

Surname	Centre Number	Candidate Number
Other Names		0



**New GCSE**

4462/02

**SCIENCE A  
HIGHER TIER  
CHEMISTRY 1**

A.M. MONDAY, 14 January 2013

1 hour

#### ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

#### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correcting fluid.

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.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

#### INFORMATION FOR CANDIDATES

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

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **10**.

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.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	6	
3.	6	
4.	6	
5.	4	
6.	6	
7.	6	
8.	8	
9.	6	
10.	6	
<b>Total</b>	<b>60</b>	

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Answer **all** questions.

1. The following table shows some information about some Group 7 elements.

Name	Formula	State at room temperature (20°C)	Colour of vapour	Melting point (°C)
chlorine	Cl <sub>2</sub>	gas	yellow-green	-101
bromine	.....	liquid	orange-brown	-7
iodine	I <sub>2</sub>	solid	purple	114

(a) Give the formula for bromine. .... [1]

(b) A pupil predicted the **boiling point** of chlorine to be -10°C.

Using the information in the table, suggest **two** reasons why the pupil gave this value.

[2]

.....

.....

.....

(c) Chlorine is a poisonous gas.

State **one** use of chlorine which relates to its poisonous nature.

[1]

.....

(d) Fluorine is above chlorine in this group of the Periodic Table.

Use the information in the table to predict **two** properties of fluorine.

[2]

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6



2. The following table shows the main products formed during the burning of coal and hydrogen.

Fuel	Main product(s) of burning
coal	carbon dioxide sulfur dioxide water
hydrogen	water

(a) (i) Name the **three** elements that must be present in coal to give the products shown in the table. [1]

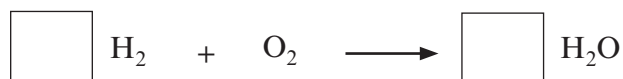
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(ii) Coal is a finite (non-renewable) resource.

State what is meant by a *finite resource*. [1]

.....

(b) (i) Balance the symbol equation for the burning of hydrogen in air. [1]



(ii) State the chemical test for hydrogen gas and give the expected result. [1]

.....

(iii) Give **two** disadvantages of using hydrogen as a fuel. [2]

1. ....

.....

2. ....

.....



3. (a) Crude oil is a mixture of hydrocarbons.  
State how it was formed. [2]

.....

.....

- (b) The table below shows properties of some fractions that can be obtained from crude oil.

Fraction	Size of molecule (number of carbon atoms)	Boiling point range (°C)	Colour of fraction	Viscosity at room temperature	How it burns
fuel gas	C <sub>1</sub> -C <sub>4</sub>	-160 to 20	colourless		very easily with a clean yellow flame
petrol	C <sub>5</sub> -C <sub>10</sub>	20 to 70	pale yellow	runny	easily with a clean yellow flame
naphtha	C <sub>8</sub> -C <sub>12</sub>	70 to 120	yellow	fairly runny	quite easily with a yellow flame and some soot
kerosene	C <sub>10</sub> -C <sub>16</sub>	120 to 240	dark yellow	quite viscous	harder to burn with quite a smoky flame
diesel oil and lubricating oil	C <sub>15</sub> -C <sub>30</sub>	240 to 350	brown	viscous	hard to burn and a smoky flame



Use the information in the table opposite to answer parts (i) and (ii).

- (i) Describe how any **two** properties of crude oil fractions depend on the size of the molecule. [2]

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.....

.....

- (ii) Two fuels used in caravans are propane,  $C_3H_8$ , and butane,  $C_4H_{10}$ . Both fuels are used in the summer but propane is preferred during the winter.

Explain why. [2]

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5. Complete the following table.

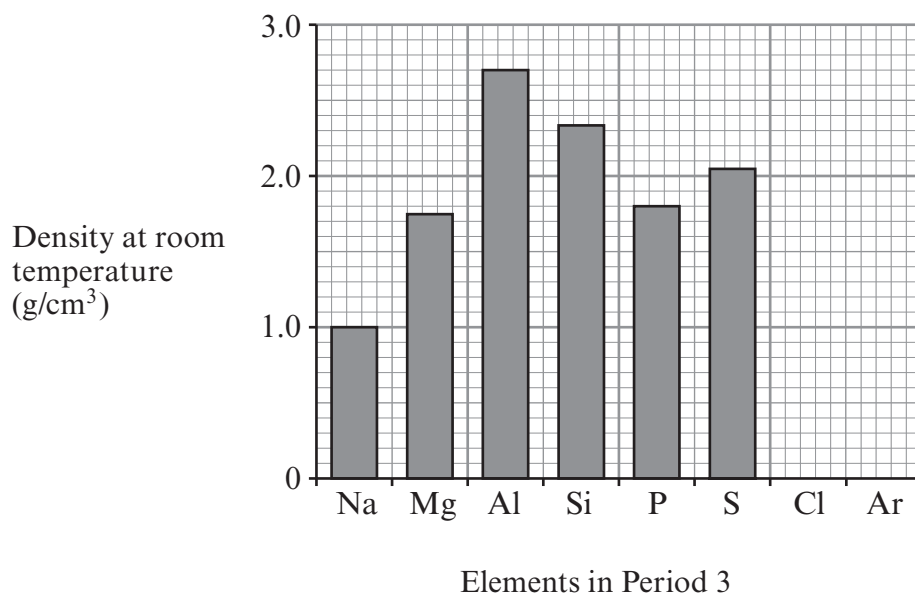
[4]

Name of compound	Formula of positive ion	Formula of negative ion	Formula of compound
ammonium hydroxide	.....	$\text{OH}^-$	$\text{NH}_4\text{OH}$
lithium sulfate	$\text{Li}^+$	$\text{SO}_4^{2-}$	.....
lead nitrate	$\text{Pb}^{2+}$	$\text{NO}_3^-$	.....
calcium hydrogencarbonate	$\text{Ca}^{2+}$	.....	$\text{Ca}(\text{HCO}_3)_2$

4



6. (a) A bar chart of the densities *at room temperature* of all the elements in Period 3 of the Periodic Table is shown below.



- (i) Name **all** the **metals** in this period. [1]
- .....
- (ii) Name the element in this period that has both metallic and non-metallic properties. [1]
- .....
- (iii) Give the reason that the bars for chlorine and argon are too small to be seen. [1]
- .....
- .....
- (iv) Give the trend in the densities of the **metals** going across this period. [1]
- .....
- .....





(b) The table below gives the melting points of all the elements in Period 3.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Melting point (°C)	98	650	660	1410	44	113	-101	-189

How well does the evidence in the table support the following statement?

*'The melting points of non-metals **decrease** from left to right across the Periodic Table.'* [2]

.....

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7. The order of reactivity of some elements is shown below.

<i>Most reactive</i>	sodium
	calcium
	magnesium
	aluminium
	carbon
	zinc
	iron
	hydrogen
	lead
	copper
	silver
<i>Least reactive</i>	gold

Predict, giving a reason for your answer, whether the following pairs of substances react and give any expected observation(s).

(a) Iron and copper sulfate solution [2]

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(b) Magnesium and dilute hydrochloric acid [2]

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(c) Aluminium oxide and carbon [2]

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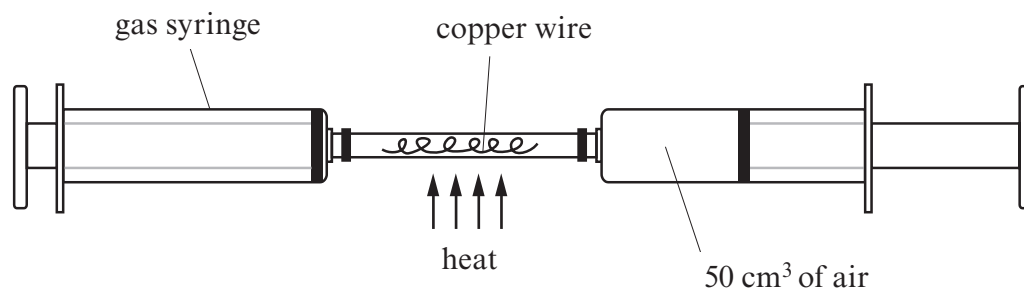


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8. Two gas syringes, containing a total  $50 \text{ cm}^3$  of air, were connected as shown in the diagram below. The copper wire was heated strongly and the air passed over it five times. The hot copper reacted with the oxygen in the air. The apparatus was then allowed to cool to room temperature before the volume of gas remaining in the syringes was measured.



### Results

Initial volume of air	$50 \text{ cm}^3$
Final volume of gas	$41 \text{ cm}^3$

- (a) Gases expand when heated. State why the apparatus was allowed to cool to room temperature before taking the final reading. [1]

.....

.....

- (b) (i) Calculate the percentage of oxygen in the air using the results from the above experiment. [2]

Percentage of oxygen = ..... %

- (ii) The actual percentage of oxygen in the air is 21%. Assuming no leakages in the apparatus give **one** possible reason why the experiment did not give this expected value. [1]

.....

.....



- (c) (i) During the experiment the shiny brown copper reacted and turned black.  
Name this black substance.

..... [1]

- (ii) What change would you expect in the mass of the solid during the experiment?  
Give a reason for your answer. [1]

.....  
.....

- (d) (i) Name the gas that makes up the biggest proportion of that remaining in the  
syringes. [1]

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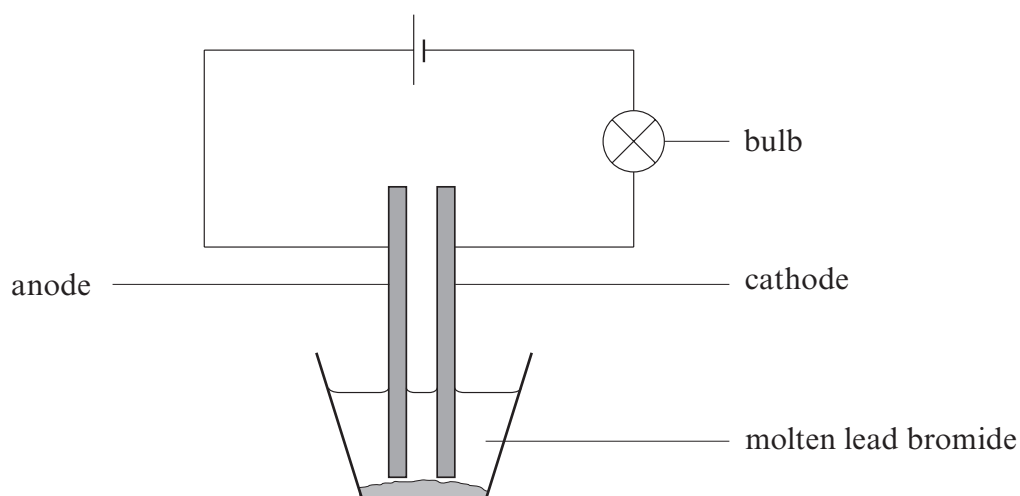
- (ii) Name the very unreactive gas used to fill light bulbs that is also present in the  
syringes. [1]

.....

8



9. The diagram below shows the apparatus used during the electrolysis of molten lead bromide.



- (a) For electricity to flow the lead bromide must be molten. Give the reason for this. [1]

.....

.....

- (b) Balance the electrode equation which takes place at the anode. [1]



- (c) (i) State, **in terms of electrons**, what happens to the lead ions at the cathode. [1]

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- (ii) Describe what you would expect to observe at the cathode. [1]

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- (iii) Electrolysis is allowed to continue for some time before the apparatus is cooled to room temperature. The bulb remains lit. Explain this observation. [2]

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6













## FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
Aluminium	$\text{Al}^{3+}$	Bromide	$\text{Br}^-$
Ammonium	$\text{NH}_4^+$	Carbonate	$\text{CO}_3^{2-}$
Barium	$\text{Ba}^{2+}$	Chloride	$\text{Cl}^-$
Calcium	$\text{Ca}^{2+}$	Fluoride	$\text{F}^-$
Copper(II)	$\text{Cu}^{2+}$	Hydroxide	$\text{OH}^-$
Hydrogen	$\text{H}^+$	Iodide	$\text{I}^-$
Iron(II)	$\text{Fe}^{2+}$	Nitrate	$\text{NO}_3^-$
Iron(III)	$\text{Fe}^{3+}$	Oxide	$\text{O}^{2-}$
Lithium	$\text{Li}^+$	Sulfate	$\text{SO}_4^{2-}$
Magnesium	$\text{Mg}^{2+}$		
Nickel	$\text{Ni}^{2+}$		
Potassium	$\text{K}^+$		
Silver	$\text{Ag}^+$		
Sodium	$\text{Na}^+$		
Zinc	$\text{Zn}^{2+}$		



