

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
November/December, 2023

Marks Scored:

Level : B.Tech.

Year : II

Exam Roll No. :

Time: 30 mins.

Course : CHEM 212

Semester : II

F. M. : 20

Registration No.:

Date 03 DEC 2023

SECTION "A"

[20 Q. × 1 = 20 marks]

Choose and mark [X] the most appropriate option.

- The result of determination of molarity of a solution by four different methods is given as: 0.501, 0.503, 0.505 and 0.502. The median of the data set is \_\_\_\_\_.  
 0.5020       0.5025       0.5030       0.5027
- In a laboratory, a 250 mL volumetric flask contains 250.2 mL of liquid. Which type of error is likely to happen?  
 Random error       Relative error       Gross error       Systematic error
- Which of the following conditions promotes the formation of dense and good quality precipitate of  $\text{Fe}(\text{OH})_3$  ?  
 Precipitation in low temperature       Homogenous precipitation  
 Use of concentrated solution       Fast mixing of solutions
- Gravimetric factor of Fe in  $\text{Fe}_3\text{O}_4$  is \_\_\_\_\_.  
 0.699       0.723       231.55       55.85
- The mean activity coefficient (calculated using Debye Huckel limiting law) for a solution of  $\text{CaCl}_2$ , having ionic strength 0.9, is \_\_\_\_\_.  
 0.107       0.394       0.485       0.457
- What will be the molarity (mol/ltr.) of a solution which contains 200.000 gram of  $\text{KMnO}_4$  (MW 158) in 5000 milliliters of solution?  
 0.253       0.750       12.06       0.126
- Bromothymol blue is an example of \_\_\_\_\_ indicator  
 Adsorption       Metallochromic       Specific       Acid base
- When 40ml of 0.01M  $\text{Ca}^{2+}$  ion is titrated with 18ml of 0.02M EDTA solution, the color of the solution is \_\_\_\_\_.  
 Pink       Wine red       Orange       Blue
- The potential, at equivalence point, for the following titration reaction is \_\_\_\_\_.  
 $\text{A}^{2+} + \text{B}^{4+} \rightleftharpoons \text{A}^{3+} + \text{B}^{3+}$  ( $E^0_{\text{A}} = 0.15\text{V}$  and  $E^0_{\text{B}} = 1.44\text{V}$ )  
 0.53V       0.58V       1.06V       0.87V

10. How can the concentration of an unknown acid solution be determined using acid-base titration?
- By measuring the volume of the titrant solution added
  - By measuring the initial pH of the acid solution
  - By determining the color change of the indicator
  - By calculating the volume of indicator used

**Fill in the bank by most appropriate VALUE or WORD.**

11. In redox titration, an example of self-indicator is \_\_\_\_\_.
12. For a weak acid HB and its conjugate acid B<sup>-</sup>, the Henderson-Hasselbalch equation can be written as \_\_\_\_\_.
13. \_\_\_\_\_ error arises when a glass electrode is employed to measure the pH of solution having pH values in the 10 to 12 range or greater.
14. The hydrogen ion concentration in mol/L of a solution having P<sup>OH</sup> 3.3 is \_\_\_\_\_.
15. A pure metal which is in direct equilibrium with its own cation in the electrolyte solution forms \_\_\_\_\_.
16. The half-cell representation for saturated silver/silver chloride electrode is \_\_\_\_\_.
17. 10.0ml of 0.100M HCl is titrated with 25.0 ml of 0.050M NaOH, the resulting pH will be \_\_\_\_\_.
18. The resistance (reciprocal of conductance) of a cell can be measured using a device called as \_\_\_\_\_.
19. Suppose that 50mg of precipitate is lost as a result of being washed with 200ml of wash liquid. If the precipitate weighs 500mg, the relative error due to solubility loss is \_\_\_\_\_.
20. The equation which gives the relation between the potential of a cell and the activities of reactants is called \_\_\_\_\_.

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Level : B.Tech.  
Year : II  
Time : 2 hrs. 30 mins.

Course : CHEM 212  
Semester : II  
F. M. : 55

SECTION "B"  
[5Q × 5 = 25 marks]

Attempt *ANY FIVE* question.

1. a. Give reasonable answer [3×1=3]
  - i. Aqueous solution of salt ammonium chloride is not neutral
  - ii. Trien is used for estimation of  $\text{Cu}^{++}$  rather than monodentate ligand  $\text{NH}_3$
  - iii. Acidic pH is maintained in Volhard method
- b. A student obtained the following result for the concentration (ppm) of sodium in water samples: 0.218, 0.219, 0.230, 0.215 and 0.220. Can any result be rejected by the Q-test? (At  $n=5$ ,  $Q=0.64$ ) [2]
2. a. 0.4852g sample of iron ore is dissolved in acid, and iron is oxidized to the +3 state and then precipitated as  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ . After filtration, washing and ignition to  $\text{Fe}_2\text{O}_3$ , the weight (of  $\text{Fe}_2\text{O}_3$ ) is found to be 0.2481g. Calculate the percentage of iron (Fe) in the sample. (MW  $\text{Fe}_2\text{O}_3=159.69$ ) [3]
- b. Why Mohr method is limited to solution with pH values 6 to 10? [2]
3. a. Draw well labelled diagram of glass electrode, write cell representation and equation for it. [3]
- b. What size sample containing 15.0% chlorine should be taken for analysis if the chemist wishes to obtain a precipitate of  $\text{AgCl}$  which weighs 1g?(MW  $\text{AgCl} =143.32$ ) [2]
4. a. With a labeled diagram of typical polarogram, write expression for average diffusion current. [2]
- b. 50.0ml of 0.100M  $\text{NaCl}$  is titrated with 0.100M  $\text{AgNO}_3$ . Calculate p-function of chloride ion concentration after addition of 25ml, 50ml and 75ml titrant. ( $K_{sp}$  for  $\text{AgCl}=1 \cdot 10^{-10}$ ) [3]
5. a. 50.0ml of 0.010M HA is titrated with 0.010M strong base. Calculate the minimum value of K so that when 49.95 ml of titrant has been added, the reaction is essentially complete and the pH changes by 2.00 units on the addition of two more drops (0.10ml) of titrant. [3]
- b. What is the optimum  $\text{P}^{\text{H}}$  for EDTA titration? What happens if the  $\text{P}^{\text{H}}$  is low or very high? [2]

6. a. 30.0 ml of a solution which is 0.0100 M in  $\text{Ca}^{2+}$  and buffered at pH 10 is titrated with 0.0100 M EDTA solution. Calculate values of pCa at various stages of titration:  
 (i) After addition of 15 ml titrant (ii) After addition of 30 ml titrant ( $K_{\text{abs}}$  for  $\text{CaY}^{2-}$  is  $5.0 \times 10^{10}$  and  $\alpha_4$  at pH 10 is 0.35) [2]
- b. A sample of copper ore weighing 2.132 gm is dissolved in acid, and the copper is electrolyzed:  $\text{Cu}^{2+} + 2e \rightarrow \text{Cu}$ .  
 If 8.04 min is required for the electrolysis using a constant current of 2.00 A, calculate the percentage copper in the ore. (AW Cu = 63.55). [3]

SECTION "C"  
 [5Q  $\times$  6 = 30 marks]

Attempt *ANY FIVE* questions.

7. a. What is an error? Describe types of error in detail. [3]
- b. What is von Weimarn theory of relative supersaturation? What are the optimum conditions for better precipitation? [3]
8. a. What is transition potential? In an oxidation reduction titration, differentiate between self-indicator and true redox indicator. [3]
- b. Why many compounds show increasing solubility in presence of electrolytes? [3]
9. a. What are visual indicators? How they show the color change at the end point of acid base titration? Which indicator is selected for the titration of oxalic acid with sodium hydroxide? [3]
- b. What are advantages and disadvantages of organic precipitants? [3]
10. a. Explain the reason of not adding too much buffer in EDTA titration. [3]
- b. What is conductometric titration? Explain conductometric titration curve for titration of strong acid with strong base. [3]
11. a. Write short note on Gaussian distribution curve? [3]
- b. Write short note on amperometric titration. [3]
12. a. What is a galvanic cell? What are the major functions of salt bridge? Define thermodynamic cell potential. [3]
- b. What are the basic components of potentiometric method? Explain in brief. [3]
13. a. What is polarography? Write about Oxygen wave. [3]
- b. Why potassium permanganate is not a primary standard? Why dilute HCl cannot be used for acidification of  $\text{KMnO}_4$ ? What are the uses of  $\text{KMnO}_4$  [3]