

SECOND EXAMINATION IN SCIENCE 1994/95  
(AUGUST/ SEPT. 1997)/REPEAT



MAIN GROUP CHEMISTRY, CO-ORDINATION CHEMISTRY  
AND ANALYTICAL CHEMISTRY (CH201)

Time : 02 Hours

Answer **FOUR** questions only .

1.) Answer **All** the parts.

a.) Write down the general properties of Group VII A elements.

b.) List the resemblance of fluorine with oxygen.

c.) Compare the properties of the following couples,

i.) Boron and Aluminium

ii.) Carbon and silicon

d.) Compare the differences between the following,

i.) Oxygen and other group VIA elements.

ii.) Nitrogen and other group V A elements.

2.) Answer **All** the parts.

a.) Write the IUPAC names of the following co-ordination complexes.

i.)  $\text{trans-}[\text{PtCl}_2(\text{NH}_3)_4]^{2+}$       v.)  $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$

ii.)  $[\text{Ni}(\text{CO})_5(\text{Py})]$       vi.)  $\text{K}[\text{Pt}(\text{NH}_3)\text{Cl}_5]$

iii.)  $[\text{Cr}(\text{EDTA})]^-$

iv.)  $[\text{Co}(\text{C}_2\text{O}_4)(\text{en})_2]^+$

b.) Write the formulas of the following complexes,

i.) Cis-diaquadichloroplatinum(II).

- ii.) diamminetetra(isothiocyanato)chromate.
- iii.) tris(ethylenediamine)-chromium(III).
- iv.)  $\mu$ -hydroxobis-[pentaamminechromium(III)] chloride.
- v.) Tetraamminecobalt(III)- $\mu$ -amido- $\mu$ -peroxotetraamminecobalt(III).
- vi.) Di- $\mu$ -chlorobis[diammineplatinum(II)]chloride.

c.) One pink solid has the formula  $\text{CoCl}_3 \cdot 5\text{NH}_3 \cdot \text{H}_2\text{O}$ . A solution of this salt is also pink and rapidly gives 3 mole  $\text{AgCl}$  on titration with silver nitrate solution. When the pink solid is heated, it loses one mole  $\text{H}_2\text{O}$  and give a purple solid with the same ratio of  $\text{NH}_3:\text{Cl}:\text{Co}$ .

- i.) Deduce the structures of the two octahedral complexes.
- ii.) Draw and name the structures of the deduced complexes.

3.) a.) i.) The magnetic moment of an octahedral  $\text{Co(II)}$  complex is  $4.0\mu_{\text{B}}$ . What is its electronic configuration.

ii.) The magnetic moment of the complex  $[\text{Mn}(\text{NCS})_6]^{4-}$  is  $6.06\mu_{\text{B}}$ . What is its electronic configuration.

b.) Draw all the possible isomers of

- i.) octahedral  $[\text{Ru}(\text{NH}_3)_4\text{Cl}_2]^+$
- ii.) Square-planar  $[\text{Ir}(\text{PR}_3)_2\text{H}(\text{CO})]^+$
- iii.) tetrahedral  $[\text{CoCl}_2(\text{OH}_2)_3]^+$
- iv.) octahedral  $[\text{CoCl}_2(\text{en})(\text{NH}_3)_2]^+$

c.) Which of the following complexes show optical isomerism.

- i.)  $[\text{Cr}(\text{Ox})_3]^{3-}$
- ii.)  $\text{Cis-}[\text{PtCl}_2(\text{en})]$
- iii.)  $\text{trans-}[\text{RhCl}_2(\text{NH}_3)_4]^+$
- iv.)  $\text{Cis-}[\text{Co}(\text{en})_2\text{Cl}_2]$

Draw the enantiomers of the complexes identified as optical isomer and identify the plane of symmetry in structures identified as optically inactive.

d.) Write a short account about Jahn-Teller distortion or Tetragonal distortion of octahedral complexes.

4.) a.) Describe the method of ion exchange chromatography in analysis.

b.) Discuss with examples the uses of ion exchange chromatography.

c.) Explain the basic principles involved in solvent extraction.

5.) a.) Discuss the principles and theory of colorimetry.

b.) Describe a method to determine the concentration of  $Fe^{3+}$  in an unknown solution.

c.) Discuss the advantages of colorimetric and spectrophotometric methods than visual colorimetric method.

6.) a.) i.) Explain the following terms.

1. Normal phase chromatography.

2. Reverse phase chromatography.

ii.) Indicate the significance of  $R_f$  value.

iii.) What are the most commonly used adsorbents for TLC?

What type of solvents can be used for TLC?

Suggest the reagents which can detect compounds with different functional groups such as phenols, carbonyls and carboxylic acids.

b.) i.) Describe the procedure for the development of TLC for an unknown compound.

ii.) Discuss the advantages of TLC when compared with other separation methods.

