

Name:

Date:

C4 - Test 4  
CHEMICAL CHANGES  
Intermediate

**GCSE**

CHEMISTRY

AQA - Combined Science

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

### Information

- The marks for the questions are shown in brackets

**1.** Sodium carbonate reacts with acids.

(i) Complete the word equation.

sodium carbonate + hydrochloric acid → sodium chloride + \_\_\_\_\_ + water

(1)

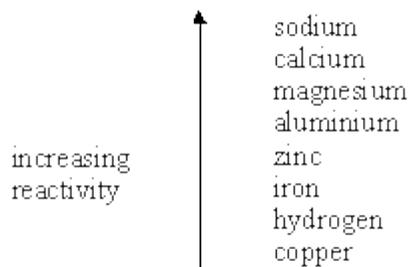
(ii) Name the salt produced if sodium carbonate reacts with dilute nitric acid.

\_\_\_\_\_

(1)

**(Total 2 marks)**

**2.** Part of a reactivity series is:



(a) Carbon is used in blast furnaces to obtain iron and zinc from their oxides, but electrolysis has to be used to obtain aluminium from its oxide.

Draw an arrow on the reactivity series above to show where carbon fits into the series.

(1)

(b) Predict the method of extraction used to obtain calcium from its ore and explain your answer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)

(c) The formula for zinc oxide is ZnO. Write a balanced equation for the extraction of zinc in the blast furnace.

\_\_\_\_\_

(2)

**(Total 5 marks)**

3.

Cassiterite is an ore of the metal tin.

(a) What is an ore?

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(2)

(b) Some metals are obtained by removing oxygen from the metal oxide.

What name do we give to this chemical reaction?

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(1)

(c) Name **one** metal which must be extracted from its melted ore by electrolysis rather than by using carbon.

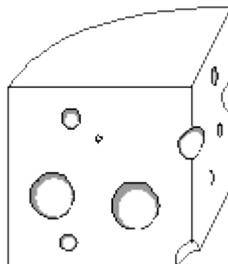
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(1)

(Total 4 marks)

4.

The salt sodium hydrogen phosphate ( $\text{Na}_2\text{HPO}_4$ ) is used as a softening agent in processed cheese.



It can be made by reacting phosphoric acid ( $\text{H}_3\text{PO}_4$ ) with an alkali.

(a) Complete the name of an alkali that could react with phosphoric acid to make sodium hydrogen phosphate.

\_\_\_\_\_ hydroxide

(1)

(b) What is the name given to a reaction in which an acid reacts with an alkali to make a salt?

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(1)

(c) How would the pH change when alkali is added to the phosphoric acid solution?

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(1)

(d) What ions are present when any acid is dissolved in water?

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(1)

(e) What ions are present when any alkali is dissolved in water?

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(1)

(f) Write a chemical equation for the reaction which takes place between the ions you have named in (e) and (f).

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(1)

(Total 6 marks)

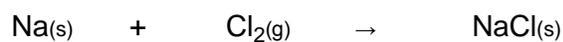
5.

This question is about sodium chloride (common salt) which is an important chemical.

Sodium chloride can be made by burning sodium in chlorine gas.

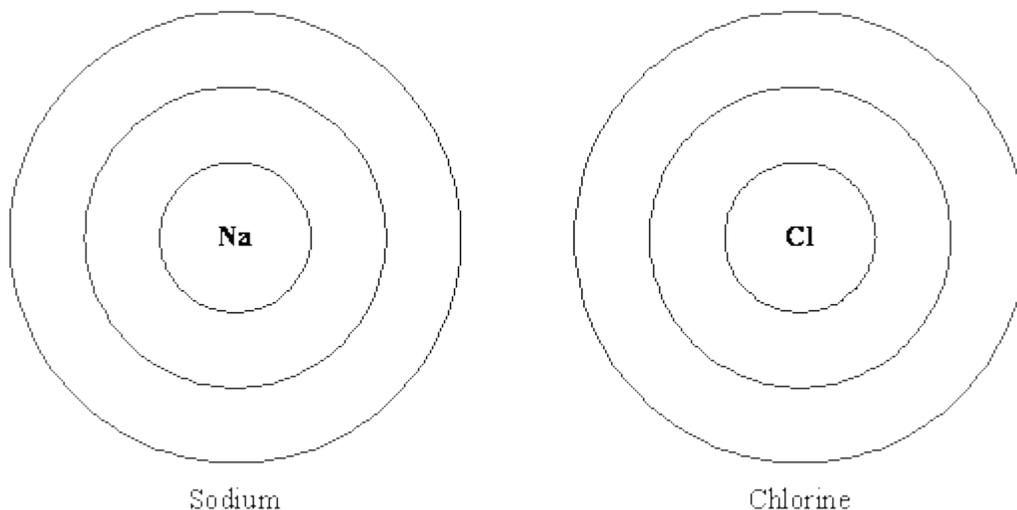


(a) Balance the symbol equation for the reaction of sodium with chlorine.



(1)

- (b) (i) Complete the diagrams below to show the electronic structures of a sodium and a chlorine atom. (Atomic number of sodium = 11 and chlorine = 17.)



(3)

- (ii) When sodium reacts with chlorine the sodium atoms are changed into sodium ions ( $\text{Na}^+$ ) and the chlorine atoms are changed into chloride ions ( $\text{Cl}^-$ ).

Explain how:

1. a sodium atom changes into a sodium ion;

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(2)

2. a chlorine atom changes into a chloride ion.

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(2)

- (c) The element potassium is in the same group of the Periodic Table as sodium. Potassium reacts with chlorine to make potassium chloride which is sometimes used instead of common salt in cooking.

- (i) Predict the formula of potassium chloride.

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(1)

By reference to the electronic structures of potassium and sodium explain:

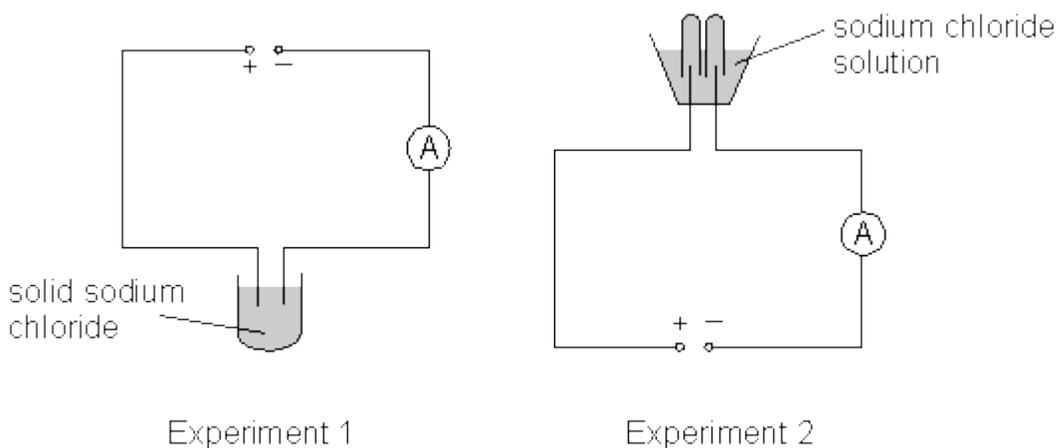
- (ii) Why the reaction of potassium with chlorine is similar to the reaction of sodium with chlorine.

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(1)

- (d) The electrolysis of sodium chloride solution is an important industrial process. The diagrams below show two experiments set up during an investigation of the electrolysis of sodium chloride.



- (i) What would be the reading on the ammeter in experiment 1?

\_\_\_\_\_ A

- (ii) Explain your answer.

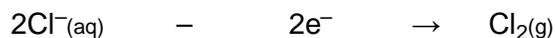
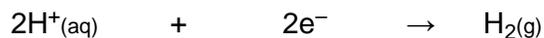
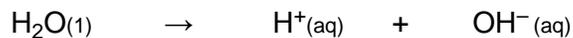
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(3)

- (e) The equations below show the reactions which take place in experiment 2.



- (i) Which substance provides hydrogen ions?

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(1)

(ii) Name the product formed at:

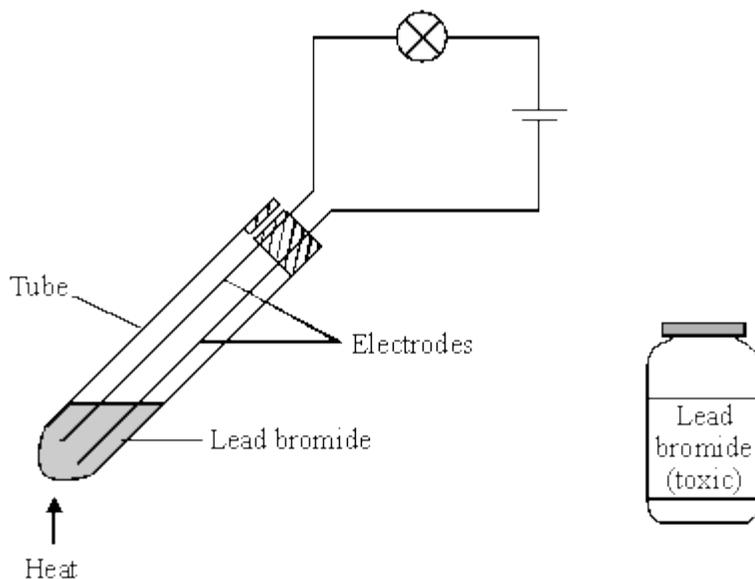
(A) the positive electrode;

(B) the negative electrode.

(1)  
(Total 15 marks)

6.

A student investigated the *electrolysis* of lead bromide.



Lead bromide was placed in the tube and the circuit was switched on. The light bulb did not light up.

The tube was heated and soon the bulb lit up. The observations are shown in the table.

Positive electrode	Negative electrode
red-brown gas	silver liquid

(a) What is meant by *electrolysis*?

\_\_\_\_\_

(2)

(b) Why did the lead bromide conduct electricity when the tube was heated?

\_\_\_\_\_

(1)

(c) Name the substances formed at the:

positive electrode; \_\_\_\_\_

negative electrode. \_\_\_\_\_

(2)

(d) Suggest **one** safety precaution that should be taken during this investigation.

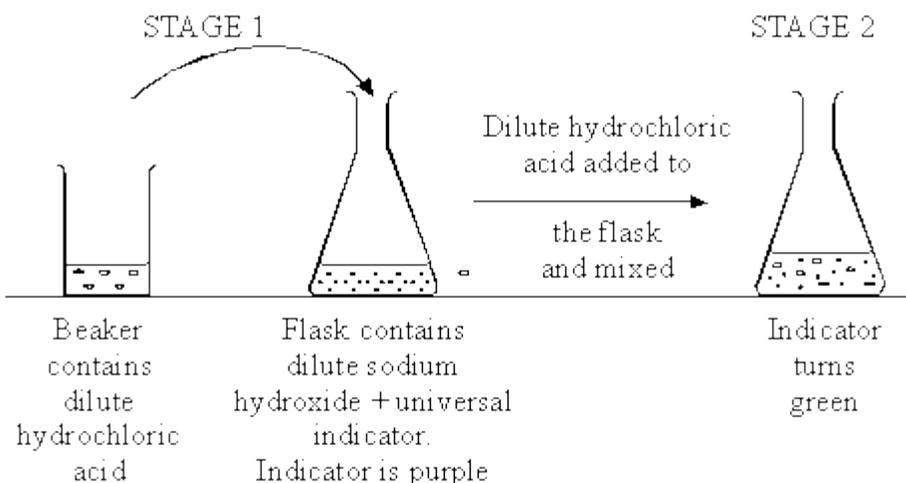
\_\_\_\_\_

(1)

(Total 6 marks)

7.

The diagrams show what happens when an acid is added to an alkali.



(a) What is present in the flask at stage 2, besides universal indicator and water?

\_\_\_\_\_

(1)

(b) Write an ionic equation to show how water is formed in this reaction and state the sources of the ions.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3)

(Total 4 marks)

8.

The table below shows information about three metals.

Metal	Mainly found as	% of metal in Earth's crust	Relative cost of 1 kg
Aluminium	Aluminium oxide, $\text{Al}_2\text{O}_3$	8.2	4.2
Gold	Gold	0.0000001	30000
Iron	Iron(III) oxide, $\text{Fe}_2\text{O}_3$	4.1	1

(a) Suggest why gold is a very expensive metal.

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(1)

(b) Iron is extracted from iron oxide by reduction with carbon.

Aluminium cannot be extracted by reduction with carbon.

(i) What is the name of the process used to extract aluminium from aluminium oxide?

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(1)

(ii) Why is it more expensive to extract aluminium than iron?

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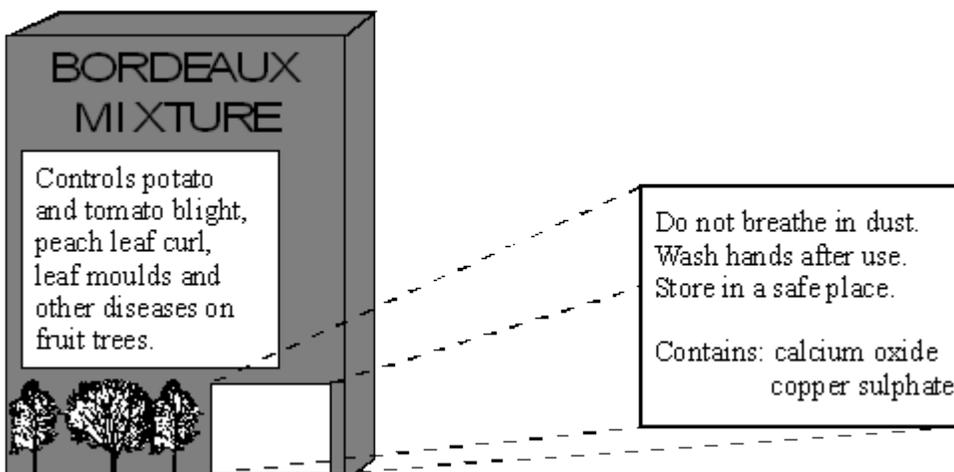
(1)

(Total 3 marks)

9.

Bordeaux Mixture controls some fungal infections on plants.

A student wanted to make some Bordeaux Mixture.



(a) The student knew that calcium oxide could be made by heating limestone. Limestone contains calcium carbonate,  $\text{CaCO}_3$ .

(i) Write the word equation for this reaction.

\_\_\_\_\_

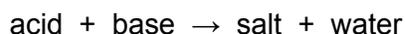
(1)

(ii) What type of reaction is this?

\_\_\_\_\_

(1)

(b) The student knew that copper sulphate,  $\text{CuSO}_4$ , could be made by the following general reaction.



(i) What type of reaction is this?

\_\_\_\_\_

(1)

(ii) The base used is copper oxide. Name and give the chemical formula of the acid used.

Name \_\_\_\_\_

Chemical formula \_\_\_\_\_

(2)

(c) The student wrote about how the copper sulphate was made.

“Some of the acid was warmed. Copper oxide was added. The mixture was stirred. More copper oxide was added until no more would react. The mixture was then filtered.”

(i) Why was the acid warmed?

\_\_\_\_\_

\_\_\_\_\_

(1)

(ii) Copper oxide was added until no more would react. Explain why.

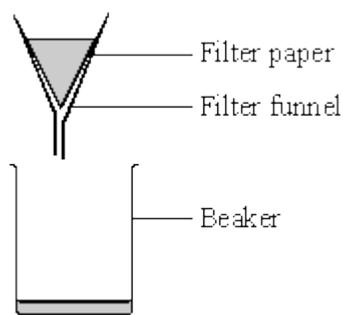
\_\_\_\_\_

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\_\_\_\_\_

(2)

(iii) The filtration apparatus is shown.



Describe and explain what happens as the mixture is filtered.

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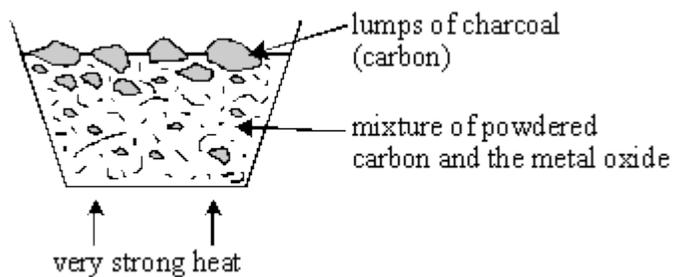
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(2)  
(Total 10 marks)

10.

A student was trying to extract the metals from lead oxide and aluminium oxide.

She heated each oxide with carbon in a fume cupboard as shown below.



She was able to extract lead from lead oxide but not aluminium from aluminium oxide.

(i) Explain the results of these experiments.

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(ii) Complete this word equation for the reaction between lead oxide and carbon.

lead oxide + carbon → \_\_\_\_\_ + \_\_\_\_\_

(Total 5 marks)

11.

Ammonium nitrate and ammonium sulphate are used as fertilisers.



(i) Which acid reacts with ammonia to form ammonium nitrate?

\_\_\_\_\_

(1)

(ii) Which acid reacts with ammonia to form ammonium sulphate?

\_\_\_\_\_

(1)

(iii) The reactions in (i) and (ii) are both exothermic. How can you tell that a reaction is exothermic?

\_\_\_\_\_

\_\_\_\_\_

(1)

(iv) The reactions in (i) and (ii) are both examples of acid + base reactions. What is the name of the chemical change which takes place in every acid + base reaction?

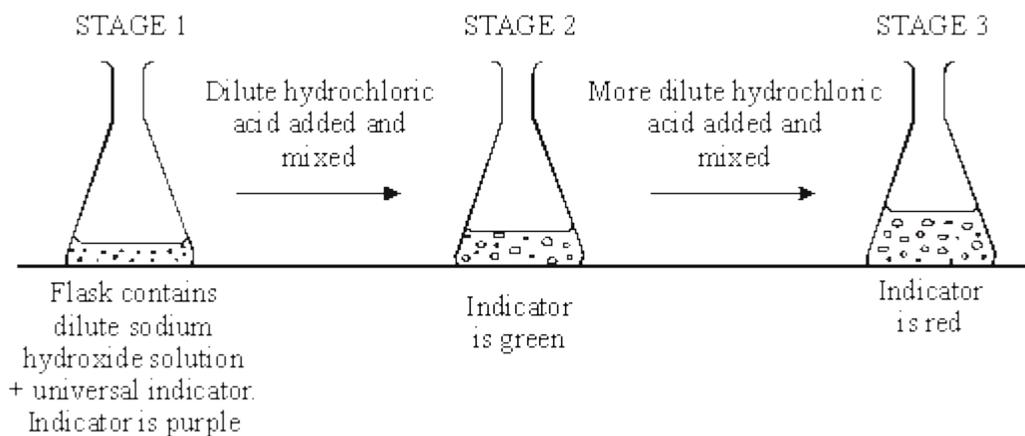
\_\_\_\_\_

(1)

(Total 4 marks)

12.

The diagrams show what happens when an acid is added to an alkali.



(a) What is present in the solution at stages 2 and 3 apart from universal indicator and water?

(i) At stage 2 \_\_\_\_\_

(ii) At stage 3 \_\_\_\_\_

(3)

(b) Write an ionic equation to show how water is formed in this reaction and state the sources of the ions.

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(3)

(Total 6 marks)