Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

236/02

SCIENCE

HIGHER TIER (Grades D-A*)

CHEMISTRY 1

P.M. THURSDAY, 21 June 2007

(45 minutes)

For Examiner's use only	
Total Marks	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

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)* Use the **data** and **key** on the Periodic Table of Elements, shown on the **back page** of the examination paper, to complete the following sentences.

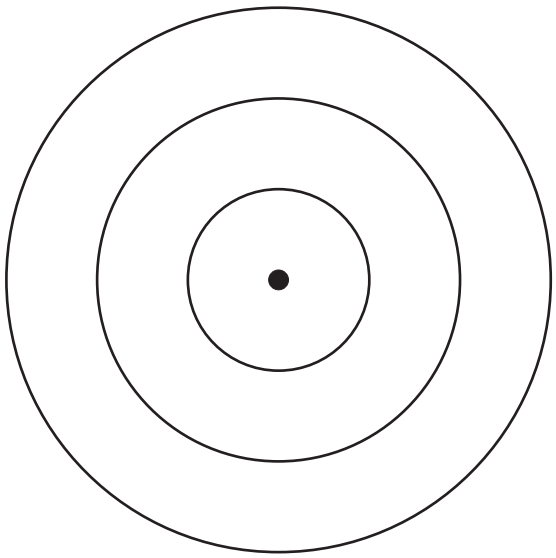
(i) The chemical **symbol** for the smallest atom in Group 1 is ..... . [1]

(ii) The element with the atomic number 12 is ..... . [1]

(iii) The element which has the electronic structure 2,8,8 is ..... . [1]

(iv) The element which is in Group 4 and Period 3 is ..... . [1]

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



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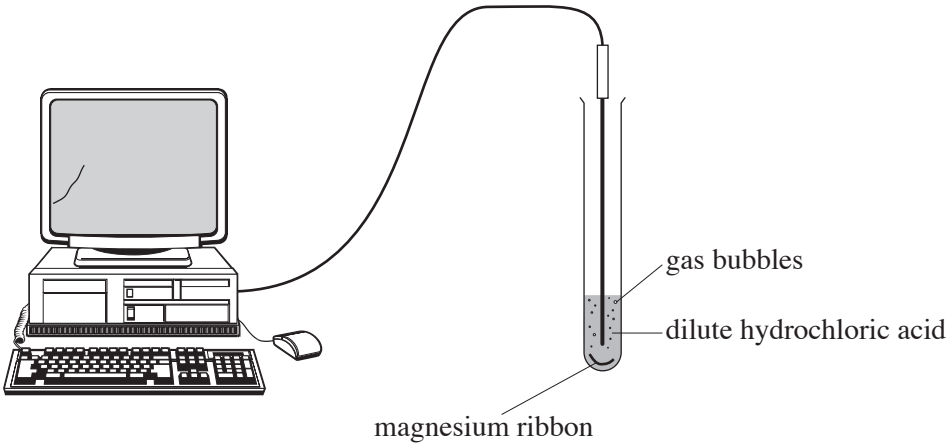
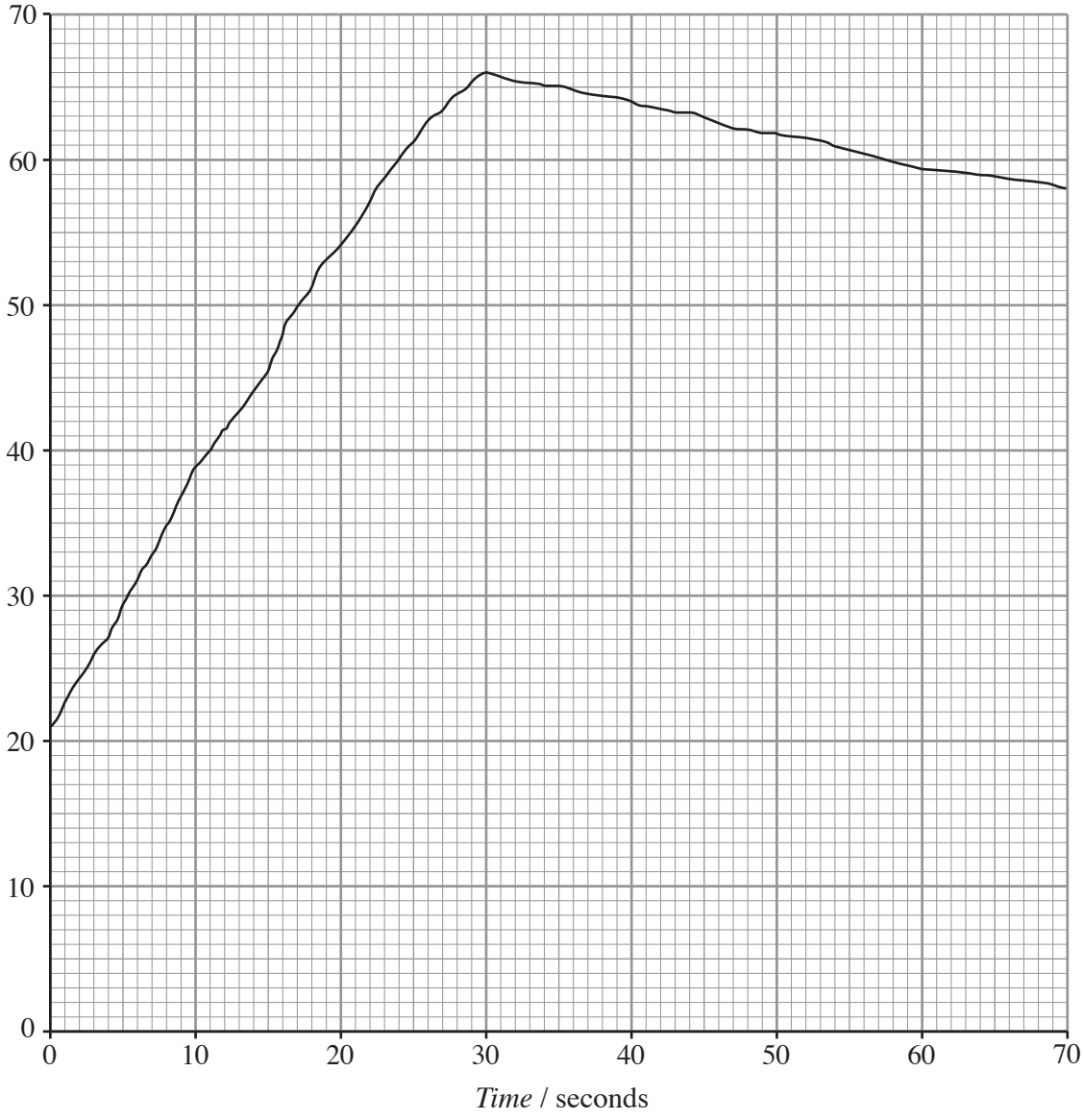
Turn over.

2. A small piece of magnesium ribbon was placed into excess dilute hydrochloric acid in a boiling tube. The temperature of the reaction mixture was recorded using a temperature sensor and displayed on a computer screen.





(i) Use the graph to give the

I. temperature of the acid at the start of the experiment, [1]

..... °C

II. maximum temperature reached during the experiment, [1]

..... °C

III. time taken until the reaction stopped. [1]

..... seconds

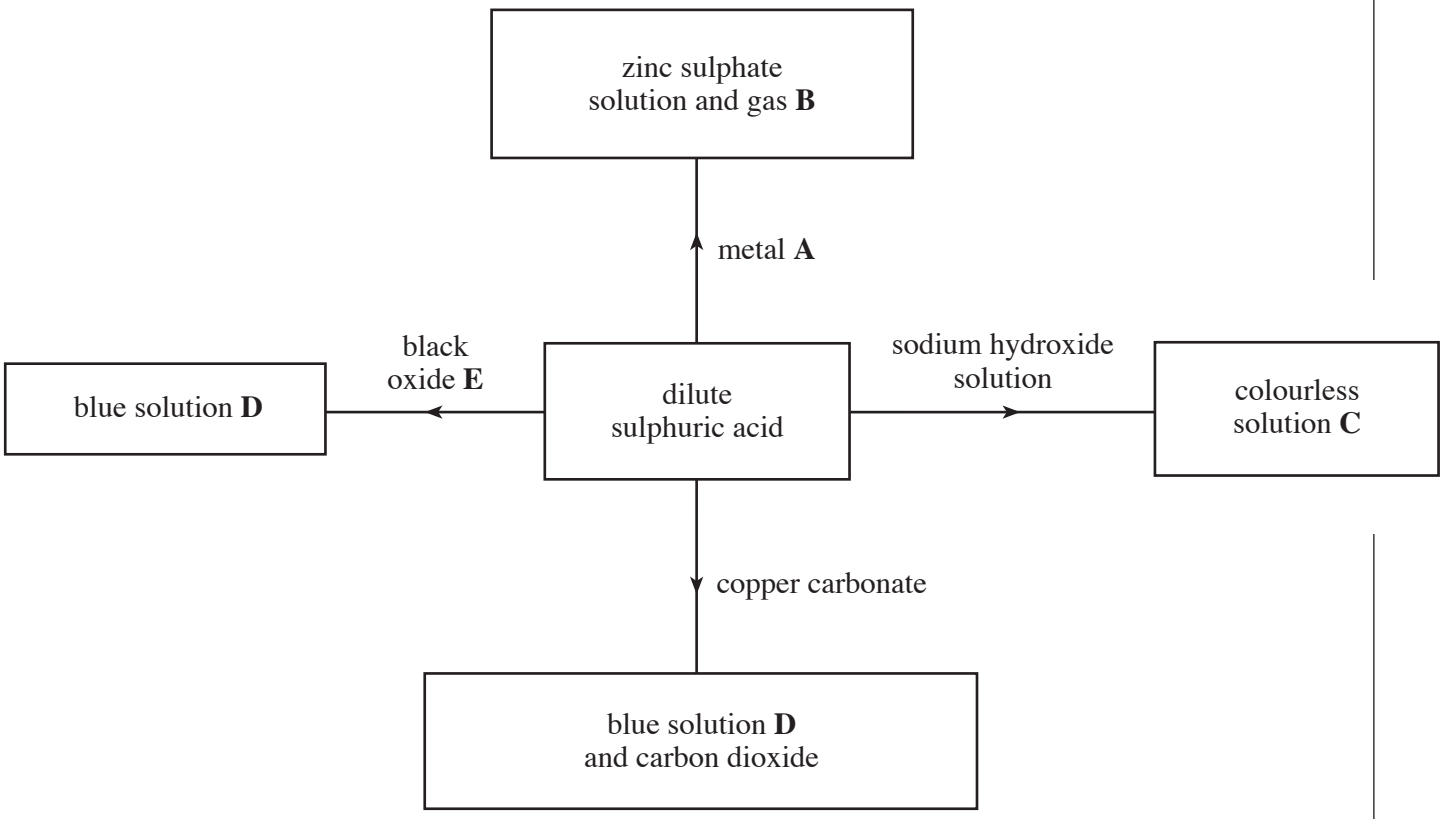
(ii) Give **one** advantage of using a computer to record the temperature. [1]

.....

(iii) Describe **one** observation which suggests that a chemical change is occurring when magnesium is added to dilute acid. [1]

.....

3. The diagram below shows some reactions of dilute sulphuric acid.



Give the name for

(i) metal **A**, ... [1]

(ii) gas **B**, ... [1]

(iii) the colourless solution **C**, ... [1]

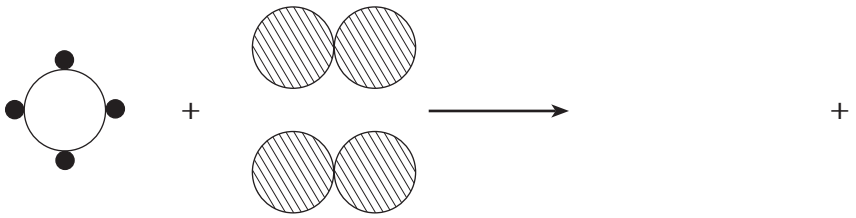
(iv) the blue solution **D**, ... [1]

(v) black oxide **E**. ..... [1]

4. *(a)* (i) The symbol equation below represents the burning of methane in air.

$$CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O$$

Complete the diagram below which respresents the above reaction.



[2]

(ii) State **two** ways in which the symbol equation above shows that a chemical reaction is taking place. [2]

1. .....

2. .....

(b) Refer to the table of common ions inside the back cover of this answer book to answer this question.

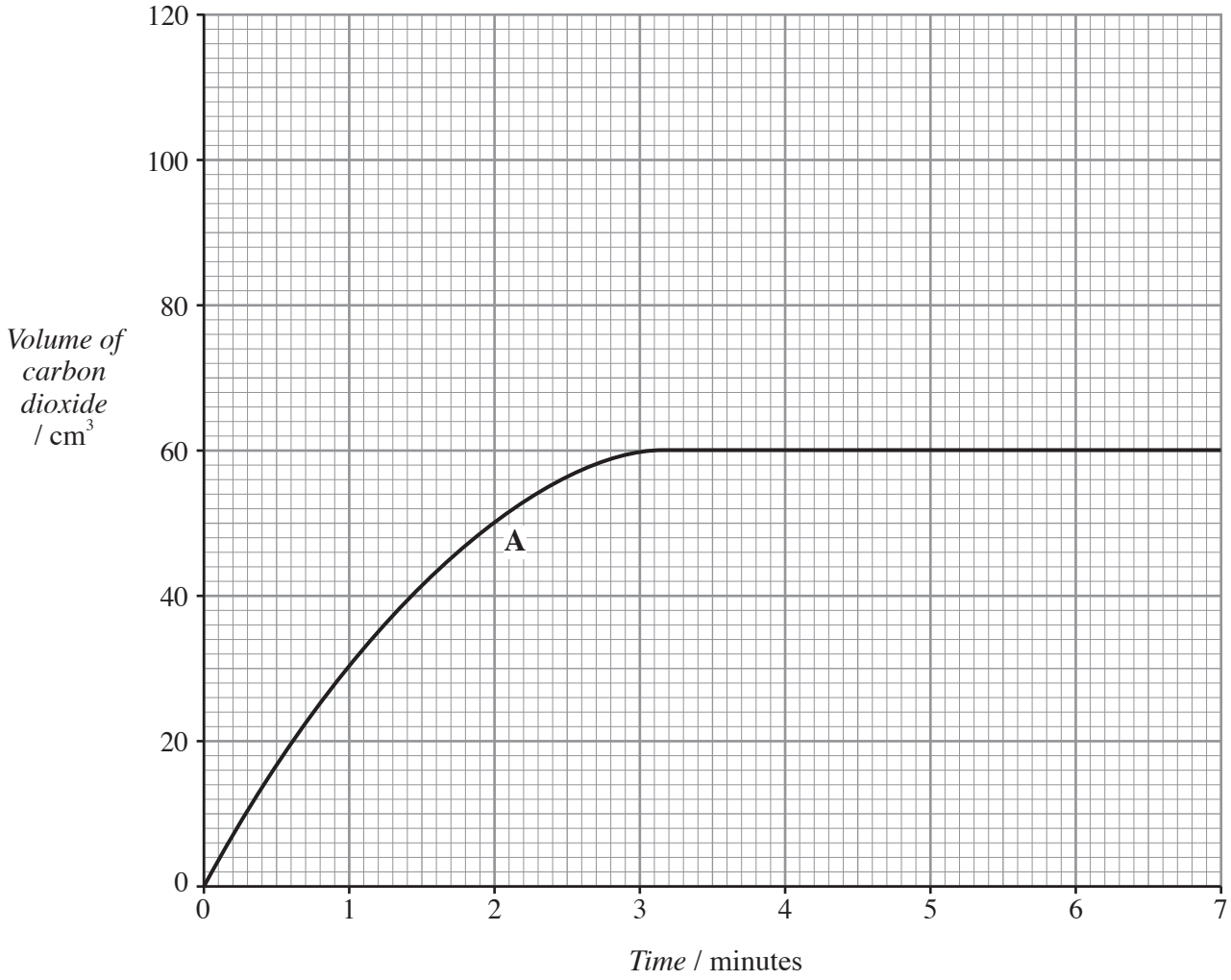
Give the chemical **formula** for magnesium fluoride. [1]

.....

(c) The chemical formula for sodium sulphate is Na_2SO_4.

Give the **total** number of atoms represented in the formula. ..... [1]

5. Graph **A** below shows the volume of carbon dioxide formed during a reaction between marble chips and ***excess*** dilute hydrochloric acid.



(i) On the same grid, sketch carefully the graph that would be obtained if the marble chips had been ground to a **powder** with the volume and concentration of the acid as for graph **A**. [2]

(ii) Explain your answer to part (i). [2]

.....

.....

.....

6. *(a)* The table below shows some physical properties of Group 1 and 7 elements.

Group 1

Element	*Melting point* /°C	*Boiling point* /°C	*Density* / g cm^{-3}
Lithium	180	1340	0.50
Sodium	98	880	0.98
Potassium	63	760	0.86

Group 7

Element	*Melting point* /°C	*Boiling point* /°C	*Density* / g cm^{-3}
Fluorine	-220	-188	0.0016
Chlorine	-101	-35	0.0029
Bromine	-7	59	3.1

(i) Describe the trends in the melting points of Group 1 and 7 elements on going down the groups. [2]

.....

.....

(ii) Give the state (solid, liquid or gas) at 60 °C of these

I. Group 1 elements, ...

II. Group 7 elements. .....

[2]

(b) Sodium reacts with chlorine, Cl_2, to form sodium chloride.

(i) Write a balanced **symbol** equation for this reaction. [3]

..... + ... ⟶ .....

(ii) Describe how a flame test and the addition of silver nitrate solution can be used to identify sodium chloride. [2]

Flame test .....

Silver nitrate solution .....

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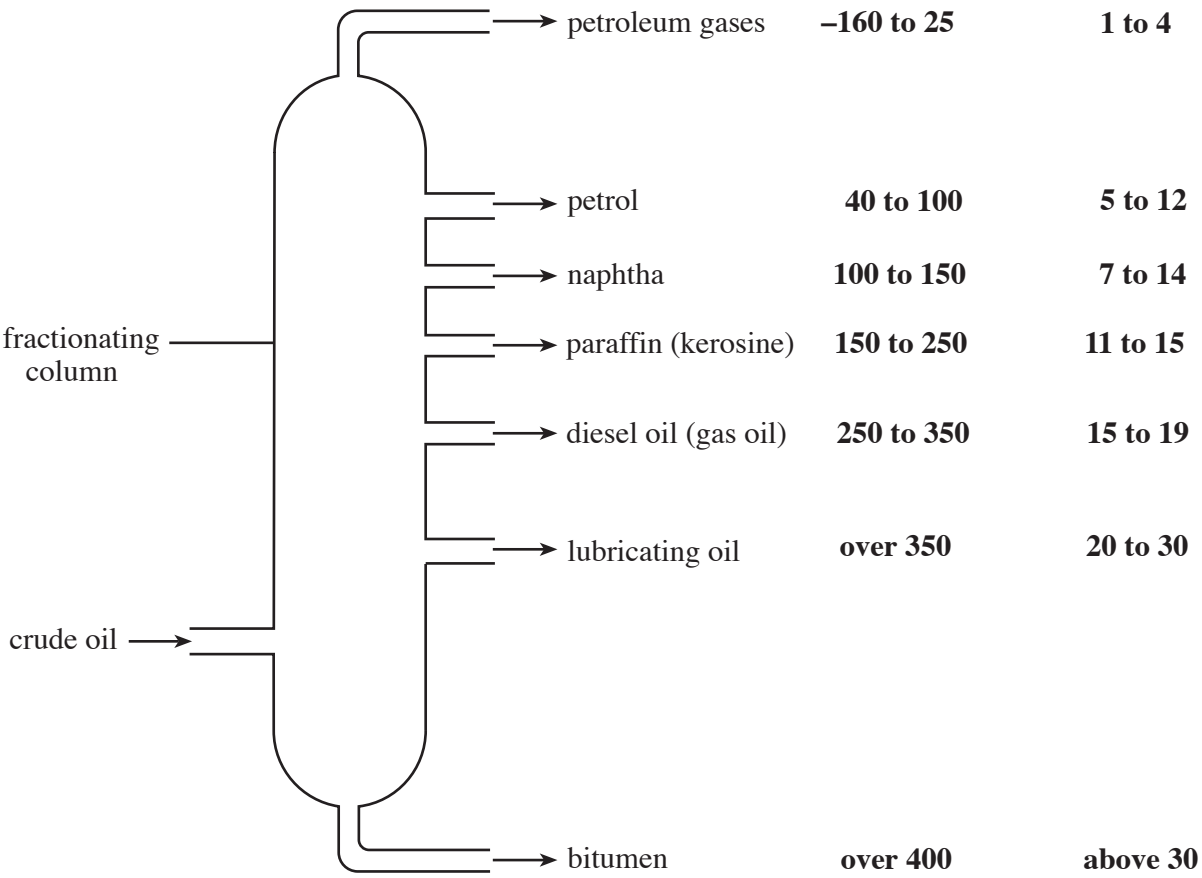
7. *(a)* Crude oil (petroleum) is a mixture of compounds called hydrocarbons which can be separated into fractions in a fractionating column.



Fraction	*Boiling Point Range* / °C	*Number of carbon atoms in chains*
petroleum gases	**–160 to 25**	**1 to 4**
petrol	**40 to 100**	**5 to 12**
naphtha	**100 to 150**	**7 to 14**
paraffin (kerosine)	**150 to 250**	**11 to 15**
diesel oil (gas oil)	**250 to 350**	**15 to 19**
lubricating oil	**over 350**	**20 to 30**
bitumen	**over 400**	**above 30**

(i) State the relationship between the chain length of a hydrocarbon compound and its boiling point. [1]

.....

(ii) Name the fraction which contains the compound with the boiling point of 287 °C. [1]

.....

(iii) Describe the **two** physical changes that must occur to separate the fractions from the crude oil. [2]

..... and .....

(b) Methane, CH_4, is an important petroleum gas. It is used in domestic heating and cooking. When methane burns in air, carbon dioxide and water are formed.

(i) Some scientists believe that the carbon dioxide produced by burning fuels, such as methane, is causing the temperature of the Earth's atmosphere to increase.

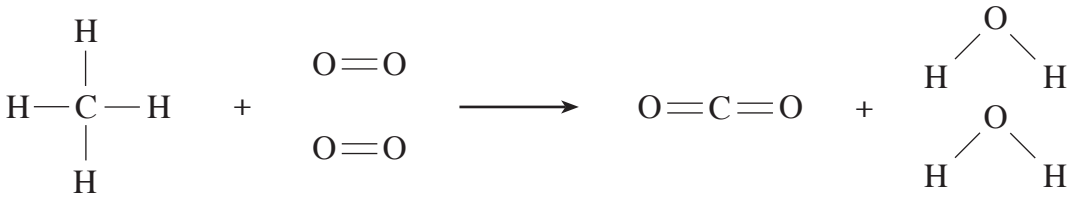
I. State the term used to describe the increase in the temperature of the Earth's atmosphere. [1]

.....

II. Give **one** environmental problem caused by an increase in temperature of the Earth's atmosphere. [1]

.....

(ii) The equation below represents the burning of methane.



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

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

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

I. Use the bond energy values in the table to calculate the relative energy

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

.....

.....

.....

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

.....

.....

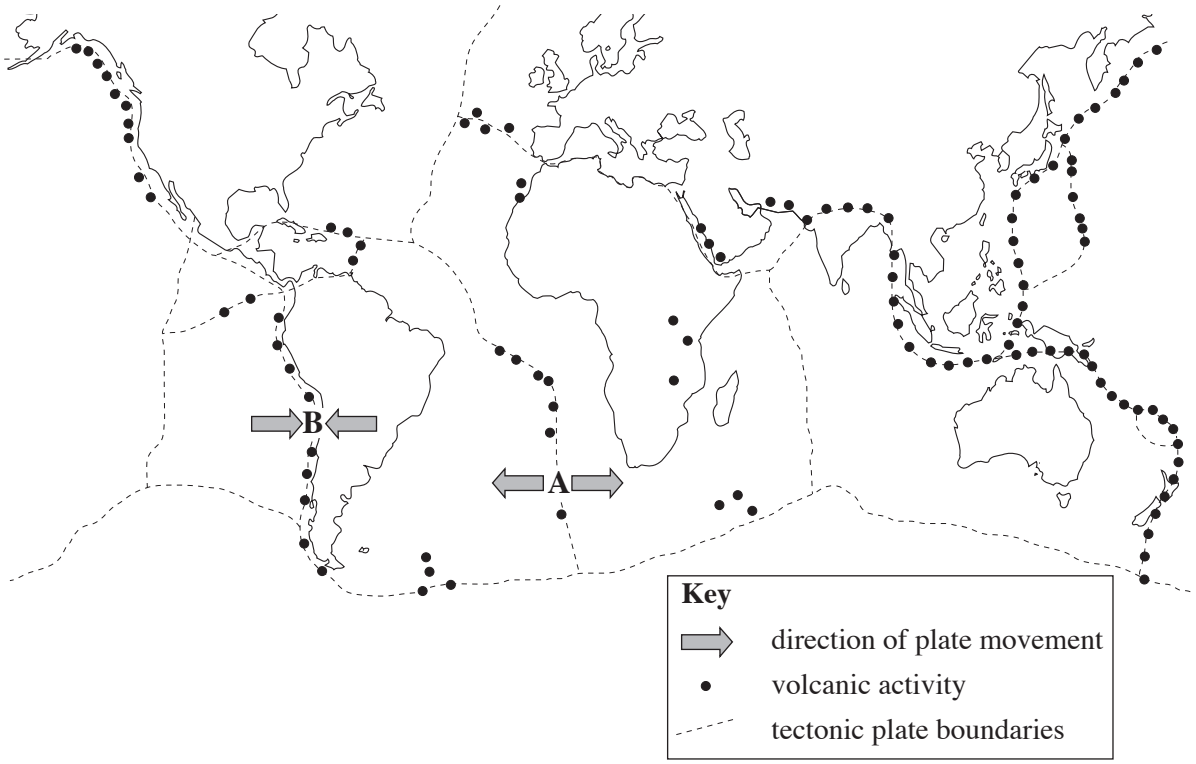
.....

II. Use your answers to part I. to show why the relative overall energy change is exothermic. [1]

.....

.....

8. *(a)* The diagram below shows the Earth's tectonic plate boundaries and volcanic activity.



(i) Apart from volcanoes, give **one** other natural geological event that occurs at plate boundaries. [1]

.....

(ii) In terms of events relating to the **rock cycle**, state what happens when plates move

I. apart, as labelled **A** above, [1]

.....

II. towards each other, labelled **B** above. [1]

.....

(b) Evidence for continental drift was proposed by Alfred Wegener in 1915 but was not accepted by other scientists until the 1960s.

(i) State **one** piece of evidence that Alfred Wegener used to support his idea of continental drift. [1]

.....

(ii) State the reason for other scientists not immediately accepting Alfred Wegener's ideas. [1]

.....

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.

(236-02)

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: