

Candidate Name	Centre Number	Candidate Number
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**GCSE**

236/02

**SCIENCE  
HIGHER TIER  
CHEMISTRY 1**

A.M. WEDNESDAY, 16 June 2010

45 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	4	
3.	5	
4.	3	
5.	4	
6.	3	
7.	6	
8.	6	
9.	5	
10.	8	
<b>Total</b>	<b>50</b>	

**ADDITIONAL MATERIALS**

In addition to this paper you may require a calculator and a ruler.

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

*Answer all questions.*

1. The electronic structure of seven different elements **A**, **B**, **C**, **D**, **E**, **F** and **G** are given in the following table.

**These letters are not chemical symbols.**

Element	Electronic structure
<b>A</b>	2,6
<b>B</b>	2,8,1
<b>C</b>	2,8,4
<b>D</b>	2,8,7
<b>E</b>	2,8,8
<b>F</b>	2,8,8,1
<b>G</b>	2,8,8,2

Choose a **letter** from the table above to answer parts (i), (ii) and (iii) I.

**Each letter may be used once, more than once or not at all.**

- (i) Give the **letters** of the **two** elements which are found in the **same** group of the Periodic Table. Explain your answer. [2]

*Elements* ..... and .....

*Explanation* .....

.....

- (ii) Give the **letter** of the element which is found in Period 2 of the Periodic Table. Explain your answer. [2]

*Element* .....

*Explanation* .....

.....

The Periodic Table of Elements shown on the **back cover of this examination paper** may be of use in answering part (iii).

(iii) I. Give the **letter** of the element which represents sodium, Na. [1]

.....

II. Give the **name** of an element in the same group as element **D**. [1]

.....

2. The following table shows the results of experiments **A**, **B**, **C**, **D** and **E**.

The table includes the appearance of the two substances before addition, the temperature of the substances before and after addition, and the observations made during each experiment.

Use the table to answer the questions that follow.

Experiment	Appearance of the <b>two</b> substances before addition	Starting temperature / °C	Temperature after addition / °C	Observation after addition
<b>A</b>	a shiny grey solid <b>and</b> a colourless solution	21	27	bubbles with colourless gas being given off
<b>B</b>	a white solid <b>and</b> a colourless solution	22	16	a colourless solution
<b>C</b>	<b>two</b> colourless solutions	20	21	a white precipitate / solid formed
<b>D</b>	a white solid <b>and</b> a colourless solution	19	19	a colourless solution
<b>E</b>	a grey solid <b>and</b> a blue solution	17	19	some brown solid formed

- (i) State which experiment is the **most** exothermic and explain your answer. [2]

*Experiment* .....

*Explanation* .....

.....

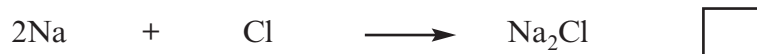
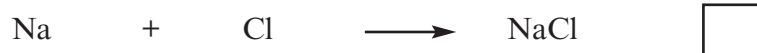
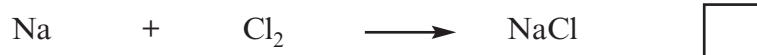
- (ii) Apart from a change in temperature, give **two** observations which could show that a chemical reaction has taken place. [2]

*Observation 1* .....

*Observation 2* .....

3. (i) Sodium and chlorine are both very reactive elements. When hot sodium is lowered into a gas jar of chlorine, the metal ignites and sodium chloride is formed.

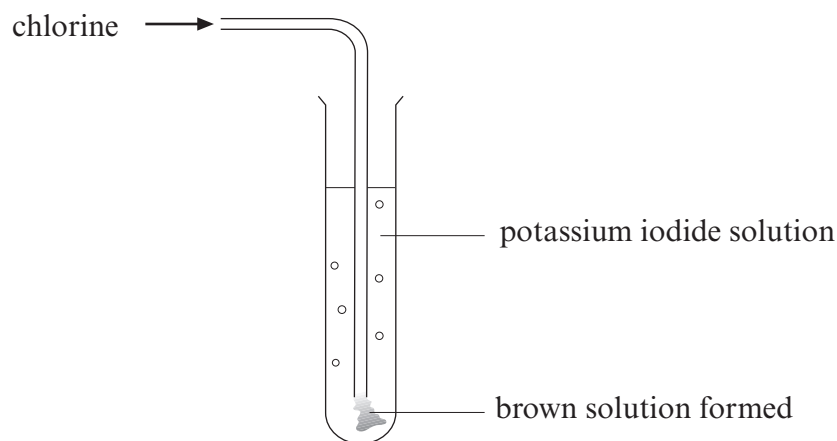
I. Place a **tick (✓)** in the box next to the correct balanced symbol equation which represents the reaction. [1]



II. State the colour of the flame seen when sodium burns in chlorine. [1]

.....

- (ii) Chlorine gas was bubbled into a colourless solution of potassium iodide. The result is shown in the diagram below.



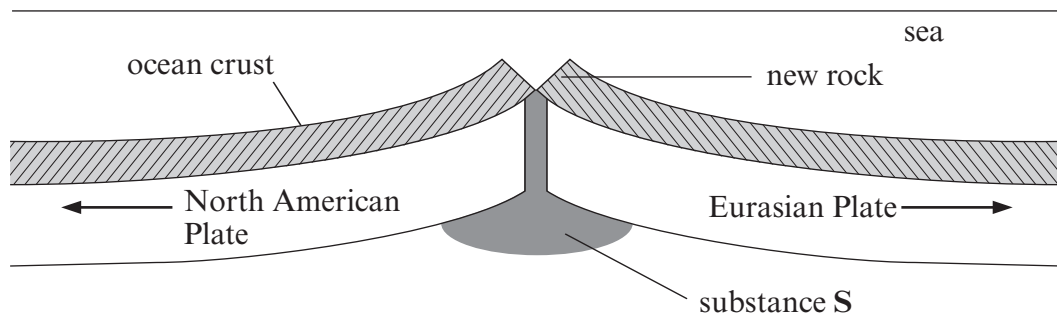
I. Give the **word equation** for the chemical reaction taking place between chlorine and potassium iodide. [2]

..... + ..... → ..... + .....

II. State why the above reaction should be carried out in a fume cupboard. [1]

.....

4. (i) The Earth's longest mountain chain is under the sea. It runs along the middle of the North Atlantic Ocean and comes to the surface at Iceland. The chain is located at the boundary between the North American Plate and the Eurasian Plate. These two plates are moving apart as shown by the arrows in the diagram below.



- I. Name substance **S**, that rises up from underneath the plates. [1]  
 .....
- II. Name the **type** of rock that forms on the ocean crust. [1]  
 .....
- (ii) Apart from volcanoes, what other geological evidence can be used to locate plate boundaries? [1]  
 .....

5. The following table contains some information about four elements labelled **A**, **B**, **C** and **D**. These are not the chemical symbols of the elements.

Element	Melting point /°C	Boiling point /°C	Conducts electricity?	Density / g cm <sup>-3</sup>
<b>A</b>	-101	-35	no	0.0029
<b>B</b>	98	890	yes	0.97
<b>C</b>	-7	59	no	3.1
<b>D</b>	113	184	no	4.9

- (i) State which element is sodium and give a reason for your choice. [2]

*Element* .....

*Reason* .....

.....

- (ii) State which element is chlorine and give a reason for your choice. [2]

*Element* .....

*Reason* .....

.....

6. Nanoscience involves the study of very small particles.

Nano-sized silver particles have antibacterial and antifungal properties.

(i) Give an estimated size of a nano-sized particle. [1]

..... nm

(ii) Give **two** uses of nano-sized silver particles which relate to the above properties. [2]

I. ....

.....

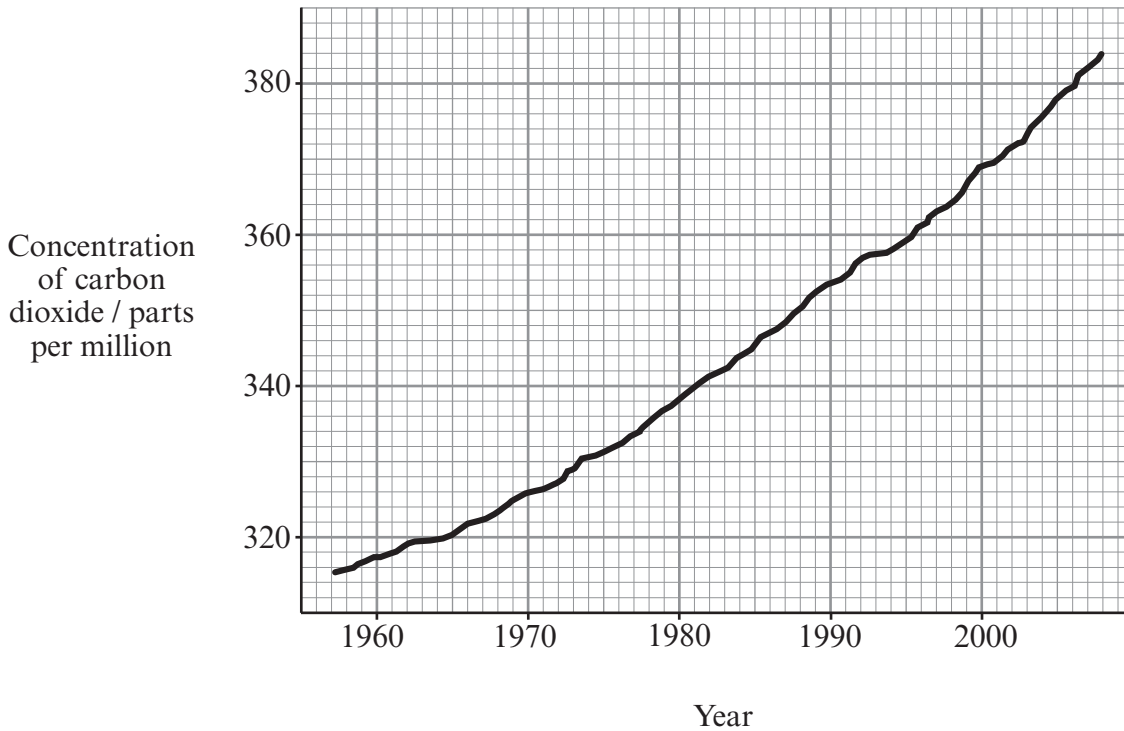
II. ....

.....

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7. The concentration of carbon dioxide in the atmosphere has been measured at the top of Mauna Loa, in Hawaii, since 1957.

The results obtained are shown in the graph below.



- (i) I. State how the concentration of carbon dioxide in the atmosphere at Mauna Loa has changed since 1957. [1]

- II. Use the graph to calculate the change in concentration of carbon dioxide between 1970 and 2000. [1]

- (ii) A similar change in carbon dioxide levels is seen in other parts of the world. Give **two** reasons why the concentration of carbon dioxide has changed in this way. [2]

1. ....

2. ....

(iii) It has been found that the concentration of carbon dioxide in the atmosphere changes throughout the year.

I. Suggest how the concentration of carbon dioxide may change during the year in the UK. [1]

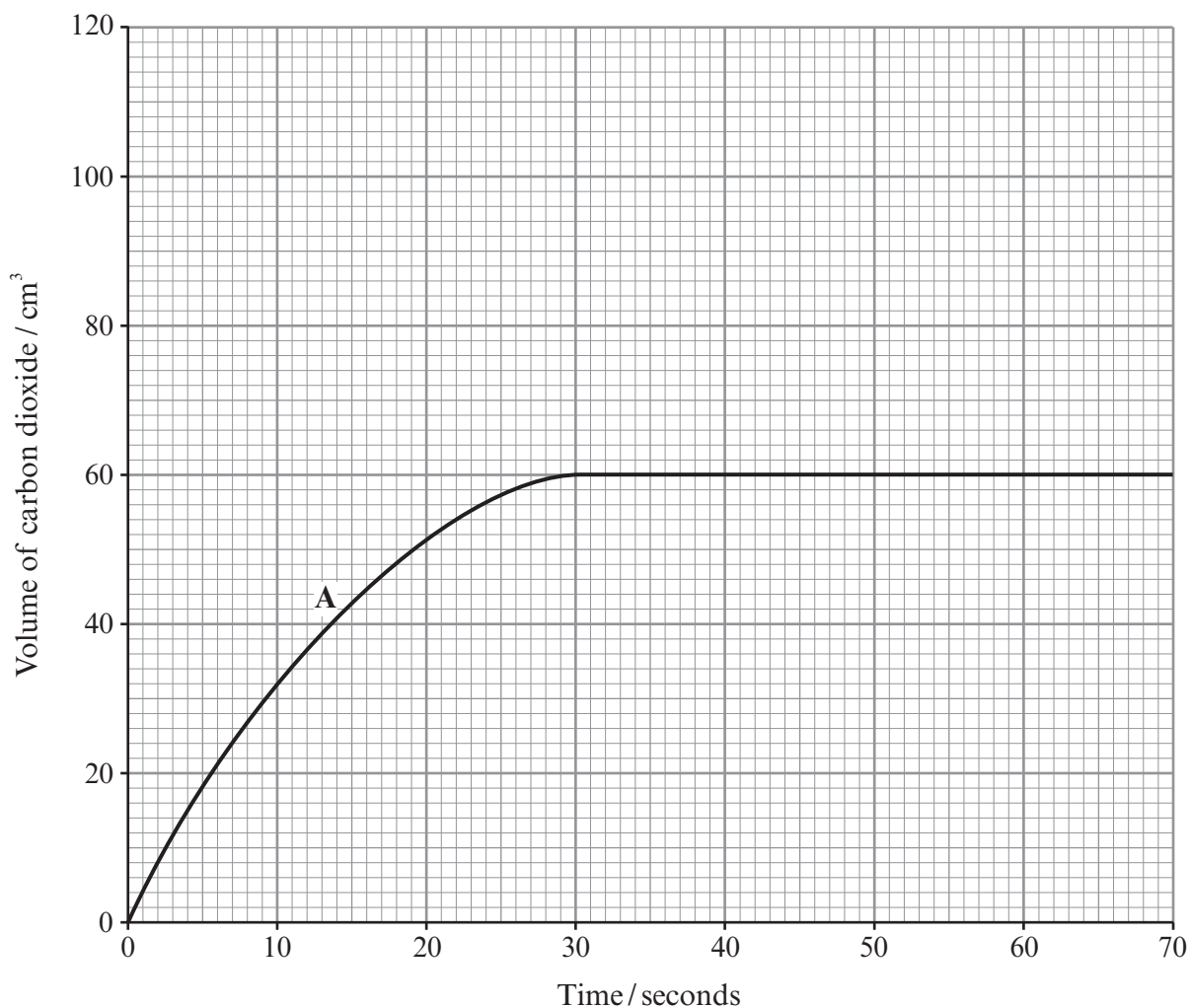
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II. Give a reason for your answer. [1]

.....  
.....

6

8. The graph A below shows the volume of carbon dioxide formed during a reaction between *excess* marble chips (calcium carbonate) and dilute hydrochloric acid.



- (i) On the same grid, sketch carefully the graph that would be obtained
- I. if the acid had been replaced by an equal volume of hydrochloric acid of **half** the concentration, with the marble chips still in *excess*. **Label this graph B.** [2]
  - II. if the marble chips were replaced by **powdered** marble, with the same volume and concentration of acid as in A. **Label this graph C.** [2]
- (ii) When the reaction is carried out at a **higher** temperature the rate increases. Explain, using **particle theory**, why the reaction is faster at a higher temperature. [2]

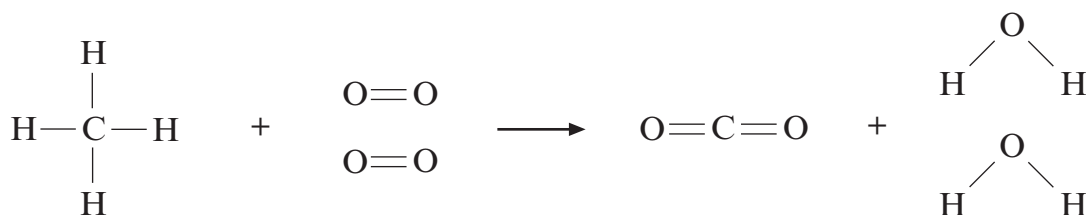
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9. Methane, CH<sub>4</sub>, is a hydrocarbon which readily burns in air to give carbon dioxide and water according to the following equation.



The relative amounts of energy needed to break the bonds in the above reaction are shown in the table below.

Bond	Amount of energy needed to break the bond / kJ
C=O	805
O=O	498
O—H	464
C—H	413

*Note:* The amount of energy **released** in making a bond is equal and opposite to that **needed** to break the bond.

- (i) Using the bond energy values in the table, calculate the relative energy

I. needed to break **all** the bonds in the **reactants**, [2]

.....  
 .....

II. released when **all** the bonds in the **products** are formed. [2]

.....  
 .....

- (ii) Using your answers to part (i) I. and II., show why the overall relative energy change is exothermic. [1]

.....  
 .....

10. (i) A Group 1 metal, **M**, when added to water, reacted vigorously on the surface, ignited and burned with a lilac flame.

I. Name metal **M**. ..... [1]

II. Give the balanced **symbol** equation for the reaction between the metal and water. [3]

.....

- (ii) The labels on bottles of two sodium compounds have fallen off. One of the compounds was known to be sodium carbonate and the other was sodium chloride.

I. Use the table of '*Formulae for some common ions*' on the **inside of the back cover of this examination paper** to help you to give the formula of sodium carbonate. [1]

.....

II. Describe briefly how a laboratory technician could distinguish between sodium carbonate and sodium chloride. [3]

*Give the expected results for both compounds.*

.....

.....

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.....

**FORMULAE FOR SOME COMMON IONS**

<b>POSITIVE IONS</b>		<b>NEGATIVE IONS</b>	
<b>Name</b>	<b>Formula</b>	<b>Name</b>	<b>Formula</b>
<b>Aluminium</b>	<b>Al<sup>3+</sup></b>	<b>Bromide</b>	<b>Br<sup>-</sup></b>
<b>Ammonium</b>	<b>NH<sub>4</sub><sup>+</sup></b>	<b>Carbonate</b>	<b>CO<sub>3</sub><sup>2-</sup></b>
<b>Barium</b>	<b>Ba<sup>2+</sup></b>	<b>Chloride</b>	<b>Cl<sup>-</sup></b>
<b>Calcium</b>	<b>Ca<sup>2+</sup></b>	<b>Fluoride</b>	<b>F<sup>-</sup></b>
<b>Copper(II)</b>	<b>Cu<sup>2+</sup></b>	<b>Hydroxide</b>	<b>OH<sup>-</sup></b>
<b>Hydrogen</b>	<b>H<sup>+</sup></b>	<b>Iodide</b>	<b>I<sup>-</sup></b>
<b>Iron(II)</b>	<b>Fe<sup>2+</sup></b>	<b>Nitrate</b>	<b>NO<sub>3</sub><sup>-</sup></b>
<b>Iron(III)</b>	<b>Fe<sup>3+</sup></b>	<b>Oxide</b>	<b>O<sup>2-</sup></b>
<b>Lithium</b>	<b>Li<sup>+</sup></b>	<b>Sulphate</b>	<b>SO<sub>4</sub><sup>2-</sup></b>
<b>Magnesium</b>	<b>Mg<sup>2+</sup></b>		
<b>Nickel</b>	<b>Ni<sup>2+</sup></b>		
<b>Potassium</b>	<b>K<sup>+</sup></b>		
<b>Silver</b>	<b>Ag<sup>+</sup></b>		
<b>Sodium</b>	<b>Na<sup>+</sup></b>		

