RAMAKRISHNA MISSION VIDYAMANDIRA
(Residential Autonomous College under University of Calcutta)
B.A./B.SC. SIXTH SEMESTER EXAMINATION, MAY 2015
THIRD YEAR

Date : 07/05/2015   **CHEMISTRY (Honours)**

Time : 11 am – 1 pm   **Paper :** VIII   Full Marks : 50

[Use a separate Answer book for each group]

Group - C

Unit – I

[*Answer **any one** question*]

1. a) The f–f transition of electrons in lanthanide complexes is much weaker and sharper than the actinide complexes —why? [3]

   b) Write down the valence shell electronic configuration of Ho (Z = 67) and Am (Z = 95). [2]

   c) Stability of No^{2+} is higher than Yb^{2+}. Explain. [Given : No $\rightarrow$ Nobelium, Yb $\rightarrow$ Ytterbium] [3]

   d) What is molar extinction co-efficient? Give its unit. [2]

   e) What is 'metal cluster'? Are $Mo_2O_7^{2-}$ and $Mo_2Cl_8^{4-}$ metal cluster? Justify your answer. [3]

2. a) i) State the primary requirement of Ln(III) ions for their separation by ion-exchange method. [1]

        ii) In ion-exchange method of Ln(III) ions separation, Lu(III) elutes first while La(III) elutes at end from ion-exchange column,. Explain. [3]

   b) Derive the ground state term symbol of the Nd^{3+} ($4f^3$) ion. Predict the magnetic moment of a compound containing the Nd^{3+} ion. [2+2]

   c) Calculate the percentage of transmittance of a solution if the absorbance is 0·54. [2]

   d) Draw the structures of $Fe_3(CO)_{12}$ and $CO_4(CO)_{12}$. [1·5+1·5]

Unit – II

[*Answer **any one** question*]

3. a) What do you understand by 'supramolecular systems'? [2]

   b) What do you mean by the term 'molecular recognition'? Give an example. [3]

   c) Write down the parameters that make a chemical species/molecule explosive. Explain with reference to $T\ell(1)$ azide and nitroglycerine. [3]

   d) Explain, with example, the difference between primary and secondary explosives. [2]

   e) 'Gold-sol' aqueous medium may be stabilized by citrate ions or alkyl thiols. Explain the mechanisms involved in each case of colloid stabilization. [2]

4. a) Explain the $\pi - \pi$ stacking phenomenon in supramolecular assembly. [2]

   b) What are molecular switches? Give one suitable example and explain the phenomenon. [2]

   c) In nanochemistry, activity of the particles enhances with decreasing size —why? [2]

   d) What are carbon nano tubes (CNTs)? Give reason behind its extraordinary mechanical properties. Give different applications of carbon nano tubes. [1+1+2]

   e) What are the chemical methods for nanoparticle synthesis? [2]

Group - D

Unit – III

[*Answer **any one** question*]

5. a) How would you determine the following :

   i) Zinc in brass   ii) Calcium in cement [3+3]

   b) Name a complexometric titrating agent. Give its structure. Mention the requisite conditions for complexometric titration. [1+1+3]

c) For a sample (0·2801 gm) containing chromium, 75 ml of 0·1 (M) ferrous sulphate was added and the excess of iron solution was titrated with 0·02507 (M), of dichromate to give 16·85 ml titre value. What is the percentage of chromium? [2]

6. a) Differentiate between coagulation and peptization. [2]
   b) Briefly enumerate the principle of argentometric estimation of Cl^-. [2]
   c) What do you mean by masking and demasking agent in connection with complexometric titration? Outline the procedure for estimation of Cu and Zn in a mixture compexometrically. [3]
   d) Outline the principle for the gravimetric estimation of PO_4^{3-}. [2]
   e) Calculate the percentage of iron in a sample, when 0·210 gm of iron sample was dissolved and iron was precipitated as hydroxide which on further ignition and weighing gave 0·11069 gm as ferric oxide. [2]
   f) Why starch indicator should be added near the end point in cold condition. [2]

Unit – IV
[*Answer **any one** question*]

7. a) What do you mean by accuracy and precision of measurements? [3]
   b) Differentiate between determinate and indeterminate error. [2]
   c) Briefly discuss about the collection and principle of estimation of NO_x in an air sample. [3]
   d) Discuss two factors that effect the selectivity of ion-exchange resins. [2]
   e) What is R_f value? Discuss its significance in chromatographic separation. [2]

8. a) What is DO? How can you estimate DO in a water sample? [3]
   b) Give the principle for the deionisation of water by ion-exchange resine. What are the advantages of the technique? [3]
   c) What do you mean by chemical oxygen demand (COD)? [2]
   d) What is the stationary phase in paper chromatography? What is its mobile phase? [2]
   e) How do you detect As in a given sample of water? [2]

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