Candidate Name	Centre Number	Candidate Number
		0

General Certificate of Secondary Education

236/02

SCIENCE
HIGHER TIER (Grades D-A*)
CHEMISTRY 1

P.M. FRIDAY, 18 January 2008
(45 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**7**	
3.	**10**	
4.	**7**	
5.	**6**	
6.	**8**	
7.	**4**	
Total	**50**	

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.

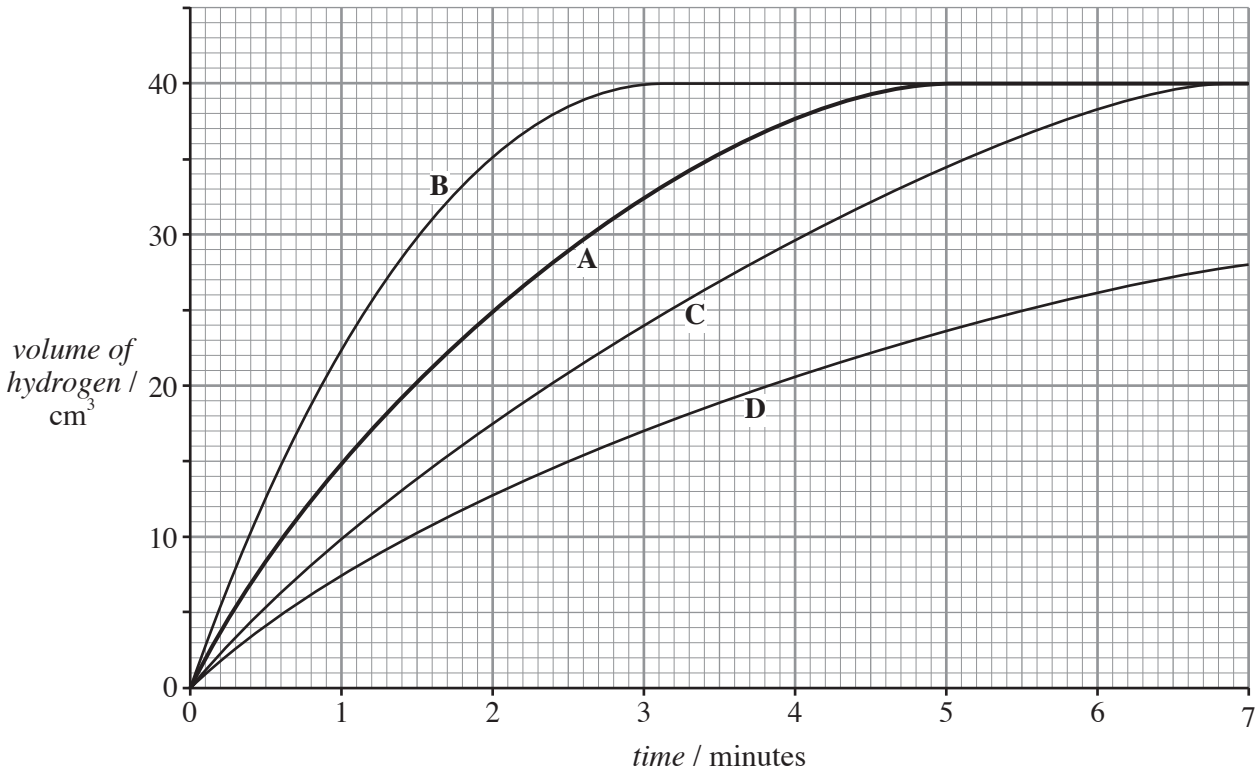
You are reminded of the necessity for good English and orderly presentation in your answers.

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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** *questions.*

1. *(a)* Magnesium reacts with hydrochloric acid to give hydrogen gas. Graph **A** below shows the volume of hydrogen formed when a certain mass of magnesium ribbon is reacted with excess hydrochloric acid at 20 °C.



(i) Use graph **A** to find the

I. volume of hydrogen given off after 2 minutes, [1]

..... cm^3

II. time when the reaction between magnesium and hydrochloric acid has stopped. [1]

..... minutes

(ii) State which of the graphs, **B**, **C** or **D**, is the correct result if the experiment had been repeated at a higher temperature of 40 °C.
Explain your answer. [2]

Graph .....

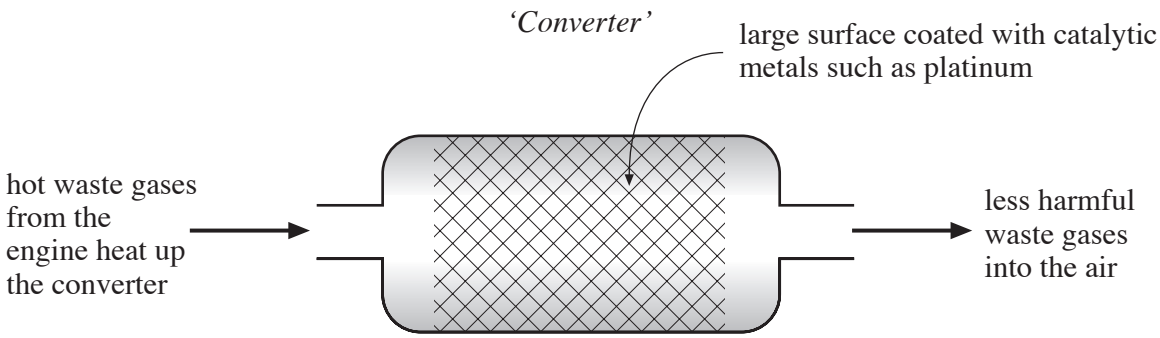
Explanation .....

.....

(iii) Apart from changing the temperature, state **one** way in which this reaction could be made to go faster. [1]

.....

(b) The exhaust systems in modern cars are fitted with catalytic convertors. Inside the converter, a reaction takes place which changes harmful gases such as carbon monoxide, hydrocarbons and nitrogen oxides into less harmful ones such as carbon dioxide, nitrogen and water vapour.



State **three** features shown above that ensure a high rate of reaction inside the converter. [3]

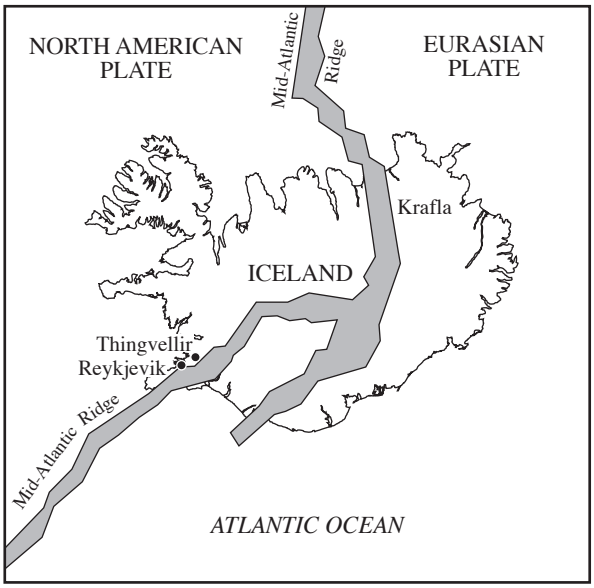
1. .....

2. .....

3. .....

2. The Earth's outer layer is split into a number of large pieces called *plates*.

(i) The map shows Iceland, which lies on the boundary between two plates. This boundary is called the Mid-Atlantic Ridge. The shaded part of the island shows relatively new or young rock that is less than 25,000 years old.



I. State how these large plates – the North American plate and the Eurasian plate – are moving and explain how the new (young) rock was formed. [2]

.....

.....

II. Name the **type** of rock present in this 'new' rock. [1]

.....

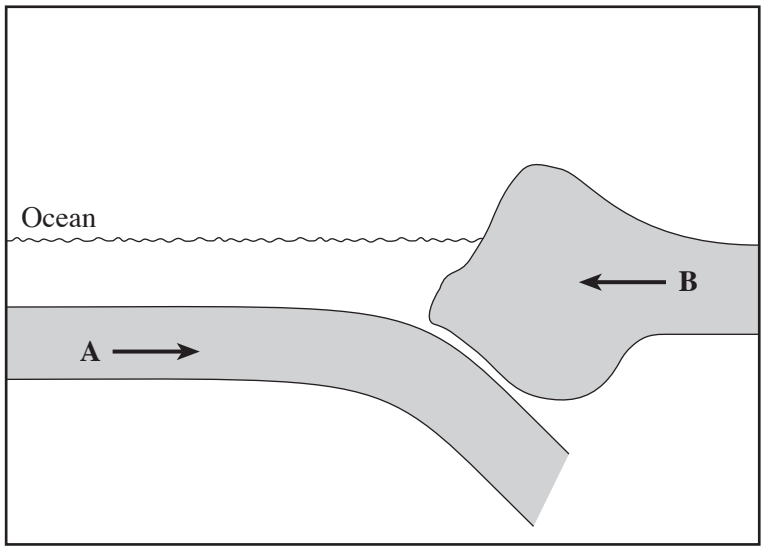
(ii) The world's highest mountain, Mount Everest, lies in the Himalayan Mountain range. The region also lies on a boundary between two different plates.

Explain how these mountains were created. [2]

.....

.....

(iii) The diagram below shows what happens when two different plates, **A** and **B**, move towards each other.



I. Give the reason for plate **A** moving **underneath** plate **B**. [1]

.....

II. State what happens to plate **A** as it moves downwards. [1]

.....

3. This question is about Group 1 elements.

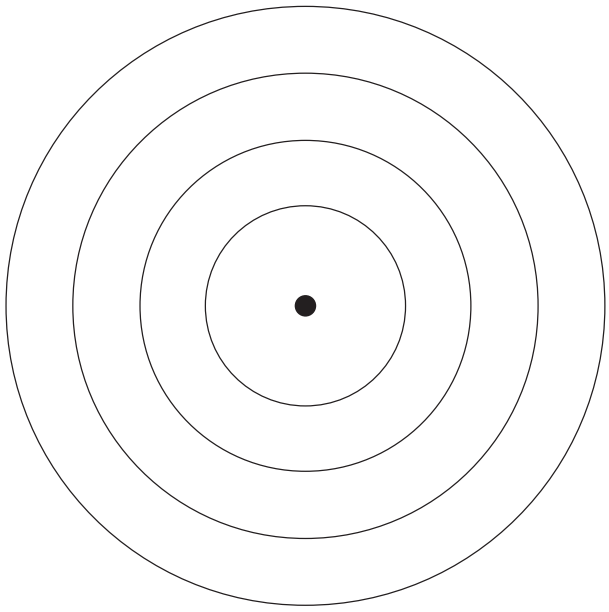
(i) Complete the following sentences using the **data** and the **key** on the Periodic Table of Elements shown on the **back cover of this examination paper**.

I. The chemical symbol for rubidium is ..... [1]

II. The element with the atomic number of 55 is ..... [1]

III. The Group 1 element in Period (row) 3 is ..... [1]

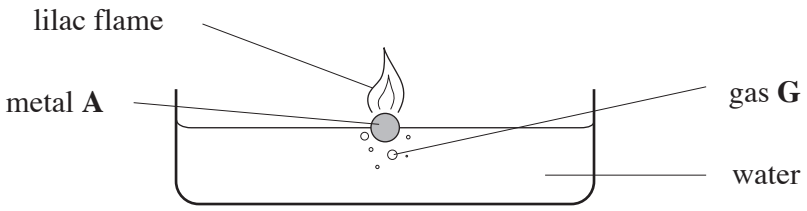
(ii) Using **X** to represent an electron, complete the following diagram to show the electronic structure for an atom of potassium. [1]



(iii) I. To prevent Group 1 metals reacting with air, they are stored in a liquid.

Name this liquid. ..... [1]

II. The following diagram shows a reaction between a Group 1 metal and water.



Name metal **A**. ..... [1]

Name gas **G**. ..... [1]

III. State **one** precaution a teacher should take in order to do the experiment safely. [1]

.....

.....

(iv) When sodium reacts with water, sodium hydroxide is formed as well as gas **G**. Complete and balance the following **symbol** equation for this reaction. [2]

$2Na + 2H_2O \longrightarrow$ ..... + ...

4. During breathing, air is inhaled and exhaled. A person can inhale as much as 20,000 litres of air in a day.
A group of scientists who had been studying the composition of inhaled and exhaled air produced the following table of results.

Air	*Percentage composition*				
	Nitrogen	*Oxygen*	*Carbon dioxide*	*Noble gases*	*Water vapour*
Inhaled	78	21	0.03	0.92	0.05
Exhaled	78	15	5	0.92	.....

(i) Complete the above table by giving the percentage composition for the water vapour in exhaled air. [1]

(ii) State what the scientists will have done to produce ***reliable*** results. [2]

.....

.....

(iii) Apart from the percentage of the water vapour, state **two** other differences between the composition of inhaled and exhaled air. [1]

.....

.....

(iv) Describe an experiment that would show the difference in the percentage composition of carbon dioxide found in inhaled and exhaled air.
Your account should include what is done and what is observed. [3]

.....

.....

.....

.....

Examiner only

5. Use the table of '*Formulae for some common ions'* on the **inside of the back cover of this examination paper** to help you give the required formula in part (i) of each of the following.

(a) Barium sulphate is used as a 'barium meal' to make the intestines visible in an X-ray which allows radiographers to find ulcers. Barium sulphate can be made in a laboratory by adding a solution of sodium sulphate to a solution of barium chloride. The barium sulphate appears as a white *'precipitate'*.

(i) Give the formula for barium sulphate. ..... [1]

(ii) Explain the term ***precipitate***. [1]

.....

.....

(b) Nitrogenous fertilizers, such as ammonium sulphate, are essential for the growth of healthy plants. Ammonium sulphate can be made in the laboratory by reacting the alkali, ammonia solution, with sulphuric acid.

(i) Give the formula of ammonium sulphate. ..... [1]

(ii) Give the general name for the reaction that takes place between an acid and an alkali. [1]

.....

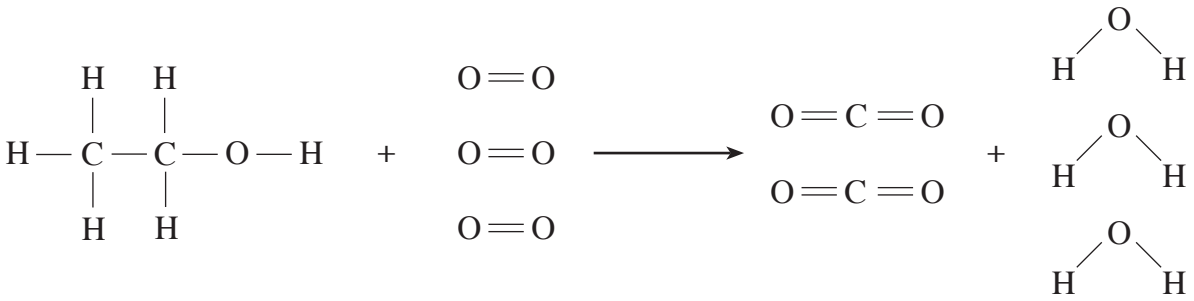
(c) Milk of magnesia, which contains magnesium hydroxide, is often used to remove excess hydrochloric acid in the stomach.

(i) Give the formula for magnesium hydroxide. ..... [1]

(ii) Name the two products formed during the reaction between magnesium hydroxide and hydrochloric acid. [1]

..... and .....

6. *(a)* Alcohols such as ethanol, C_2H_5OH, are very good fuels and some countries actually use ethanol as a fuel for their cars instead of petrol. The following diagram shows the chemical changes that occur as ethanol burns.



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

Bond	*Amount of energy needed to break the bond* / kJ
O = O	496
C — H	413
C — C	347
C — O	358
O — H	464
C = O	743

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

(i) Calculate the total energy needed to **break** the bonds of ethanol and oxygen in the above reaction. [2]

.....

.....

.....

(ii) Calculate the total energy released when the bonds of carbon dioxide and water are **formed** in the above reaction. [2]

.....

.....

.....

(iii) Calculate the overall energy change in the reaction and use this to state whether the reaction is exothermic or endothermic. [2]

.....

.....

.....

(b) Hydrogen is another very good fuel.
The symbol equation for the burning of hydrogen is shown below.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

State the main advantage to the environment of using hydrogen as a fuel in preference to ethanol. [2]

.....

.....

.....

7. Aqueous solutions of potassium iodide, silver nitrate and sodium chloride are stored in three bottles labelled **A**, **B** and **C**, but not necessarily in that order. When each was mixed with the others in turn, the following results were obtained.

Experiment	*Observation*
A added to **B**	White precipitate
B added to **C**	Pale yellow precipitate
A added to **C**	No change

Use the above results to identify solutions **A**, **B** and **C**. Explain your choice. [4]

A is .....

B is .....

C is .....

Explanation

.....

.....

.....

4

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		

Turn over.

(236-01)

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: