

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2019

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours

Maximum Marks : 75

 Note : (i) Attempt any five questions.

(ii) All questions carry equal marks.

(iii) Log tables may be provided.

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1. (a) Choose the correct option (any five) : 5
- (i) DTA is a _____ method of analysis. (thermal/electrochemical)
- (ii) Ion exchange is a _____ method of separation. (classical/modern)
- (iii) Dropping mercury electrode is used in _____
(electrophoresis/polarography)
- (iv) For the addition :
 $4.1374 + 2.81 + 0.603 =$ _____ the correct answer based on significant figures is. (7.007/7.01)
- (v) The central tendency of a group of results is _____. (median/mode)
- (vi) The _____ is used for rejection of data. (Q-test, t-test)
- (b) Describe very briefly preservation and storage methods for water sample for bacteriological analysis. 5
- (c) Define any two of the following and give an example of each : 5
- (i) Flammable liquid
- (ii) Flammable solid
- (iii) Toxic substance
2. (a) Consider the following set of replicate measurements of an analyte - 0.692, 0.694, 0.713 and 0.800 g. Calculate (i) mean (ii) median (iii) range (iv) standard deviation. 5
- (b) What are the units of rate constant for a first order and second order reaction ? 5
Consider the following elementary reaction.
 $2A + B \rightarrow \text{Products}$.
- (i) What is the overall order of reaction ?
- (ii) What is the order of reaction with respect to B ?
- (iii) What will be the order of reaction if A is present in very large excess ?
- (c) Calculate the pOH of a solution prepared by mixing 4.0 g of acetic acid in water to make 250 mL of solution. ($K_a = 1.76 \times 10^{-5}$) 5

3. (a) Define buffer capacity. Calculate the buffer capacity of a solution which is 0.2 M in formic acid and 0.2 M in sodium formate. 5
(pK_a of formic acid = 3.74)
- (b) Give one example of each of the following : 5
(i) Acid base indicator
(ii) Primary standard
(iii) Metallochromic indicator
(iv) Redox indicator
(v) Polyprotic acid
- (c) What is a titration curve ? How does the titration curve of a strong acid Vs strong base differ from that of a weak acid Vs strong base ? Sketch both the curves. 5
4. (a) Give the reaction between potassium dichromate and iron (ii) in acidic medium. Apart from potassium dichromate name another oxidizing agent which can be used as a titrant for iron (ii) and give the equation. 5
- (b) Expand EDTA. Why is the disodium Salt of EDTA used in titrations ? Is it a primary standard ? 5
- (c) What are complexometric titrations ? Give its different types. 5
5. (a) Name the indicators used in precipitation titration by (i) Volhard's method, (ii) Fajan's method, (iii) Mohr's method. Which of these methods will you use to estimate (i) SCN⁻, (ii) Cl⁻ ? 5
- (b) What is meant by coprecipitation and post precipitation ? Highlight the differences between them. 5
- (c) What are the major advantages of organic precipitation over their inorganic counter parts in gravimetric determinations ? 5
6. (a) Under what conditions do we use non-aqueous medium for redox titration ? What are the criteria for solvent selection ? 5
- (b) Define an acid and a base according to Bronsted - Lowry concept what is a conjugate acid - base pair ? Identify the base on left and its conjugate acid on right in the following : 5
- (i) $\text{NH}_3 + \text{CH}_3\text{OH} \rightleftharpoons \text{NH}_4^+ + \text{CH}_3\text{O}^-$
- (ii) $\text{CH}_3\text{OH} + \text{HNO}_3 \rightleftharpoons \text{CH}_3\text{OH}_2^+ + \text{NO}_3^-$
- (c) Differentiate between chronic and acute effect of a chemical. Illustrate with alcohol as an example. 5

7. (a) An analyst got the percent alcohol content in a blood sample as 0.084, 0.089 and 0.079. Calculate the 95% Confidence limit for the mean assuming $t = \pm 4.30$ for 2 degrees of freedom and 95% confidence. 5
- (b) Explain accuracy and precision with suitable examples. 5
- (c) Name the different types of non aqueous solvents. Give an example each of any two of them. 5
8. Write short notes on any three of the following : 3x5=15
- (a) F - test
- (b) Requirements of a primary standard
- (c) Safety aspects in the design of a chemical laboratory
- (d) Marking and Demarking in EDTA titration
- (e) Role of computers in analytical instrumentation
- (f) Suspended Particulate Matter
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