|MCH-001|

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

June, 2016

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MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours *Maximum Marks : 75*

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

1. (a) List any four electrical methods of analysis. In which of these is a dropping mercury electrode used ? **5**

    (b) What is meant by relative error ? In an analysis the observed value and the true value are 7·24 g and 7·28 g, respectively. What is the relative error in parts per thousand ? **5**

    (c) What is meant by suspended particulate matter ? Give three examples and their sources. **5**

2. (a) What is meant by median ? Calculate median for the following data : **5**

    14·1, 13·8, 13·6, 14·3, 13·5, 13·4

(b) What are the objectives of water quality monitoring ? Classify the determinants for water quality monitoring. 5

(c) What is the difference between acute and chronic effect of a chemical ? Illustrate with an example. 5

3. (a) Describe the initial rate method for measurement of rate of a reaction. What are the advantages of this method ? 5

(b) What is meant by conjugate acid-base pair ? Identify the acid on the left and its conjugate base on the right in the following : 5

(i) $CH_3COOH + HClO_4 \rightleftharpoons$

$$CH_3COOH_2^+ + ClO_4^-$$

(ii) $NO_2^- + H_2O \rightleftharpoons HNO_2 + OH^-$

(c) Name *one* analytical technique each based on the following : 5

(i) Absorption of radiation

(ii) Diffraction of radiation

(iii) Measurement of change of potential

(iv) Change in weight

(v) Heat absorbed or evolved

4. (a) Calculate the equilibrium constant for the following reaction and predict the direction of the reaction : 5

$$Sn^{4+}(aq) + 2Fe^{2+}(aq) \rightleftharpoons Sn^{2+}(aq) + 2Fe^{3+}(aq)$$

Given : $E^0_{Sn^{4+}/Sn^{2+}} = 0.14 \text{ V};$

$E^0_{Fe^{3+}/Fe^{2+}} = 0.77 \text{ V}.$

(b) What is meant by direct and back titration with reference to complexometric titrations ? Give an example of a metallochromic indicator. 5

(c) Give three requirements which a primary standard should possess and two examples of primary standards. 5

5. (a) Describe bromide estimation by Volhard's method. 5

(b) What are the advantages and disadvantages of alphabetical and categorical storage of chemicals ? 5

(c) What is a buffer ? Give the expression relating the pH of a buffer with concentrations of its constituents. Calculate the pH of a solution which is 0·10 M in acetic acid and 0·10 M in sodium acetate. (pK_a of $CH_3COOH = 4.7$) 5

6. (a) Draw and compare the pH titration curves of HCl vs NaOH and CH_3COOH vs NaOH titrations. 5

(b) What are indicators ? Give two examples of acid-base indicators and state their colours in acidic and basic media. 5

(c) How can an analyst minimize errors in an analysis ? 5

7. (a) What is meant by digestion of precipitate ? Why is it done ? Which of the following precipitates is likely to improve by digestion — $Al(OH)_3$, $PbSO_4$ or ZnS ? 5

(b) Give any two examples of organic precipitants used in gravimetry. What are the advantages and disadvantages of organic precipitants ? 5

(c) Show that for the complex formed between Cd^{2+} and NH_3, the overall stability constant, β_4 is the product of stepwise stability constants, K_1, K_2, K_3 and K_4. 5

8. Write short notes on any *three* of the following : 3×5=15

(a) Determinate and Indeterminate Errors

(b) F-Test

(c) Sampling of Food Materials

(d) Co-precipitation and Post-precipitation

(e) Factors affecting Reaction Rates