

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FOURTH SEMESTER EXAMINATION, MAY 2012

SECOND YEAR

CHEMISTRY (General)

Date : 25/05/2012

Time : 11 am – 2 pm

Paper : IV

Full Marks : 75

[Use separate Answer Books for each group]

Group – A

UNIT-I

(Answer **any three** questions)

1. a) What are the precipitating agents used for gravimetric analysis of zinc and nickel? [1]
b) Which brand no. filter paper (What man) would you use for filtration of (i) BaSO_4 and (ii) $\text{Fe}(\text{OH})_3$ ppts. ? [1]
c) Pure water is not used for washing a precipitate in gravimetric analysis – why? [1]
d) State the effect of addition of the following salts in the system: [1+1]
 $\text{AgCl}(s) \rightleftharpoons \text{Ag}^+ + \text{Cl}^-$ (aqueous medium)
(i) KCl (ii) NH_4Cl
2. a) Name two metal ion indicators used in complexometric titration. [1]
b) What is the function of syrupy H_3PO_4 acid during estimation of Fe^{+2} iron using dichromate solution? [1]
c) What is the basis of complexometric titration? [1]
d) Write the structure of Zn-EDTA complex. At what pH condition is this complex stable? [1+1]
3. Discuss the principle of common ion effect and its application in the qualitative analysis of group II, IIIA and IIIB radicals. [5]
4. a) Write the procedure and principle for the gravimetric estimation of sulphate. [3]
b) The solubility of silverchloride is 0.0015 g.dm^{-3} . Calculate its solubility product. [Mol. Wt of AgCl is 143.5] [2]
5. a) Give the name and structure of a redox indicator stating its colour in oxidised and reduced states. [1+1]
b) Draw a comparison between $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 as an oxidising agent in chemical analysis. [2]
c) pH of the medium plays an important role in complexometric titration. [1]

UNIT-II

(Answer **any two** questions)

6. a) Carryout the following conversion: [2½]
D-Arabinose to D-Glucose
b) Write a short note on mutarotation. [2½]
7. a) How would you prove that glucose bears five hydroxyl groups attached to five separate carbon atoms? [2]
b) What is meant by epimerisation? Illustrate with suitable example. [2]
c) How would you distinguish between glucose and fructose by a chemical test? [1]
8. a) Write the steps for the preparation of alanine from phthalimide. [3]
b) Give the reagents for the following conversions: [1]

Glucose

$\swarrow$

$\searrow$

$\longrightarrow$ Gluconic Acid

$\longrightarrow$ Glucaric Acid

c) What form of alanine would you expect to predominate in [½+½]
(i) strongly acidic condition
(ii) isoelectric condition

Group – B

Unit – I

(Answer **any three** questions)

9. a) State Carnot theorem.
b) Calculate the amount of work done, heat evolved and efficiency of an engine working between 0°C and 100°C and absorbing 840 Joule of heat. [2+3]
10. a) Under what condition $K_p = K_C$ for a gaseous reaction. Give an example.
b) Show for the gaseous reaction : $2\text{H}_2\text{S}(\text{g}) \rightleftharpoons 2\text{H}_2(\text{g}) + \text{S}(\text{g})$ the equilibrium constant,
$$K_p = \frac{\alpha^3 P}{(2 + \alpha)(1 - \alpha)}$$
 where α be the degree of dissociation and P be the total pressure. [3+2]
11. a) What are the nature of entropy changes in the following cases? Give reasons.
i) $\text{H}_2\text{O}(\text{l}) = \text{H}_2\text{O}(\text{g})$
ii) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) = 2\text{NH}_3(\text{g})$
iii) Common salt dissolves in water
b) At normal pressure and 127°C, PCl_5 is 30% dissociated. Calculate the value of K_p . [3+2]
12. a) What do you mean by 'gold number of Haemoglobin is 0.03'. The lower value of gold number signifies the higher stability of the colloid —Explain.
b) Give an example of a spontaneous process. State how Gibb's free energy at constant temperature and pressure is related to it. [3+2]
13. a) $\text{Fe}(\text{OH})_3$ solutions get coagulated with positively charged species. As charge increases, coagulation occurs rapidly. Explain with proper theory.
b) Explain **any one** :
(i) Tyndall effect of colloid (ii) Zeta potential [3+2]

Unit – II

(Answer **any two** questions)

14. a) Differentiate order and molecularity with respect to two important features.
b) For the reaction : $\text{CH}_3\text{COOEt} + \text{H}_2\text{O} + \text{H}^+ \rightarrow \text{CH}_3\text{COOH} + \text{EtOH} + \text{H}^+$
write down the rate equation w.r.t. $[\text{CH}_3\text{COOEt}]$. Mention the conditions for arriving the 1st order kinetics of the above equation. [2+(1+2)]
15. Write down the rate equation of a zero order reaction and derive a mathematical expression for the rate constant. Show that the half life period for a zero order reaction is directly proportional to the initial concentration of the reactant. [5]
16. a) Catalyst enhances the reaction rate but equilibrium constant is same for catalyzed and uncatalyzed reaction. —Explain.
b) Calculate the time required for 90% completion of a 1st order reaction which is 50% complete is one hour. Half life period for a 2nd order reaction is initial concentration dependent. —Comment. [2+(1½+1½)]

Unit – III

(Answer **any three** questions)

17. a) Deduce an expression for the degree of hydrolysis of a salt of weak acid and strong base.
b) Calculate the pH of a solution having H^+ concentration $5 \times 10^{-3}(\text{N})$. [4+1]

18. a) Citing one example, state Lewis acid-base theory. Is it applicable in aqueous solution?
 b) What is pH? Show that at 25°C, pH of water is 7. Do you think, with increase in temperature pH of water remains same? —Justify. [2+3]
19. Define equivalent conductance. Relate specific conductance with equivalent conductance. What are the units of specific conductance and cell constant. [2+1+2]
20. a) Explain the variation of equivalent conductance with dilution of weak electrolytes.
 b) Calculate the equivalent conductance of acetic acid at infinite dilution at 25°C. Given : $\lambda_{\infty}(\text{CH}_3\text{COONa}) = 78$, $\lambda_{\infty}(\text{HCl}) = 78$ and $\lambda_{\infty}(\text{NaCl}) = 109 \text{ ohm}^{-1}\text{cm}^2\text{equiv}^{-1}$ at 25°C. [2+3]
21. a) Define buffer solution and express the pH of a buffer solution in terms of [acid] and [salt].
 b) For a buffer solution of weak acid and its salt, how does one explain the invariance of pH of same solution with the addition of small amount of either acid or alkali? [2+3]

Unit – IV

(Answer any two questions)

22. a) Arrange the following dilute solutions in aqueous medium in increasing order of freezing point :
 i) 0.1 molar solution of cane sugar
 ii) 0.1 molar solution of CaCl_2
 iii) 0.1 molar solution of NaNO_3
 b) State the Raoult's laws of elevation of boiling point. [3+2]
23. a) What is standard hydrogen electrode? What is its potential?
 b) What is the standard potential for the cell consisting of two electrodes :
 Cd^{+2}/Cd ($E^\circ = -0.403\text{V}$) and Cu^{+2}/Cu ($E^\circ = +0.34\text{V}$) [3+2]
24. a) Write notes (any two) :
 i) Nernst equation of EMF
 ii) Beckman thermometer
 iii) Abnormal colligative property
 b) What is the expected ratio of osmotic pressure of (M/10) solution of NaCl and (M/2) solution of sucrose? [(2×2)+1]

