
 - a. 7
 - b. less than 7
 - c. more than 7
- x. During titration the solution in the burette is called _____.
 - a. Indicator
 - b. titrand
 - c. titrant
- xi. Complexometric titrations are titration between EDTA and _____.
 - a. Oxidising agents
 - b. metal ions
 - c. anions
- xii. In thermogravimetry the weight of sample is recorded as a function of _____.
 - a. mass
 - b. temperature
 - c. concentration
- xiii. Absorbance and transmittance of an absorbing solution are related by the expression _____.
 - a. $A = 1/T$
 - b. $A = \log_{10}T$
 - c. $A = -\log_{10}T$
- xiv. Bathochromic effect is the shift in absorption to _____.
 - a. Shorter wavelength
 - b. longer wavelength
 - c. very high peak
- xv. Wavelength of ultra-violet light is _____.
 - a. 400 to 750 nm
 - b. 200 to 400 nm
 - c. 400 to 750 m
- xvi. _____ cuvettes are used for analysis in UV region.
 - a. plastic
 - b. quartz
 - c glass
- xvii. Colorimeter is useful only in _____ region.
 - a. Visible
 - b. Infra red (IR)
 - c. Ultra violet (UV)
- xviii. In photometric titrations, _____ is plotted against volume of titrant added.
 - a. absorbance
 - b. adsorbance
 - c. emission intensity

B. State whether the following statements are true or false (any **Three**) (3)

- i) The instrumental analysis is also known as classical analysis.
- ii) Analytical sample means the sample subjected to analysis.
- iii) All precipitates are required to be heated above 250°C for drying.
- iv) Equivalence point and end point are always the same.
- v) Colorimeters are more sensitive than Spectrophotometers.
- vi) Cis and trans isomers can be distinguished using UV-visible spectroscopy

C. Match the following: (any **Five**)

(5)

- A
1. Digestion
 2. Post precipitation
 3. Molar absorptivity
 4. Transmittance
 5. Volumetric analysis
 6. Cell Constant

- B
- a. Impurity in precipitate
 - b. Conductometry
 - c. $\text{dm}^3 \text{mol}^{-1} \text{cm}^{-1}$
 - d. Methodic errors
 - e. I_t / I_0
 - f. Increase in particular size
 - g. Separation technique

Q 2. Answer **any Four** of the following sub-questions

(20)

- a. Compare the advantages and limitations of classical method of analysis with instrumental method of analysis.
- b. What is error? Distinguish between determinate and indeterminate errors.
- c. What is sub-sample? Discuss coning and quartering method to reduce the sample size of solid sample.
- d. The Copper content of the ETP of electroplating industry was recorded for five times in a day to get following data:

reading	1	2	3	4	5
Cu (ppm)	9.4	9.7	9.6	10.1	9.7

Calculate absolute and relative error for above data if the true value is 9.8 ppm.

- e. With the help of a suitable diagram explain tools used for sampling of gases.
- f. Discuss the methods of minimizing the errors.

Q 3. Answer **any Four** of the following sub-questions

(20)

- a. What are the various types of titrations? Give one example each.
- b. Discuss the criteria for selection of an indicator in acid – base titrations.
- c. At 298 K 10.0 cm^3 of 0.1 M acetic acid is titrated against 0.1 M sodium hydroxide Calculate the pH of the solution on ($K_a = 1.8 \times 10^{-5}$, $K_w = 10^{-14}$).
 - (i) Addition of 7.0 cm^3 sodium hydroxide from the burette
 - (ii) Addition of 13.0 cm^3 sodium hydroxide from the burette.
- d. What is co-precipitation and post precipitation? How can it be avoided?
- e. Discuss various types of gravimetric analysis giving one example each.
- f. Define standard solution. How are they prepared? Distinguish between primary standard and secondary standard

Q 4. Answer **any Four** of the following sub-questions

(20)

- a. Discuss the principle and experimental set-up for performing photometric titrations.
- b. With the help of suitable diagram explain working of single beam spectrophotometer?
- c. $3.2 \times 10^{-4} \text{ M}$ solution of substance has a transmittance of 0.805 when measured at 525 nm in a cell with path length of 1 cm. Calculate the absorbance of the solution if its concentration is double of its original concentration.
- d. How are Cu(II) and Bi(III) estimated in a mixture using photometric titration?
- e. Explain the calibration curve method of quantitative analysis. How is the concentration of unknown solution calculated without plotting the graph?
- f. How are organic functional groups identified using UV – Visible spectrometry

- Q 5. Answer **any four** of the following. (20)
- Discuss the sampling of stationery and flowing liquids.
 - What are the different methods of instrumental analysis?
 - Discuss the importance of calibration of volumetric apparatus? How is 100 cm³ standard flask is calibrated?
 - Calculate the normality (N) of the following molar solutions:
 - 0.30 M sulphuric acid
 - 0.25 M sodium hydroxide
 - 0.50 M succinic acid
 - 0.30 M ammonium hydroxide
 - 0.10 M oxalic acid
 - Explain the working of "photo multiplier tube with the help of a diagram". What are its applications?
 - List the fundamental differences between colorimeter and spectrophotometer.
