Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Inorganic 2

Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

Iron forms many complexes that contain iron in oxidation states +2 and +3.

(a) Hexaaquairon(III) ions react with an excess of hydrochloric acid in a ligand substitution reaction.

Write an equation for this reaction.

_____

(1)

(b) Explain why the initial and final iron(III) complexes in the equation above have different shapes.

_____

_____

_____

_____

_____

(2)

(c) Hexaaquairon(II) ions react with an excess of $H_2NCH_2CH_2NH_2$ in a ligand substitution reaction.

Draw the structure of the iron(II) complex formed showing its charge.

(2)

(d) Hexaaquairon(II) ions react with an excess of $H_2NCH_2CH_2NH_2$ in a ligand substitution reaction.

Which of the following shows the correct change in entropy for a reaction of hexaaquairon(II)

ions with $H_2NCH_2CH_2NH_2$?

Tick (✔) **one** box.

change in entropy is negative ☐

change in entropy is close to zero ☐

change in entropy is positive ☐

(1)

(e) The percentage of iron(II) sulfate in iron tablets can be determined by titration with potassium manganate(VII) in acidic solution.

Deduce an ionic equation for the reaction of iron(II) ions with manganate(VII) ions.

_____

(1)

(f) A student dissolved 1980 mg of iron tablets in an excess of dilute sulfuric acid.
The solution was titrated with 0.0200 mol dm^{-3} potassium manganate(VII) solution. A 32.50 cm^3 volume of potassium manganate(VII) solution was required to reach the end point in the titration.

Calculate the percentage of iron in the sample of iron tablets.
Give your answer to the appropriate number of significant figures.

Percentage _____ %

(4)

(g) State the colour change at the end point in this titration.

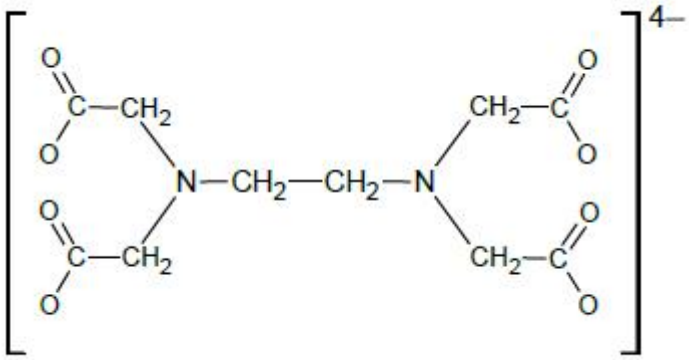
_____

(1)

(Total 12 marks)

Q2.

EDTA is a useful laboratory chemical and is found in a wide variety of commercial products including detergents. It is very soluble in water and is often used in its ionic form $EDTA^{4-}$ as shown in the diagram below.



(a) $EDTA^{4-}$ can act as a multidentate ligand.

Explain the meanings of the terms **multidentate** and **ligand** with reference to the reaction of $EDTA^{4-}$ with $[Cu(H_2O)_6^{2+}](aq)$ ions to form a complex ion.

Draw on the diagram above a separate circle around each atom that bonds to the Cu^{2+} ion in this complex ion.

Multidentate _____

_____

Ligand _____

_____

(3)

(b) Copper(II) compounds may be used as fungicides in vineyards. When used in this way, copper(II) ions can enter the water supply and cause problems because they are toxic in high concentrations.

The water supply near a vineyard can be tested for copper(II) ions by forming a blue aqueous complex with $EDTA^{4-}$ ions. The concentration of this complex can be determined using a colorimeter.

Outline the practical steps that you would follow, using colorimetry, to determine the concentration of this complex in a sample of water.

_____

_____

_____

_____

_____

(3)

(c) The concentration of copper(II) ions, in the sample of water, determined by colorimetry was 7.56×10^{-5} mol dm^{-3}.

This result was checked by titrating a sample of the water with a solution containing $EDTA^{4-}(aq)$ ions.

The $EDTA^{4-}(aq)$ used in the titration had a concentration of 1.00×10^{-3} mol dm^{-3}.

Write an equation for the reaction between $[Cu(H_2O)_6]^{2+}$ and $EDTA^{4-}$ ions.

Calculate the volume of the $EDTA^{4-}$ solution needed to react with a 25.0 cm^3 sample of the water.

Justify whether this titration will give an accurate value for the concentration of copper(II) ions. If necessary, suggest a practical step that would improve the accuracy.

(5)

(Total 11 marks)