Q1.

Aqueous aluminium sulfate is added to aqueous sodium carbonate.

What are the formulas of the precipitate and the gas formed?

A $Al_2(CO_3)_3$ and SO_2 ⬭

B $Al_2(CO_3)_3$ and CO_2 ⬭

C $Al(H_2O)_3(OH)_3$ and SO_2 ⬭

D $Al(H_2O)_3(OH)_3$ and CO_2 ⬭

(Total 1 mark)

Q2.

This question is about aqueous ions of the metal iron.

When an aqueous $[Fe(H_2O)_6]^{3+}$ ion reacts with ethanedioate ions, an iron(III) complex ion **X** is formed.

The only ligands in **X** are ethanedioate ions.

(a) Draw the structure of **X**.

Include the charge.

(2)

(b) The formation of **X** is an example of the chelate effect.

Explain the meaning of the chelate effect.

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(2)

(c) Outline how Fe^{2+} ions catalyse the reaction between $S_2O_8^{2-}$ ions and I^- ions in aqueous solution.

In your answer you should include

- a sketch graph to show how the concentration of $S_2O_8^{2-}$ ions changes over time
- an explanation of how Fe^{2+} ions catalyse the reaction, including equations
- an overall equation for the reaction.

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(6)

(d) A student adds dilute ammonia solution to a solution containing $[Fe(H_2O)_6]^{2+}$ ions.

Give the formula of the precipitate that forms.

_____

(1)

(e) The student adds sodium carbonate solution to a solution containing $[Fe(H_2O)_6]^{2+}$ ions.

State **one** observation the student would make.

Give an equation for the reaction.

Observation _____

Equation

_____

(2)

(f) A solution containing $[Fe(H_2O)_6]^{2+}$ ions changes to a yellow-brown colour after several hours in contact with air.

The student adds sodium carbonate to the yellow-brown solution.

Give an equation for the reaction with sodium carbonate.

_____

(1)

(Total 14 marks)

Q3.

A student is given two aqueous solutions, **L** and **M**, that both contain iron salts.

The student does a series of tests on the solutions.

The table below shows these tests and the observations.

Test	Observations with L	Observations with M
Add ammonia solution slowly until in excess.	A red-brown precipitate forms that is insoluble in excess.	A green precipitate forms that is insoluble in excess.
Add sodium carbonate solution.	A red-brown precipitate forms. Effervescence is seen.	A green precipitate forms.
Add dilute nitric acid and then divide into two portions.	No change is seen.	No change is seen.
Add barium chloride solution to the first portion.	No change is seen.	A white precipitate forms.
Add silver nitrate solution to the second portion.	A white precipitate forms.	No change is seen.

Identify **L** and **M** using the results in the table.

In your answer:

- identify all precipitates
- explain why effervescence is seen in the reaction of sodium carbonate with **L** but **not** with **M**
- give ionic equations for all reactions.

(Total 6 marks)