Q1.   (a)   In Peru, chlorine was removed from the water supply due to concerns about it reacting with organic chemicals in the water to produce toxic substances. This resulted in the death of ten thousand people due to cholera. The cholera epidemic ceased when chlorination of the water supply was restarted.

State why chlorine is added to the water supply and give a reason why the amount of chlorine must be carefully monitored. Write an equation for the reaction of chlorine with water.

(3)

(b)   How can the addition of an aqueous solution of chlorine be used to distinguish between aqueous solutions of sodium bromide and sodium iodide?

State any observations you would make and write equations for the reactions occurring.

(4)

(c)   How can reactions with concentrated sulphuric acid be used to distinguish between solid samples of sodium bromide and sodium iodide?

State the observations you would make and give all the oxidation and reduction products formed in both reactions. Using half-equations, construct an overall equation for **one** of these redox reactions.

(11)
(Total 18 marks)

Q2.   (a)   State and explain the trend in electronegativity down Group VII from fluorine to iodine.

Trend ....

Explanation ....

....

....

(3)

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(b)   State what you would observe when chlorine gas is bubbled into an aqueous solution of potassium iodide. Write an equation for the reaction that occurs.

Observation ....

Equation …..

(2)

(c)   Identify **two** sulphur-containing reduction products formed when concentrated sulphuric acid oxidises iodide ions. For each reduction product, write a half-equation to illustrate its formation from sulphuric acid.

Reduction product 1 ....

Half-equation ....

Reduction product 2 ....

Half-equation ....

(4)

(d)   Write an equation for the reaction between chlorine gas and dilute aqueous sodium hydroxide. Name the **two** chlorine-containing products of this reaction and give the oxidation state of chlorine in each of these products.

Equation ....

Name of product 1 ....

Oxidation state of chlorine in product 1 ....

Name of product 2 ....

Oxidation state of chlorine in product 2 ....

(5)
(Total 14 marks)

Q3.   (a)   State the trend in electronegativity of the elements down Group VII. Explain this trend.

Trend ....

Explanation ....

....

....

(3)

(b)   (i)   State the trend in reducing ability of the halide ions down Group VII.

....

(ii)   Give an example of a reagent which could be used to show that the reducing ability of bromide ions is different from that of chloride ions.

....

(2)

(c)   The addition of silver nitrate solution followed by dilute aqueous ammonia can be used as a test to distinguish between chloride and bromide ions. For each ion, state what you would observe if an aqueous solution containing the ion was tested in this way.

Observations with chloride ions ....

....

Observations with bromide ions ....

....

(4)

(d)   Write an equation for the reaction between chlorine and cold, dilute aqueous sodium hydroxide. Give two uses of the resulting solution.

Equation ....

Use 1 ....

Use 2 ....

(3)
(Total 12 marks)

Q4.   (a)   Explain, by referring to electrons, the meaning of the terms *reduction* and *reducing agent*.

(2)

(b)   Iodide ions can reduce sulphuric acid to three different products.

(i)   Name the **three** reduction products and give the oxidation state of sulphur in each of these products.

(ii)   Describe how observations of the reaction between solid potassium iodide and concentrated sulphuric acid can be used to indicate the presence of any **two** of these reduction products.

(iii)   Write half-equations to show how two of these products are formed by reduction of sulphuric acid.

(10)

(c)   Write an equation for the reaction that occurs when chlorine is added to cold water. State whether or not the water is oxidised and explain your answer.

(3)
(Total 15 marks)