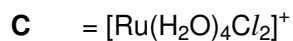
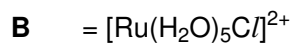


**F325 Module 3: HW15**

1. Ruthenium (Ru) is a metal in the second transition series. It forms complex ions with the following formulae.



- (a) (i) What is the oxidation number of ruthenium in **B**?

oxidation number of ruthenium = .....

[1]

- (ii) One of the complex ions, **A**, **B** or **C**, shows stereoisomerism.

Draw diagrams to show the structures of the two isomers.

[2]

- (iii) Name this type of stereoisomerism.

.....

[1]

(b) The complex ion  $[\text{Ru}(\text{H}_2\text{O})_6]^{3+}$  can be converted into  $[\text{Ru}(\text{H}_2\text{O})_5\text{Cl}]^{2+}$ .

(i) Suggest a suitable reagent for this conversion.

.....

[1]

(ii) What type of reaction is this?

.....

[1]

[Total 6 marks]

2. Iron forms several complex ions in which the oxidation state of iron is +3.

One of these complex ions is  $[\text{Fe}(\text{CN})_6]^{3-}$ . This is called the hexacyanoferrate(III) ion. In the hexacyanoferrate(III) ion the cyanide ions,  $\text{CN}^-$ , act as ligands.

(i) Suggest why a cyanide ion can act as a ligand.

.....

.....

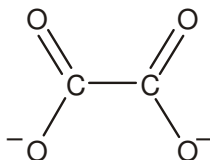
[1]

(ii) Draw the expected shape for the complex ion  $[\text{Fe}(\text{CN})_6]^{3-}$ . Include bond angles and the name of the shape.

[2]

[Total 3 marks]

3. The ethanedioate ion,  $\text{C}_2\text{O}_4^{2-}$ , can act as a bidentate ligand when it forms complex ions with a transition metal ion. The structure of the ethanedioate ion is shown below.



- (a) What do you understand by the term *bidentate ligand*?

.....  
.....

[2]

- (b) The ethanedioate ion readily forms an octahedral complex ion with  $\text{Cr}^{3+}$ .  
Show the structure and charge of this complex ion.

[3]

[Total 5 marks]

**F325 Module 3: HW15**

4. The  $\text{Cr}^{3+}$  ion forms a complex ion of formula  $[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]^-$ .

Use this complex to explain what is meant by the term stereoisomerism. Your answer should contain suitable diagrams.

*(Allow one lined page).*

[7]

Quality of Written Communication [1]

[Total 8 marks]