

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. SIXTH SEMESTER EXAMINATION, MAY-JUNE 2013

THIRD YEAR

CHEMISTRY (Honours)

Date : 28/5/2013

Time : 11 am – 1 pm

Paper : VIII(B)

Full Marks : 50

[Use separate Answer Books for each group]

## Group – C

### Unit – I

(Answer any one question)

9. a) Calculate the magnetic moment ( $\mu_J$ ) value of a  $\text{Ln}^{+3}$  ion. (Given : Ground state Term symbol is  $^7\text{F}_6$ ). [2]  
b) Explain the structure and bonding of  $[\text{Re}_2\text{Cl}_8]^{-2}$  using m.o. concept. [2+3]  
c) Unlike the lanthanides at least two oxidation states are found for most actinides —Comment on the statement. [3]  
d) State the conditions for metal-Metal bonding. [3]
10. a) Show that the energy difference between ground and first excited state of Eu(III) is roughly equal to the thermal energy at 298 K. [3]  
(Given : spin-orbit coupling constant for single electron for Eu(III) =  $1415\text{ cm}^{-1}$ )  
b) Give a short account on lanthanide complexes as NMR-shift reagent. [3]  
c)  $[\text{HOs}_4(\text{CO})_{13}]^-$  has a tetradedral arrangement of metal atoms while the corresponding  $[\text{HFe}_4(\text{CO})_{13}]^-$  has a butterfly structure. Rationalise the observation. [2]  
d) How  $[\text{Mo}_2\text{Cl}_8]^{-4}$  is prepared from  $\text{Mo}(\text{CO})_6$  [1]  
e) i)  $\text{Pb}_5^{2-}$  and  $\text{Bi}_5^{3+}$  are isoelectronic, but their structures are different — explain. [2]  
ii) Find the value of X in  $\text{H}_2\text{Ru}_4(\text{CO})_x$  (Tetrahedral cluster) [1]  
f) Why is  $\text{U}^{235}$  used in nuclear reactor although it is just present as 0.7% in pitch blend. [1]

### Unit – II

(Answer any one question)

11. a) What are the differences between supermolecules and supramolecules? Discuss the various types of forces operating in supramolecules. [2+3]  
b) What do you mean by Lock and Key principle in supramolecular chemistry? [2]  
c) What do you mean by overoxidised and underoxidised explosives? [3]  
d) Discuss the thermochemistry of explosives with reference to RDX. [2]
12. a) What do you mean by the term 'Nanoparticles'? How will you prepare the nanoparticles of a material? [1+4]  
b) Write notes on — (i) Inverse crown ethers and (ii) Alkalides and Electrides. [3]

Or,

Write notes on Carbon nanotubes.

- c) Write a short note on 'Different types of explosives'. [4]

## Group – D

### Unit – I

(Answer any one question)

13. a) Distinguish between accuracy and precision in quantitative chemical analysis. [2]  
b) What do you mean by 'Ion exchange capacity' of an ion exchange resin? [2]  
c) Define COD and BOD? How is COD of water sample determined? [2+2]  
d) What do you mean by normal phase chromatography and reversed phase chromatography? [2]

- e) What do you mean by errors in a quantitative analysis? How can you minimise it? [1+2]
14. a) Calculate the standard deviation for the set of data : 9.975, 9.981, 9.982 and 9.972. [2]  
 b) Discuss the principle of detection and estimation of arsenic in a water sample. [4]  
 c) How will you collect and estimate SPM in an air sample? [3]  
 d) Write down the applications of ion exchange separation. [2]  
 e) What are the largest and smallest ( $R_f$ ) values possible? [2]

### **Unit – II**

(Answer **any one** question)

15. a) Write down the principle of argentometric estimation of chloride ion. [2]  
 b) What do you mean by co-precipitation and post precipitation? Give suitable examples. [2]  
 c) What do you mean by Gravimetric factor? Calculate the gravimetric factor for estimation of nickel as its complex with dimethyl glyoxime. [1+3]  
 (Given : Ni – 58.71, C – 12, N – 14, O – 16, H – 1)  
 d) State the properties of a metal ion indicator. Does pH play any role in its action? [2+2]
16. a) Explain with examples masking and demasking phenomena. [2]  
 b) Discuss the principle involved in the estimation of  $MnO_2$  in pyrolusite with suitable equations. [2]  
 c) Distinguish between iodometry and iodimetry. Why an iodimetric titration is usually done in neutral solution and iodometric titration done in acid solution? [1+2]  
 d) State the optimum conditions for precipitation to get a pure filterable precipitate. [3]  
 e) How does oxidation by permanganate in acid solution differ from oxidation in alkaline or neutral solution? [2]

