**MCH-001**

# POST GRADUATE DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

## Term-End Examination

## June, 2020

### MCH-001 : BASIC ANALYTICAL CHEMISTRY

*Time : 3 Hours*　　　　*Maximum Marks : 75*

*Note : (i) Answer any five questions.*

　　　　*(ii) All questions carry equal marks.*

1.  (a) Give the classification of analytical techniques on the basis of properties. Describe briefly nuclear methods of analysis.　　5

    (b) Define the terms mean, median, mode, deviation and average deviation. Calculate these terms for the data :　　5

    4.23, 4.35, 4.18, 4.29, 4.37, 4.09 and 1.43.

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(c) What do you understand by Confidence Interval ? How is this related to standard deviation ($\sigma$) ? Explain confidence interval when $\sigma$ is known or not known.    5

2. (a) Consider the data set :    5

4.95, 4.76, 4.51, 4.38 and 4.87.

If Q = 0.64 for 90% confidence. Find out if any data should be rejected.

(b) Explain determinate errors and describe their sources. How can these errors be minimized ?    5

(c) What are the physico-chemical determinants in the preservation of samples ? Discuss any *three* of these briefly.    5

3. (a) Define Suspended Particulate Matter (SPM). Explain its types and sources.    5

(b) Enlist the requirement that must be kept while designing a chemical laboratory and write briefly about personal protective devices. 5

(c) Write briefly about the safe handling of chemicals and glassware. 5

4. (a) A quantity is represented as $x = a - b$, where $a = 45.8 \pm 0.9$ and $b = 12.5 \pm 0.7$. Calculate the quantity $x$ with standard deviation. Explain the significance of final result. 5

(b) Explain initial rate method for the determination of concentration of analyte with the help of plots. What are its shortcomings and how can these be overcome ? 5

(c) What do you understand by enzyme catalyzed reactions ? Derive the rate equation if the rate is determined by complex formation. 5

5. (a) Explain Bronsted-Lowry's theory of acid-base. How does water act as a base in aqueous solution of $CH_3COOH$ whereas it acts as an acid in case of $NH_3$ solution ? Identify base and conjugate acid in the reaction :                    5

$$NH_3 + CH_3OH \rightleftharpoons NH_4^+ + CH_3O^-$$
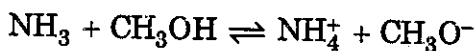
(b) Define polyprotic acid with examples. Calculate the concentration of $[H_3O^+]$ in a $1.0 \times 10^{-3}M$ solution of phosphoric acid. Given that :                    5

$$k_1 = 7.4 \times 10^{-3}$$

$$k_2 = 6.9 \times 10^{-8}$$

$$k_3 = 5.1 \times 10^{-13}$$

(c) Define primary and secondary standards with suitable examples of each. Describe the requirements of a primary standard.  5

6. (a) Describe classification of solvents with suitable examples in each case. Define autoprotolysis constant. Which type of solvents exert levelling effect ?          5

(b) Define redox potential and discuss its significance. Explain the significance of the following potentials :          5

$$MnO_4^- \rightleftharpoons Mn^{2+}\ E° = +1.52\ V$$

$$Ce^{4+} \rightleftharpoons Ce^{3+}\ E° = +1.44\ V$$
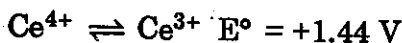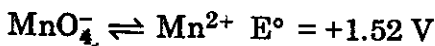
(c) Draw the structure of EDTA and explain its pKa values $pK_1 = 0.0$, $pK_2 = 1.5$, $pK_3 = 2.0$, $pK_4 = 2.66$, $pK_5 = 6.16$ and $pK_6 = 10.24$ in terms of all the equilibrium reactions and constants.          5

7. (a) What is Volhard's method of titration ? Which indicator is used in this titration ? Write down the reactions that occur between indicator and the reagent at the end point. 5

(b) Define and differentiate between co-precipitation and post-precipitation. Describe the methods of minimizing co-precipitation. 5

(c) Explain the difference between photometer, colorimeter and spectrophotometer with regard to accuracy in wavelength measurement, sensitivity and accuracy of concentration measurement. 5

8.  Write brief notes on any *five* of the following :                    3 each

(a)  Chromatography

(b)  Fume cupboard

(c)  Aprotic solvents

(d)  Chelates

(e)  Nucleation

(f)  First aid box/procedures

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