

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY  
(PGDAC)**

**Term-End Examination**

**June, 2015**

00708

**MCH-001 : BASIC ANALYTICAL CHEMISTRY**

*Time : 3 hours*

*Maximum Marks : 75*

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

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1. (a) How are analytical techniques classified on the basis of types of properties ? Briefly explain any one technique based on electrical property. 5
  
- (b) What are the nuclear analytical methods ? Explain the difference between activation analysis and isotope dilution methods. 5
  
- (c) Explain the criteria for evaluating the utility of analytical methods. List the various steps in performing complete quantitative analysis. 5

2. (a) What is meant by errors in a chemical measurement ? List the various methods for minimization of errors and explain any one method, in brief. 5
- (b) Explain the importance of significant figures in the calculation of analytical results. Express the results of the following calculations in significant figures :
- (i)  $2.81 - 1.987 + 0.3592$
- (ii)  $\frac{4.38 \times 75.239}{143.7}$  5
- (c) Explain Q test for rejection of data. Which one of the following set of replicate measurements on silicon content in a sample may be rejected at 90% confidence interval ?
- 5.24, 5.27, 5.30, 5.12, 5.21, 5.38
- Given that Rejection quotient Q at 90% confidence interval for 6 observations is 0.56. 5
3. (a) What is the importance of site selection in water sampling ? Briefly describe the various types of samples. 5
- (b) What is Suspended Particulate Matter (SPM) ? List the various types of SPM and state their sources. 5
- (c) Discuss the various personal protective devices used in a chemical laboratory. 5

4. (a) Discuss the various modes of exposure to chemicals. Differentiate between acute and chronic effects of exposure to chemicals. 5
- (b) Explain the initial rate method for the measurement of reaction rate and state its advantages. 5
- (c) Derive an expression for calculation of pH of a buffer solution. 5
5. (a) Explain the determination of rate of enzyme catalyzed reaction by steady state approximation method. 5
- (b) Define indicators and explain the Ostwald's theory for acid-base indicators. 5
- (c) Explain Nernst equation, explaining all notations. Write down Nernst equation for the reaction
- $$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e} \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}.$$
- On what factors does potential depend in this case? 5

6. (a) Complete and balance the following redox equations : 5
- (i)  $C_2O_4^{2-} + MnO_4^- + H^+ \rightarrow CO_2 + \underline{\quad} + H_2O$
- (ii)  $MnO_4^- + 10Cl^- + H^+ \rightarrow Mn^{2+} + \underline{\quad} + H_2O$
- (iii)  $Fe^{2+} + Cr_2O_7^{2-} + \underline{\quad} \rightarrow Cr^{3+} + Fe^{3+} + H_2O$
- (iv)  $BrO_3^- + \underline{\quad} + Br^- \rightarrow Br_2 + H_2O$
- (v)  $Fe^{2+} + MnO_4^- + H^+ \rightarrow Fe^{3+} + \underline{\quad} + H_2O$
- (b) Explain with suitable examples that EDTA is a universal and versatile titrant for direct titration and back titration. 5
- (c) What are the common strategies followed for the selectivity of complexometric titrations ? Discuss any two briefly. 5
7. (a) Describe Volhard or Mohr method of precipitation titrations indicating the indicator used. 5
- (b) Explain why organic precipitants are considered better than inorganic precipitants in a gravimetric determination, by taking a suitable example. Write the structure of any two organic precipitants commonly used in gravimetric analysis. 5
- (c) Explain the term 'nucleation'. What are the different experimental variables that influence the particle size in nucleation ? 5

8. Write brief notes on any *five* of the following :  $5 \times 3 = 15$

- (a) Modern quinonoid theory of indicators
  - (b) Oxidimetric reagents
  - (c) Electrochemical cells
  - (d) Use of blank in analysis
  - (e) Standard deviation
  - (f) Coprecipitation
  - (g) Computers in Analytical Instrumentation
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