Question 38 **(10 marks)**

Groundwater, in addition to dam water and desalinated seawater, is part of the water supply to Perth homes. Groundwater contains a wide variety of chemicals that can affect the quality of drinking water. One of the contaminants is iron, often found in the form of iron(II) hydrogencarbonate.

The iron can be removed by the addition of chlorine gas. Enough calcium hydrogencarbonate is added to maintain a slightly basic pH. The reaction can be represented by the following equation:

$$2\ Fe(HCO_3)_2 + C\ell_2 + Ca(HCO_3)_2 \rightarrow 2\ Fe(OH)_3 + CaC\ell_2 + 6\ CO_2$$

(a) 7.00 g of chlorine gas is bubbled through 30 000 L of groundwater containing 39 010 mg of iron(II) hydrogencarbonate to which 16.22 g of calcium hydrogencarbonate has been added. Calculate the mass of iron(III) hydroxide that will be precipitated. (8 marks)

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(b) Calculate the concentration of calcium chloride in the final solution. (2 marks)