AS LEVEL CHEMISTRY

1.1.4 REDOX

1.3.2 GROUP 2

1.3.3 GROUP 7

TEST

Answer all questions

Max 43 marks

Name	……
Mark	……../43 ……...% Grade ……

1. A student prepared an aqueous solution of calcium chloride by reacting calcium with hydrochloric acid. Calcium chloride contains Ca^{2+} and Cl^- ions.

(a) Complete and balance the following equation for this reaction.

……Ca(s) + …… HCl(aq) → ……. $CaCl_2$(aq) + ……

[2]

(b) This is a redox reaction.
Use oxidation states to show that calcium has been oxidised.

.....

.....

.....

[2]

[Total 4 marks]

2. The elements calcium and strontium in Group 2 of the Periodic Table both react with water.

A student reacted 0.20 g of calcium and 0.20 g of strontium separately with 250 cm^3 of water. The student measured the volume of gas produced from each reaction.

The student's results are shown below.

metal	calcium	strontium
volume of gas / cm^3	120	55

(i) Name the gas produced.

.....

[1]

(ii) Write a balanced equation for the reaction of strontium with water.

.....

[1]

(iii) Explain why the student obtained different volumes of gas by reacting water with the same mass of calcium and strontium.

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[2]

(iv) Predict the pH of the solutions formed in each of these reactions.

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[1]

[Total 5 marks]

3. When barium metal is added to water, the reaction taking place is much more vigorous than with calcium.

Explain why barium is more reactive than calcium.

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[Total 4 marks]

4. The element strontium forms a nitrate, $Sr(NO_3)_2$, which decomposes on heating as shown below.

$$2Sr(NO_3)_2(s) \rightarrow 2SrO(s) + 4NO_2(g) + O_2(g)$$

Using oxidation numbers, explain why the reaction involves both oxidation and reduction.

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[Total 3 marks]

5. When heated strongly, $CaCO_3$ decomposes.

Write an equation, including state symbols, for the thermal decomposition of $CaCO_3$.

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[Total 2 marks]

6. Calcium oxide reacts with water and with nitric acid.

State the formula of the calcium compound formed when:

(i) calcium oxide reacts with water, ...

[1]

(ii) calcium oxide reacts with nitric acid. .....

[1]

[Total 2 marks]

7. During the extraction of bromine industrially, chlorine is bubbled through a solution of bromide ions. A student thought this principle would also work for extracting iodine and carried out the experiment below.

Stage 1 The student bubbled some chlorine through an aqueous solution of potassium iodide.

Stage 2 The student added an organic solvent and shook the mixture.

(i) What would the student see at **stage 1**?

.....

.....

[1]

(ii) Name the products and write an ionic equation for the reaction in **stage 1**.

names of products: .....

ionic equation: .....

[2]

(iii) Why does the reaction in **stage 1** occur?

.....

.....

[1]

(iv) What would the student see at **stage 2**?

.....

[1]

[Total 5 marks]

8. Aqueous silver nitrate can be used as a test for halide ions. A student decided to carry out this test on a solution of magnesium chloride. The bottle of magnesium chloride that the student used showed the formula $MgCl_2.6H_2O$.

The student dissolved a small amount of $MgCl_2.6H_2O$ in water and added aqueous silver nitrate to the aqueous solution.

(i) What is the molar mass of $MgCl_2.6H_2O$?

molar mass = ... g mol^{-1}

[1]

(ii) What would the student see after adding the aqueous silver nitrate, $AgNO_3(aq)$?

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[1]

(iii) Write an ionic equation for this reaction. Include state symbols.

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[2]

(iv) Using aqueous silver nitrate, it is sometimes difficult to distinguish between chloride, bromide and iodide ions.

How can aqueous ammonia be used to distinguish between these three ions?

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[3]

[Total 7 marks]

9. Domestic tap water has been chlorinated.

Chlorine reacts with water as shown below.

$$Cl_2(g) + H_2O(l) \rightarrow HOCl\,(aq) + HCl\,(aq)$$

(i) State the oxidation number of chlorine in

Cl_2 .....

HOCl .....

HCl .....

[3]

(ii) When carrying out halide tests with aqueous silver nitrate, it is important that distilled or deionised water is used for all solutions, rather than tap water.

Suggest why.

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[1]

[Total 4 marks]

10. A student carried out two experiments using chlorine gas, $Cl_2(g)$.

(a) In the first experiment, the student bubbled chlorine through 120 cm^3 of an aqueous solution of 0.275 mol dm^{-3} sodium hydroxide, NaOH(aq).

The equation for this reaction is shown below.

$$Cl_2(g) + 2NaOH(aq) \rightarrow NaCl(aq) + NaClO(aq) + H_2O(l)$$

What is a common use for the solution that the student prepared?

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[1]

(b) In the second experiment, the student repeated the procedure in (a) but with hot concentrated sodium hydroxide. A different reaction took place in which sodium chlorate (V) was formed instead of NaClO.

Suggest the formula of sodium chlorate (V).

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[1]

[Total 2 marks]

11. Chlorine is used in the production of safe drinking water throughout the world.

Drinking water is purified by addition of small amounts of chlorine. The reaction that takes place can be represented by the equation below.

$$Cl_2(g) + H_2O(l) \rightleftharpoons 2H^+(aq) + ClO^-(aq) + Cl^-(aq)$$

(a) Describe a simple test that would confirm the presence of chloride ions in drinking water.

Include an equation in your answer.

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[3]

(b) Chlorine can also be converted into bleach.

How is bleach made from chlorine? Include an equation in your answer.

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[2]

[Total 5 marks]