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MCH-001

POST GRADUATE DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2021

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) Classify optical methods of analysis and explain any ***one*** of these methods briefly. 5

   (b) Explain significant figures and discuss rules for rounding off addition/subtraction and multiplication/division by considering suitable examples. 5

   (c) Explain the criteria for rejection of data in terms of 4*d* rule. In replicate analysis of Cu in an ore, % of Cu recorded were; 5.24, 5.25, 5.28, 5.19 and 5.27. Should any of the results be rejected ? Given that rejection

quotient for 5 determinations at 90% confidence level is 0.64. 5

2. (a) Explain frequency distribution curve and normal error curve. 5

   (b) Describe various physico-chemical determinants required for preservation of samples from nutrient groups. 5

   (c) Discuss safety aspects of a functional chemical laboratory. 5

3. (a) What are the emergency procedures to be followed in a chemical laboratory in case of chemical and thermal burns ? 5

   (b) Discuss various precautions followed for safe handling of glassware. 5

   (c) Write briefly about handling of chemicals with emphasis on information on the label and explain how bulk chemicals should be transported. 5

4. (a) Discuss different applications of kinetic methods of analysis. 5

   (b) Differentiate between order of reaction and molecularity with an example. Define pseudo first order reaction. 5

   (c) Explain enzyme catalyzed reaction with a suitable example. How can it be used for the determination of an enzyme ? 5

5. (a) Define acid and base in terms of Bronsted-Lowry's theory. Identify the base on the left and its conjugate acid on the right in the following reactions : 5

$$NH_3 + CH_3OH \rightleftharpoons NH_4^+ + CH_3O^-$$

$$CH_3COOH + HClO_4 \rightleftharpoons CH_3COOH_2^+ + ClO_4^-$$

(b) Derive an expression for ionization equilibria for a weak monoprotic acid. 5

(c) Define buffer solution. Derive an expression for calculating pH of a buffer solution. Calculate pH of a solution containing 0.01 M CH_3COOH and 0.01 M CH_3COONa. Given $K_a = 1.76 \times 10^{-5}$ at 25°C for acetic acid. 5

6. (a) Discuss all the requirements of a primary standard with suitable examples. Draw the nature of neutralisation plot for 10 cm^3 of 0.1 M HCl with 0.1 M NaOH. 5

(b) Explain quinonoid theory of acid-base indicators. How colour changes in cases of phenolphthalein on the basis of quinonoid structures ? (Draw the structures). 5

(c) Classify non-aqueous solvents and explain each of these 3 groups with ***two*** examples. 5

7. (a) What do you understand by redox indicators ? Write an example and show how it is used for studying redox reactions. 5

(b) Derive an expression for redox equilibrium constant. 5

(c) Explain the nature of metal-EDTA titration curves with a schematic diagram. Name any ***one*** indicator used in such titration. 5

8. (a) Discuss Volhard's method of precipitation titration between Ag^+ and SCN^-. Name the indicator used and write all chemical equations. 5

(b) Explain the process of precipitation from homogeneous solution. Describe how anions could be generated by hydrolysis considering precipitation of oxalates or sulphates. Write complete chemical equation. 5

(c) What is the difference between colorimeter and spectrophotometer with respect to range of wavelength, accuracy of the instrument and limitations ? 5