MCH-001

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

00785

June, 2018

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours   *Maximum Marks : 75*

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

1. (a) Explain briefly the difference between Derivative Thermogravimetry (DTG) and Differential Thermal Analysis (DTA). In which of these two can we find out whether the change is exothermic or endothermic ?   5

    (b) Results of three measurements of the amount of a certain constituent of a sample were 3·90 g, 3·94 g and 3·96 g. Find the error of the mean, the percentage relative error and relative accuracy of mean of the measurement when the true value is 3·92 g.   5

    (c) What are the three ways in which percentage in liquid samples are expressed ? In which of these should we specify the temperature ?   5

2. (a) What is average deviation and relative average deviation ? What is the disadvantage of employing average deviation as the estimate of precision ? 5

(b) Why is variance less commonly used to measure precision in statistics ? In which cases is it advantageous to use it ? What is the ratio of two variances called ? 5

(c) Three quantities are summed up as $z = p - q + r$. The individual absolute standard deviations of the three quantities are given in parentheses. Calculate the standard deviation of the arithmetic operation and express the result of summation. 5
$p = 3.60$ ($\pm$ 0.03), $q = 4.20$ ($\pm$ 0.02), $r = 2.50$ ($\pm$ 0.05)

3. (a) What is sampling ? List different types of samples for analysis of water. Describe any one of these. 5

(b) Name any five common forms of suspended particulate matter. Give one source of each. 5

(c) Give any five dos and don'ts each, regarding the code of conduct in a chemical laboratory. 5

4. **(a)** Write any five reasons behind electrical mishaps in a chemistry laboratory. 5

(b) In the initial rate method, how is the concentration of the analyte determined ? Explain with the help of suitable plots. 5

(c) A solution of initial concentration of 0·020 M on first-order reaction showed the rate constant as 0·0180 s^{-1}. Calculate the concentration of reactant after 9·1 s. 5

5. **(a)** What is the Arrhenius theory of acids and bases ? Discuss its limitations. 5

(b) What are buffers ? Discuss the effects of addition of acids and bases and the effect of dilution on the properties of buffer solution. 5

(c) Write down the Nernst equation for the half reaction of divalent copper ion forming metallic copper. Will this metallic copper be deposited at the anode or cathode and why ? 5

6. **(a)** Give any five factors affecting the stability of Metal-Ligand complexes. 5

(b) What are primary and secondary standards ? Give the requirements for a substance to function as a primary standard. 5

(c)   A solution is 10^{-2} M in $Cr_2O_7^{2-}$ and 10^{-3} M in Cr^{3+}. If the pH is 1, what is the potential of the half reaction ?

($E°_{cell} = 1·33$)   5

7.   (a)   Give different ways in which electrochemical cells are used in electroanalytical methods.   5

(b)   What are the different types of non-aqueous solvents ? What is levelling effect ? Explain with the help of one example.   5

(c)   What is the range of pH in which Mohr's titration should be carried out and why ? In practice, how is this maintained ? What serious limitation is imposed due to this ? 2+3=5

8.   Write brief notes on any **three** :   3×5=15

(a)   Thermometric Enthalpy Titration (TET)

(b)   Indeterminate Errors

(c)   Disadvantages of graphic log extrapolation

(d)   Criteria for metal indicators for complexometric titrations

(e)   Nucleation