Q1. (a) State what is meant by the term *co-ordinate bond*.

.....

.....

(2)

(b) Define the terms *Brønsted–Lowry acid* and *Lewis acid*.

Brønsted–Lowry acid .....

Lewis acid .....

(2)

(c) State what is meant by the term *bidentate ligand*.

.....

.....

(2)

(d) State how the co-ordination number of cobalt(II) ions in aqueous solution changes when an excess of chloride ions is added. Give a reason for the change.

Change in co-ordination number .....

Reason for change .....

.....

(2)

(e) Suggest why the enthalpy change for the following reaction is close to zero.

$[Co(NH_3)_6]^{2+} + 3NH_2CH_2CH_2NH_2 \rightarrow Co(NH_2CH_2CH_2NH_2)_3]^{2+} + 6NH_3$

.....

.....

(2)

(f) Deduce the formula of the compound formed when ethane-1,2-diamine is treated

with an excess of hydrochloric acid.

.....

(1)

(Total 11 marks)

Q2. Which one of the following statements about the reaction below is **false**?

$[Cu(H_2O)_6]^{2+} + EDTA^{4-} \rightleftharpoons [Cu(EDTA)]^{2-} + 6H_2O$

A $[Cu(EDTA)]^{2-}$ is a more stable complex than $[Cu(H_2O)_6]^{2+}$

B Both $[Cu(H_2O)_6]^{2+}$ and $[Cu(EDTA)]^{2-}$ are octahedral complexes.

C There is an increase in entropy when the reaction occurs.

D There is a redox reaction.

(Total 1 mark)

Q3. Which one of the following statements is true?

A A blue solution containing the ion $[CoCl_4]^{2-}$ turns pink when added to an excess of water.

B A purple solution is formed when chlorine is bubbled into aqueous sodium bromide.

C A yellow precipitate is formed when aqueous silver nitrate is added to aqueous sodium chloride.

D A green solution containing the ion $[CuCl_4]^{2-}$ turns blue when added to an excess of concentrated hydrochloric acid.

(Total 1 mark)