

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2014

THIRD YEAR

CHEMISTRY (Honours)

Paper : VIII

Date : 05/05/2014

Time : 11 am – 1 pm

Full Marks : 50

[Use a separate Answer book for each group]

Group - C

Unit – I

[Answer any one question]

1. a) Justify the following observations (any three) : [3×2]
 - i) Atomic size of Ba → Eu → Yb decreases linearly while that of other 4f-block elements decreases irregularly.
 - ii) Magnetic moments calculated for Gd^{3+} ($4f^7$) using μ_J , μ_{L+S} and μ_{spin} give the same value.
 - iii) Tendency of M-M bond formation increases from V to Ta.
 - iv) When $MoBr_2$ is dissolved in HCl, different anionic species are obtained.
- b) Classify the following as closo, nido or arachno : (any two) [2×1]
 Ge_9^{4-} , Bi_5^{3+} , $[Ni_5(CO)_{12}]^{2-}$
- c) Give a brief outline of the ion exchange method of separation of the lanthanide ions. [3]
- d) Derive the valence shell electronic configuration of a Ln^{3+} ion (Given : Ground State Term : 3H_4) [2]
2. a) Arrange the following sets of ions with increasing hydrolytic tendency with justification : [2×2]
 - i) Pu^{4+} , Pu^{3+} , Pu^{2+}
 - ii) Ac^{3+} , U^{3+} , Pu^{3+} , Cm^{3+}
- b) Discuss the structure and molecular orbital bonding pattern of $Re_2Cl_8^{2-}$. [2+4]
- c) Write a short note on the use of lanthanide complexes as NMR-shift reagent. [3]

Unit – II

[Answer any one question]

3. a) Depict the methods for nanomaterial syntheses. Outline a method for the synthesis of size-controlled nanoparticles. [3+3]
- b) What are the differences between primary and secondary explosives? [3]
- c) Mention the forces working in supra molecules. [3]
4. a) Write short notes on the following (any three) : [3×3]
 - (i) Carbon nanotubes, (ii) detonation velocity, (iii) molecular switches, (iv) inverse crown ethers.
- b) What do you mean by RDX as an explosive? [1]
- c) What do you mean by overoxidised and underoxidised explosives. Explain with proper examples. [2]

Group - D

Unit – I

[Answer any one question]

5. a) A solution of 0.05(M) $KMnO_4$ has been used for titration at pH = 10. What is the normality of the $KMnO_4$ solution. Justify your answer. [2]

- b) Determine the concentration of Mg(II) and Ca(II) ions in solution in gm/lit from the given titre values. [4]
- When 20ml of Mg(II) and Ca(II) mixture was titrated with Na₂H₂EDTA at pH = 10 using NH₄Cl/NH₄OH buffer and EBT as indicator, 18.5ml of Na₂H₂EDTA solution was consumed.
 - When 20ml of the same Mg(II) and Ca(II) mixture was titrated with Na₂H₂EDTA at pH = 12 in strongly alkaline medium (using NaOH) and Patton-Reeder's indicator, 12ml of Na₂H₂EDTA solution was consumed.
- Strength of Na₂H₂EDTA solution was 0.0112(M).
(Given atomic wt. of Ca = 40.08 and atomic wt. of Mg = 24.31)
- c) What are 'co-precipitation' and 'post-precipitation'? Distinguish between co-precipitation and post-precipitation. [2+2]
- d) Give outlines of the analytical procedure for estimation of the following (**any one**) : [3]
- Fe in Portland Cement
 - MnO₂ in Pyrolusite
6. a) Calculate the potential of the solution in the titration of 100ml of 0.1(M) Fe²⁺ in 0.5(M) H₂SO₄ with 100ml of 0.02(M) MnO₄⁻. [2]
- b) What is argentometry? Discuss the mechanism of adsorption indicator. [1+2]
- c) Metal ion-indicator's action is pH sensitive. Explain with an example. [3]
- d) Outline the optimum conditions for the precipitation that will give pure and filterable precipitate. [2]
- e) What do you mean by gravimetric factor? [1]
- f) Among the reagents : (i) Na₂CO₃, (ii) K₂S₂O₈ and (iii) Na₂O₂ which one will you use for fusing a sample of Fe₂O₃ and why? [2]

Unit – II

[Answer **any one** question]

7. a) Elucidate the following with examples.
- determinate error
 - indeterminate error
 - absolute and relative errors in analytical results. [1+1+1]
- b) Discuss the principle of determination of NO_x in air sample. [2]
- c) What are the largest and smallest possible R_f values? Discuss the significance. [2]
- d) Distinguish between precision and accuracy. Replicate water samples are analysed for water hardness with the following results : 102.2, 102.8, 103.1 and 102.3 ppm of CaCO₃. Calculate the standard deviation. [1.5×2]
- e) State the principle of estimation of NH₄⁺ in soil sample. [2]
8. a) Discuss 'Winkler test' for the determination of DO of water sample indicating the interferences. [3]
- b) How will you detect and estimate arsenic in a water sample. [3]
- c) Discuss the principle of demineralization of water using ion exchange method. [2]
- d) What are—
- 'Ascending' and 'Descending' chromatography?
 - Stationary and Mobile phases in paper chromatography?
- Give examples in each case. [2+2]

