

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)****Term-End Examination****December, 2015****MCH-001 : BASIC ANALYTICAL CHEMISTRY***Time : 3 hours**Maximum Marks : 75*

Note : Answer any *five* questions. All questions carry equal marks.

1. (a) What are the various classical and modern separation methods ? Explain briefly the solvent extraction or ion-exchange method. 5
- (b) Explain the basic principle involved in thermal methods of analysis. Differentiate between thermogravimetric analysis (TGA) and derivative thermogravimetric analysis (DTGA). 5
- (c) Define error. Explain briefly the various types of errors. In a measurement, the observed value is 3.98, whereas the true value is 3.92. Calculate the percentage relative error and accuracy. 5

2. (a) Define precision and accuracy of an analytical measurement. How do you distinguish between the two ? Give suitable examples for each. 5
- (b) In a series of n measurements, the following set of values were observed :
21.57, 21.28, 21.83, 21.35, 21.42 and 21.69.
Calculate mean, median, range and average deviation of the set. 5
- (c) Explain control chart and its significance with the help of a suitable plot. What inference do you make when one sided deviation is observed ? 5
3. (a) Describe the sampling procedure for water quality monitoring. How are water samples preserved for nutrient groups ? 5
- (b) Discuss the general requirements for solid waste sampling in analysis and explain the importance of sample size. 5
- (c) Discuss the classification of hazardous materials. 5
4. (a) Give a brief account of emergency procedures followed in a chemical laboratory. 5

(b) What are the various methods used for the measurement of reaction rates ? Describe any one method with the help of a suitable plot.

5

(c) Derive rate law for first order reaction. If analyte concentration reduces to half in 15.3 s, then calculate the rate constant.

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5. (a) What are the various groups of non-aqueous solvents ? Explain each group with a suitable example.

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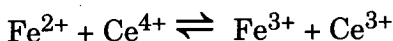
(b) Explain the importance of dielectric constant (ϵ) of a solvent by considering the example of acetic acid in water ($\epsilon = 78.5$) and ethanol ($\epsilon = 24.3$). Write the expression for Hammett's acidity function and name the various terms used in it.

5

(c) Explain redox reactions with a suitable example. How can these be represented as two half reactions ? Define redox potential.

5

6. (a) Write down the structure of EDTA. Give equilibrium corresponding to different stages of its ionization. Why is EDTA tetrabasic and a hexadentate ligand ? 5
- (b) Write the Nernst equation for the following reaction :



Draw and explain the titration curve between the volume of $\text{Ce}(\text{SO}_4)_2$ and E (Volts). 5

- (c) What are the criteria for solvent selection for titrations in non-aqueous solvents ? Write the names of any four solvents that fulfill these criteria. 5

7. (a) Explain the nature of precipitation titration curve by taking the example of Cl^- with Ag^+ . How does it change if a mixture of Cl^- and Br^- is taken ? 5
- (b) Explain what will happen if a precipitate is overdigested with the mother liquor by taking a suitable example. What kind of error occurs in this process ? Explain. 5
- (c) Describe the advantages and disadvantages of organic reagents used as precipitants. Write down the structures of any three organic precipitants along with the names of metals for which these are used. 5

8. Write brief notes on any *five* of the following : $5 \times 3 = 15$

- (a) Confidence Interval
 - (b) Primary Standard
 - (c) Sampling of Gaseous Pollutants
 - (d) Bronsted-Lowry Theory of Acids and Bases
 - (e) Metallochromic Indicators
 - (f) Precipitation from a Homogeneous Solution
 - (g) Inductively Coupled Plasma
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