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KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Level : B.Sc./B. Pharm./B. Tech.

Course : CHEM 212

Year : II

Semester : II

Exam Roll No. :

Time: 30 min

F. M. : 20

Registration No.:

Date SEP 04 2017

SECTION "A"

[20Q × 1 = 20 marks]

- Who discovered polarography?
 Dionýz Ilkovič Jaroslav Heyrovský
 Walther Hermann Nernst Debye-Hückel
- In titrimetric analysis of acid and base, pH change at the equivalent point will be large if
 reaction is fast no side reaction occurs
 reaction occurs in 1:1 ratio reaction has large equilibrium constant
- All sulphate in an aqueous solution is precipitated by adding excess Ba^{2+} solution and the unprecipitated Ba^{2+} is then determined by EDTA. This method of determining sulphate concentration is
 direct titration back titration
 replacement titration indirect determination
- Ion that is responsible for conducting electricity in the dry interior region of corning 015 glass is
 Ca^{2+} Na^+ K^+ H^+
- Metallic indicator electrode whose potential is determined by certain anion in the solution is classified as
 first kind metallic indicator second kind metallic indicator
 third kind metallic indicator inert metallic indicator
- In titration of Fe^{2+} ($E^0 = 0.68V$) with Ce^{4+} ($E^0 = 1.44V$), the most suitable indicator among the list is
 phenol safranin (transition potential 0.28 V)
 diphenyl amine (transition potential 0.76 V)
 ferroin (transition potential 1.11 V)
 nitro ferroin (transition potential 1.25 V)
- Indicator error in acid base titration may be eliminated by
 using buffer solution increasing concentration of titrant
 performing blank titration using methyl orange indicator
- The process by which impurity is deposited after precipitation of analyte is
 co-precipitation digestion
 occlusion post precipitation

9. Practically the cell constant of an unknown conductivity cell is measured by using the relation

[] $\frac{\text{Distance between two electrode (cm)}}{\text{Average cross section area of electrode (cm}^2\text{)}}$

[] $\frac{\text{Specific conductance of standard electrolyte (S cm}^{-1}\text{)}}{\text{Measured conductance (S)}}$

[] $\frac{1000 \times \text{Specific conductance of standard electrolyte (S cm}^{-1}\text{)}}{\text{Concentration of electrolyte (N)}}$

[] $\frac{1}{\text{Resistance (ohm)}}$

10. In an analysis of replicate samples, following data are obtained: 0.215, 0.218, 0.22, 0.228 and 0.230. Which one of the outlier data can be rejected for further analysis? [Given: Q for $n = 5$ at 90% CL is 0.64]

[] 0.215

[] 0.230

[] Both 0.215 and 0.230

[] None of them

Fill in the blank with appropriate words/symbols/values:

11. α , β and γ are the determinant error for measuring A, B and C. The final result R is defined as: $R = A - B + C$. The error in the final result (ρ) is: $\rho =$ _____

12. Colloidal particles has dimension of _____

13. The ionic strength of solution containing the mixture of 0.1 M NaCl and 0.1 M MgSO_4 is _____

14. pH of solution prepared by mixing 54 mL 0.1M HCl and 28 mL 0.2 M NaOH is _____

15. 50 mL 0.01M EDTA and 50 mL 0.01 M Mg^{2+} are mixed at pH 10. pMg at the establishment of equilibrium is _____ [Given $K_{\text{eff}} = 1.7 \times 10^8$]

16. Organic molecules that interacts with M-ion with two or more functional group forming heterocyclic rings are called _____ agents.

17. A solution that resists the change in potential on addition of oxidizing or reducing agent is called _____ solution.

18. The unit of equivalent conductance is _____

19. Crystalline membrane electrode that is used to determine F^- is made up of _____

20. Use of dropping mercury electrode as anode has serious limitation, because at potential greater than about _____ V, formation of mercury (I) give a wave that masks the curves of other oxidizable species.

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Level : B.Sc./B. Pharm./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 questions.

1. a. What is oxygen wave? What is the best method to eliminate the effect of interference of oxygen wave for determination of other species? [2+1]
b. What sample size which contains 18.0% Fe₃O₄ should be taken for analysis in order to obtain a precipitate of Fe₂O₃ which weighs 0.400gm? Given MW Fe₃O₄ = 231.53 and, Fe₂O₃ = 159.69 [2]
2. a. A cell consisting of saturated calomel electrode and lead ion electrode develops a potential of - 0.4706V when immersed in 50 mL sample. The same cell gives potential of - 0.5196 when immersed in 10⁻⁵ M standard lead ion solution. Use the equation of "Direct Potentiometry" to determine concentration of lead. [2]
b. 50.00 mL of 0.100 M solution of the weak acid HB, K_a = 1 × 10⁻⁵, is titrated with 0.100 M NaOH. Calculate the pH at the start of titration and after addition of 25 mL and 50 mL of titrant. [3]
3. a. What is a reference electrode? Write in short about saturated Ag/AgCl reference electrode. [1+2]
b. Give the simple sketch of curves in conductometric titration of [2]
(i) strong acid with strong base (ii) weak acid with strong base
(iii) strong acid with weak base (iv) weak acid with weak base
4. a. i. What do you know about the confidence interval of mean? [1]
ii. How is t-test applicable for [2]
(a) comparison of calculated mean with true mean
(b) comparison of two means obtained for the same sample.
b. For the titration of Red₁ with Ox₂;
show that the electrode potential at the equivalence point is $E = \frac{aE_1^0 + bE_2^0}{a + b}$
where standard electrode potential for: Ox₁ + ae⁻ = Red₁ is E₁⁰ and for Ox₂ + be⁻ = Red₂ is E₂⁰. [2]
5. a. Define activity coefficient. How is activity coefficient determined using Debye-Huckel equation and Davies equation? [1+2]
b. How do pH of analyte solution affect the feasibility of EDTA titration? [2]
6. a. How are diffusion current and half wave potential different? [2]
b. A sample of pure sodium oxalate Na₂C₂O₄, weighing 0.2856 g is dissolved in water, sulphuric acid is added and the solution is titrated at 70°C, which requires 45.12 mL of KMnO₄ solution. The end point is overrun and back titration is carried out with 1.74 mL 0.0516 M oxalic acid solution. Calculate the molarity of KMnO₄ solution. Given: MW of Na₂C₂O₄ = 134 [3]

SECTION "C"
[5Q.× 6 = 30 marks]

Attempt ANY FIVE questions.

7. a. How is the line of best fit obtained using method of least square? Write the expressions that are used to determine parameters m , b , s_y , s_m and s_u using the same method. [2+2]
[Where m = slope, b = intercept, s_y = standard deviation of y values, s_m = standard deviation of slope and s_u = standard deviation of final result]
- b. State the desirable characteristics of primary standard substances. [2]
8. a. Give reasons [1× 4 = 4]
- i. Precision does not refer to accuracy.
- ii. Use of chromate indicator in precipitation titration is limited to pH range between 6 and 10.
- iii. The complexometric titration of Cu^{2+} with NH_3 is not feasible.
- iv. Calmagite indicator exists in different dissociated forms, H_2In^- , HIn^{2-} , In^{3-} . Only HIn^{2-} is suitable form in complexometric titration.
- b. List the sources of residual current in polarography. [2]
9. a. Explain von-Weimarn theory of relative supersaturation. What are the favorable conditions for obtaining large sized precipitate in gravimetric analysis? [2+2]
- b. Discuss the effect in change of concentration of the titrant and the analyte for the feasibility of acid base titration. [2]
10. a. What is a carbonate error? What are the methods that reduce carbonate error? [3]
- b. Discuss the process for the determination of Cu^{2+} ion using iodometric titration. [3]
11. a. Describe the properties and composition of glass membrane that is sensitive to H^+ concentration. Derive the relation that shows "boundary potential of glass membrane is dependent only on pH of solution". [2 + 2]
- b. What are different applications of EDTA titration? [2]
12. a. Explain Volhard's method of precipitation titration. Can Cl^- concentration be determined by this method? [2+1]
- b. What are the different types of redox indicators? Give example for each. [3]
13. a. Define equivalent conductance.
Derive the relation : $\Lambda_{\text{eq}} = \frac{k \times 1000}{C}$
where terms used possess the usual meaning. [1+3]
- b. What is an amperometric titration? Give one example. [2]