

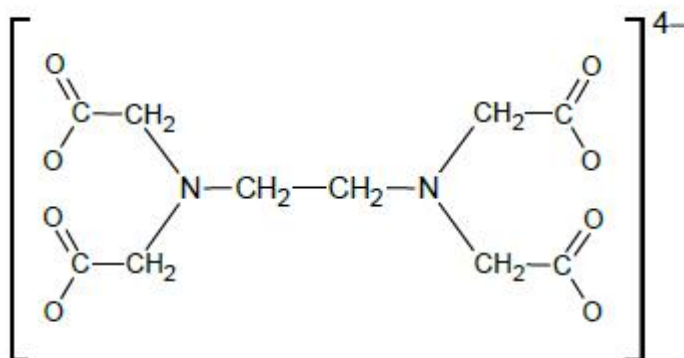
Name of the Student: \_\_\_\_\_

Max. Marks : 11 Marks

Time : 11 Minutes

Q1.

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  $\text{EDTA}^{4-}$  as shown in the diagram below.



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

Explain the meanings of the terms **multidentate** and **ligand** with reference to the reaction of  $\text{EDTA}^{4-}$  with  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}(\text{aq})$  ions to form a complex ion.

Draw on the diagram above a separate circle around each atom that bonds to the  $\text{Cu}^{2+}$  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  $\text{EDTA}^{4-}$  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  $7.56 \times 10^{-5} \text{ mol dm}^{-3}$ .

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

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

Write an equation for the reaction between  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$  and  $\text{EDTA}^{4-}$  ions.

Calculate the volume of the  $\text{EDTA}^{4-}$  solution needed to react with a  $25.0 \text{ cm}^3$  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)