# RAMAKRISHNA MISSION VIDYAMANDIRA

**(Residential Autonomous College affiliated to University of Calcutta)**

**B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2018**

**THIRD YEAR [BATCH 2015-18]**

Date : 7/5/2018 **CHEMISTRY (Honours)**

Time : 11 am – 1 pm **Paper :** VIII [Gr. C & D] Full Marks : 50

**[Use a separate Answer Book for <u>each group</u>]**

## <u>Group – C</u>

### UNIT-I **[13 marks]**

[Attempt **<u>one</u>** only]

1. a) Give reasons: The solutions of Ce(IV) salt are orange red while that of Sm(II) salts are red. 2
   b) Identify [A] and [B] in the following scheme: 2
   Uranyl salt solution + potassium ferocyanide → [A]
   [A] + sodium hydroxide & boil → [B]
   c) Using the concept of polyhedral cluster electron count, predict the structure type of the following: 2 × 1
   $\left[Ni_5(CO)_{12}\right]^{2-}$ , $\left[Fe_4C(CO)_{12}\right]^{2-}$
   d) Stability of $No^{2+}$ is higher than $Yb^{2+}$, explain. 2
   e) Derive the ground state term symbol of the $Pr^{3+}(4f^2)$ ion. Predict the magnetic moment of a compound containing the $Pr^{3+}$ ion. 2 + 1
   f) Niobium and tantalum have greater tendency to form cluster in their low oxidation states. Explain. 2

2. a) Give the molecular orbital configurations of $Mo_2$ - unit in the following species:
   $\left[Mo_2(HPO_4)_4\right]^{2-}$ , $\left[Mo_2(SO_4)_4\right]^{3-}$ and $\left[Mo_2(SO_4)_4\right]^{4-}$
   Hence, predict the Mo – Mo bond shortness. 3 + 1
   b) If the molar extinction co-efficient of $KMnO_4$ solution is $2.235 \times 10^3$ at 520 mμ, what will be transmittance of a 0.001 per cent solution in a 2.0 cm cell at this wave length. 2
   c) Write down the valence shell electronic configuration of Ho (Z=67) and Am (Z=95). 1
   d) How would you expect the first and second ionization energies of the lanthanoids to vary across the series? 3
   e) Find out L, S, J and magnetic moment for free-ion term $^7F_6$. 3

### UNIT-II **[12 marks]**

[Attempt **<u>one</u>** only]

3. a) Describe the principle behind the design of anthracene based molecular on-off switches used in nanomachines. 3
   b) Define detonation velocity of an explosive. 1
   c) What is the Hall-Petch relationship? 2
   d) Explain supramolecular interactions with suitable examples. 3½
   e) 'Cryptands are more effective sequestering agents than crown ethers'– explain this with suitable examples. 2½

4. a) What do you mean by primary and secondary explosives? Give examples of each class. 2
   b) Explain the enthalpy and entropy factors behind the explosive nature of nitrogen trihalides. 2

c) Illustrate the solution based chemical method of synthesis of gold nanoparticles. 2
d) Explain the phenomenon of molecular recognition with suitable receptor molecules. 3
e) What is molecular cleft? Give a suitable example and show its action. 3

## Group - D

### UNIT-III [13 marks]

[Attempt **one** only]

5. a) Calculate the percentage of iron in a sample, when 0.2010 gm of iron sample was dissolved and iron was precipitated as hydroxide on further ignition and weighing gave 0.11069 gm of ferric oxide. 3
   b) Mention the components present in pyrolusite, and give the scheme for the estimation of Mn in pyrolusite. 3
   c) Explain the role of metal ion indicators in complexometric estimation of $Ca^{+2}$ and $Mg^{+2}$. 2
   d) Discuss the principle of argentometric estimation of $Cl^-$ using adsorption indicators. 3
   e) What are co-precipitation and post-precipitation? How can those be avoided during gravimetric analysis? 2

6. a) What are the common errors in iodometry/iodimetry? How can you minimise these errors? 1½+1½
   b) Comment on potassium bi-iodate behaving as a primary standard acid. Determine its acidimetric and oxidimetric equivalent weight. 1+2
   c) Why is Mg-EDTA used in the complexometric estimation of $Ca^{+2}$ in aqueous solution? 1
   d) 0.15 gm of an ore containing $MnO_2$ was treated with excess HCl and the Chlorine formed was distilled off and absorbed in KI solution. Titration of liberated $I_2$ requires 40.5 ml of 0.0492 (N) $Na_2S_2O_3$. Calculate the % of $MnO_2$ in ore. 3
   e) Showing ionic equation, calculate the equivalent weight of $KBrO_3$ (Mol. wt. = M) for using it as a primary standard in iodometric titration. 1½
   f) Discuss briefly the dissolution of dolomite. 1½

### UNIT-IV [12 marks]

[Attempt **one** only]

7. a) $R_f$ values of three amino acids $A_1$, $A_2$ and $A_3$ are 0.12, 0.45 and 0.60 respectively in a certain eluent. Which one of these amino acids in their TLC separation will occur on the top and which one at the bottom of the TLC plate? Give reasons. 2
   b) What do you mean by accuracy and precision in quantitative chemical analysis? 2
   c) Calculate the standard deviation of the result of $0.50(\pm 0.02) + 4.10(\pm 0.03) - 1.97(\pm 0.05)$. 2
   d) How will you detect and estimate the amount of CO in air. 2
   e) What do you mean by BOD in a water sample? Why it is higher than C.O.D? 2
   f) What do you mean by the exchange capacity of an ion-exchange resin? Mention one practical application of ion-exchange resin. 2

8. a) Discuss the principle of estimation of BOD in water sample. 3
   b) Differentiate between determinate and indeterminate error? 2
   c) Distinguish between absolute error and relative error. 2
   d) How dissolved oxygen (DO) is determined in water? Give the mathematical expression to calculate DO. 3
   e) How arsenic is detected and estimated in water sample. 2

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