MCH-001

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

00762   **Term-End Examination**
          December, 2014

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours   *Maximum Marks : 75*

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

1. (a) Differentiate between accuracy and precision with the help of suitable examples.   5

    (b) How is the confidence interval calculated, when the standard deviation is not known ?   5

    (c) What is the shortcoming of the initial rate method and how can it be overcome ?   5

2. (a) Write the specific criteria that should be followed while selecting location for air sampling.   5

    (b) Give the classification of kinetic methods of analysis.   5

    (c) What is meant by 'colour change interval' of the indicator ? What is the basis of selecting a suitable indicator for neutralisation titration ?   5

3. (a) Name the commonly used thermal methods of analysis. *5*

(b) Calculate the equilibrium constant for the following reaction : *5*

$$MnO_4^- + 5Fe^{2+} + 8H^+ \rightleftharpoons Mn^{2+} + 5Fe^{3+} + 4H_2O$$
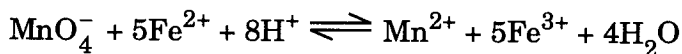
Given :

$$E^°_{MnO_4^-/Mn^{2+}} = 1·52 \text{ V}$$

$$E^°_{Fe^{3+}/Fe^{2+}} = 0·77 \text{ V}$$

(c) Discuss any five factors affecting the stability of metal-ligand complexes. *5*

4. (a) "Thermogravimetric analysis data should be used with a little caution to assign drying or ignition temperature range for precipitates." Justify this statement. *5*

(b) Name one anion and one cation that interfere in Mohr's titration. How do these ions interfere ? *5*

(c) What are the criteria for selecting a non-aqueous solvent for redox titrations ? *5*

5. Write short notes on any ***three*** of the following :   *15*

   (a) '4d' rule for rejection of data

   (b) Types of SPM and their sources of emission

   (c) Personal protective devices in a chemistry laboratory

   (d) Metallochromic indicators

6. (a) Give the advantages of graphical logarithmic extrapolation method.   *5*

   (b) How are the solvents classified on the basis of their proton donor-acceptor properties ? Illustrate autoprotolysis with the help of a suitable example.   *5*

   (c) What are adsorption indicators ? What is the principle of their functioning ?   *5*

7. (a) Calculate the hydronium ion concentration of a $3 \cdot 0 \times 10^{-3}$ M solution of phosphoric acid. The successive dissociation constants of phosphoric acid are

   $$K_1 = 7 \cdot 4 \times 10^{-3}; \quad K_2 = 6 \cdot 9 \times 10^{-8};$$

   $$K_3 = 5 \cdot 1 \times 10^{-13}$$ *5*

   (b) In the determination of iron (taking 1 g sample every time), the following replicate results were obtained :

   30, 30·1, 30·2, 30·4 mg of iron.

   Calculate the coefficient of variation and the relative standard deviation.   *5*

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(c) What is coprecipitation ? Give three ways of minimizing it in gravimetric determination. 5

8. (a) What are gaseous pollutants ? Give the classification of their sampling methods. 5

(b) How are separation methods classified ? Give two examples of each class. 5

(c) Draw a labelled diagram depicting the variation of rate of product formation versus the concentration of substrate for an enzyme catalysed reaction. Indicate the regions that are useful for determination of substrate and enzyme. 5