

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel**  
**Level 1/Level 2 GCSE (9-1)**

# Chemistry

## Paper 2

### Foundation Tier

Sample Assessment Materials for first teaching September 2016

**Time: 1 hour 45 minutes**

Paper Reference

**1CH0/2F**

**You must have:**

a calculator  
a ruler

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (\*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**PEARSON**

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.  
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The Earth's early atmosphere was different from that of the Earth's atmosphere today.

(a) The Earth's early atmosphere was formed by

(1)

- A animals breathing.
- B global warming.
- C plants growing.
- D volcanic activity.

(b) Figure 1 shows some data about the composition of gases present in the Earth's early atmosphere and today's atmosphere.

gas	composition (%)	
	Earth's early atmosphere	today's atmosphere
nitrogen	4	78
oxygen	<0.01	21
argon	<0.01	0.9
gas X	95	0.04
ammonia	0.5	<0.001
sulfur dioxide	0.5	<0.001

Figure 1

Explain, using the data, the identity of gas X.

(2)

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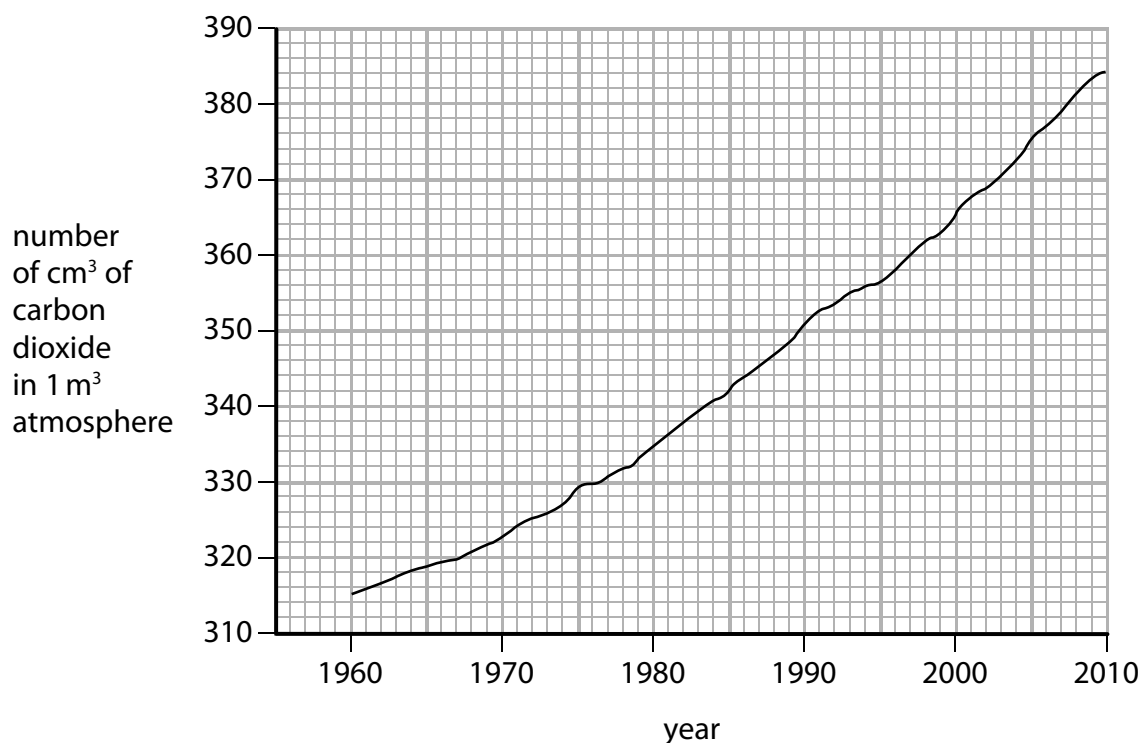
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(c) Figure 2 shows the concentration of carbon dioxide in the atmosphere above Hawaii from 1960 to 2010.



**Figure 2**

(i) Use the graph to calculate the increase in the volume of carbon dioxide in 1 m<sup>3</sup> of atmosphere from 1960 to 2010.

(2)

increase in volume of carbon dioxide = ..... cm<sup>3</sup>

(ii) Describe how carbon dioxide is released into today's atmosphere.

(2)

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**(Total for Question 1 = 7 marks)**



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(b) Figure 4 shows information about some of the elements in group 7 of the periodic table.

element	melting point / °C	boiling point / °C
fluorine	-220	-188
chlorine	-101	-35
bromine	7	59
iodine	114	184

**Figure 4**

Astatine is below iodine in group 7 of the periodic table.

Estimate the boiling point of astatine.

(1)

boiling point of astatine = ..... °C

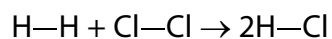
(c) Chlorine reacts with potassium iodide to form iodine and potassium chloride.

Complete the word equation for the reaction between bromine and potassium astatide.

(2)

bromine + potassium astatide → +

(d) Hydrogen reacts with chlorine to form hydrogen chloride.



The symbol — is used to show a covalent bond.

The electronic configuration of hydrogen is 1.

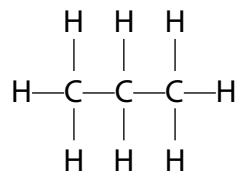
The electronic configuration of chlorine is 2.8.7.

Draw the dot-and-cross diagram for the molecule of hydrogen chloride.  
Show outer electrons only.

(2)

**(Total for Question 2 = 8 marks)**

3 The structure of a molecule of propane is shown as



(a) Give the names of the elements combined together in propane.

(2)

(b) Propane can burn completely in oxygen to form carbon dioxide and water.

(i) Write the word equation for this reaction.

(2)

(ii) Propane is a fuel.

Give the reason why fuels are burned.

(1)

(c) Which product is formed when there is incomplete combustion of propane?

(1)

- A sulfur dioxide
- B oxygen
- C hydrogen
- D carbon monoxide

(d) Which of the following is the formula of a hydrocarbon?

(1)

- A  $\text{C}_6\text{H}_5\text{OH}$
- B  $\text{CH}_2\text{OHCH}_2\text{OH}$
- C  $\text{H}_2\text{C}=\text{CHCH}_2\text{CH}_3$
- D  $\text{C}_6\text{H}_{12}\text{Cl}_2$

**(Total for Question 3 = 7 marks)**

- 4 (a) When solid ammonium chloride is shaken with water, a colourless solution forms and the temperature changes from 20 °C to 16 °C.

Give the name of the type of heat change occurring.

(1)

- (b) A student carries out an experiment to measure accurately the temperature changes when different metals are added to iron(II) sulfate solution.

The method for the experiment is:

- measure 25 cm<sup>3</sup> of iron(II) sulfate solution and pour into a container
- record the initial temperature of the solution
- add excess magnesium ribbon
- record the highest temperature of the mixture
- repeat the experiment using excess copper turnings, then using excess zinc foil.

- (i) State a suitable container for the iron(II) sulfate solution in this experiment.

(1)

- (ii) State what the student should do to the mixtures during the experiment.

(1)

- (iii) Figure 5 shows the results obtained by the student.

metal added to iron(II) sulfate solution	temperature rise / °C
magnesium	6.0
copper	0.0
zinc	2.8

**Figure 5**

Explain the order of reactivity of the metals magnesium, copper and zinc using the results.

(2)



(iv) Explain how the student could improve the method to make a fairer comparison of the temperature change produced by the different metals.

(2)

.....

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.....

.....

(v) The iron(II) sulfate solution contained 6.2 g of iron(II) sulfate in 50 cm<sup>3</sup> of solution.

Calculate the concentration of the iron(II) sulfate solution in g dm<sup>-3</sup>.

(2)

concentration = ..... g dm<sup>-3</sup>

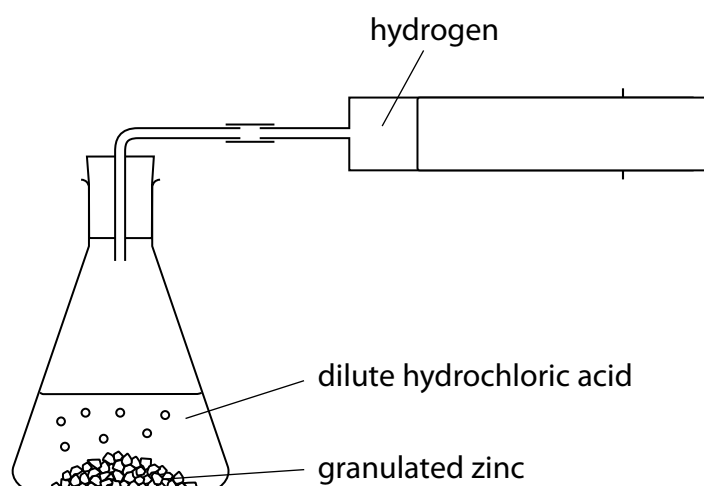
**(Total for Question 4 = 9 marks)**

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- 5 A student used the equipment in Figure 6 to investigate the rate of reaction between zinc and excess dilute hydrochloric acid.



**Figure 6**

The student uses the following method:

- place a known mass of granulated zinc into the conical flask
- pour 25 cm<sup>3</sup> of dilute hydrochloric acid (an excess) into the conical flask and fit the bung quickly into the neck of the flask
- measure the volume of gas produced every 20 seconds until after the reaction finishes.

Figure 7 shows the results.

time / s	volume of hydrogen / cm <sup>3</sup>
0	0
20	42
40	66
60	75
80	80
100	82
120	82
140	82

**Figure 7**

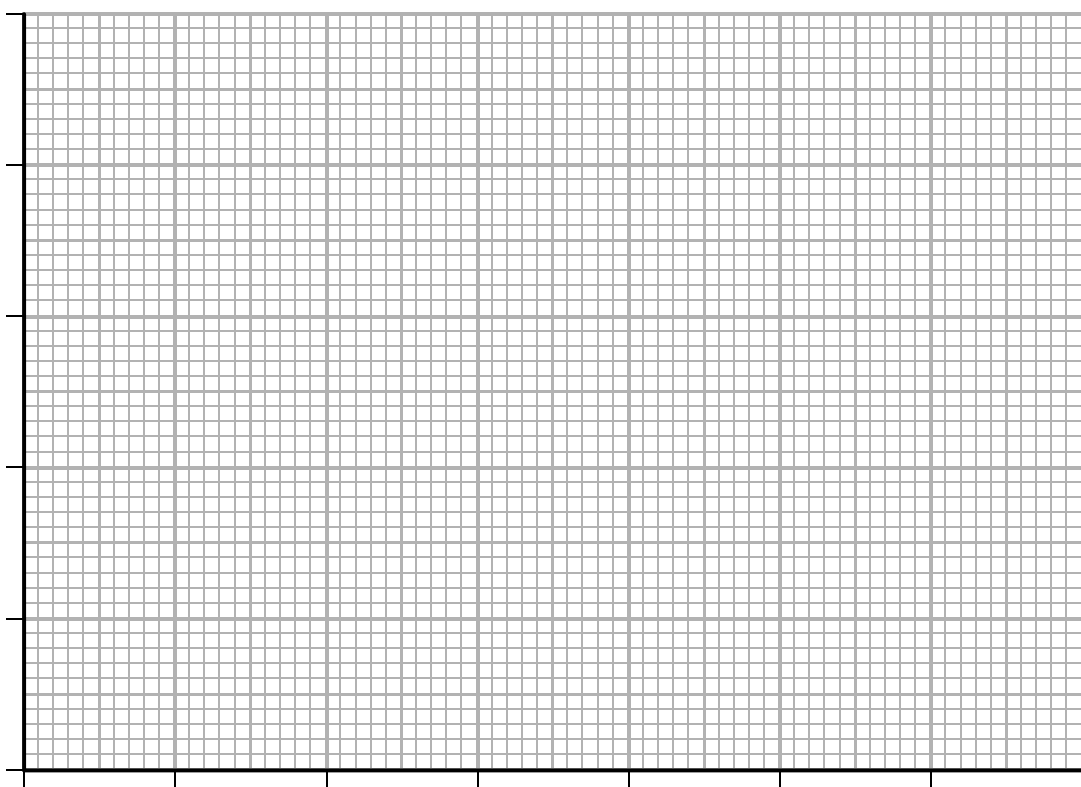
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- (a) Give the name of a piece of equipment that can be used to measure 25 cm<sup>3</sup> of dilute hydrochloric acid accurately. (1)

- (b) Draw a graph of the volume of hydrogen gas produced against time using the grid. (3)



- (c) The average rate of reaction in the first 20 seconds in cm<sup>3</sup> of hydrogen produced per second is (1)

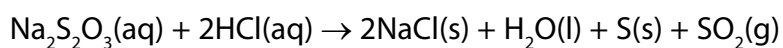
- A 2.1
- B 8.4
- C 21
- D 84

- (d) The student repeated the experiment keeping all conditions the same but using the same mass of powdered zinc instead of granulated zinc.

On the grid above sketch the graph you would expect when the experiment is repeated using powdered zinc.  
Label your line **A**.

(2)

- (e) Sodium thiosulfate solution,  $\text{Na}_2\text{S}_2\text{O}_3$ , reacts with dilute hydrochloric acid as shown in the equation.



The rate of this reaction can be investigated by mixing the reactants and finding the time taken for a precipitate of sulfur to become visible.

A student wants to investigate the effect of changing the temperature on the rate of this reaction.

Devise a method the student could use to find out how the time taken for the precipitate of sulfur to become visible changes with temperature.

(3)

**(Total for Question 5 = 10 marks)**

6 Alcohols and carboxylic acids are important organic compounds.

Figure 8 shows the names and formulae of three alcohols in a homologous series.

name	formula
methanol	$\text{CH}_3\text{OH}$
ethanol	$\text{C}_2\text{H}_5\text{OH}$
propanol	$\text{C}_3\text{H}_7\text{OH}$

Figure 8

- (a) Predict the formula of the alcohol that has **five** carbon atoms in its molecule, using the information in Figure 8.

(1)

- (b) Calculate the relative formula mass of ethanol,  $\text{C}_2\text{H}_5\text{OH}$ .

(relative atomic masses: H = 1, C = 12, O = 16)

(2)

relative formula mass = .....

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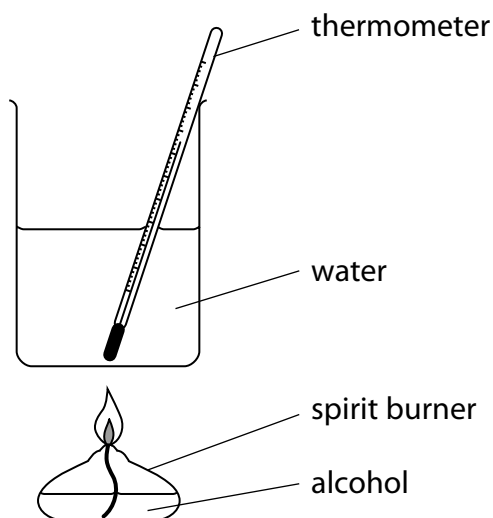
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(c) Ethanol can be oxidised to form ethanoic acid.

Draw the structure of a molecule of ethanoic acid, showing all the covalent bonds.

(2)

- (d) The temperature rise in water when liquid fuels burn can be found using the equipment shown in Figure 9.



**Figure 9**

- (i) A student compares the temperature rise produced in the water when propanol burns with the temperature rise produced when ethanol burns.

State **two** factors that the student must keep the same in both experiments in order to have a fair comparison.

(2)

1 .....

2 .....

(ii) The results for the two alcohols are shown in Figure 10.

alcohol	mass of alcohol burned / g	temperature rise / °C
ethanol	0.33	20
propanol	0.28	20

**Figure 10**

Explain, using only the information in Figure 10, why propanol might be the better fuel.

(2)

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**(Total for Question 6 = 9 marks)**

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7 This question is about some of the elements in groups 1 and 2 of the periodic table.

- (a) The atomic number of lithium is 3.  
The mass number of a lithium atom is 7.

Which row of the table shows the number of protons, neutrons and electrons in an atom of lithium-7?

(1)

	number of protons	number of neutrons	number of electrons
<input type="checkbox"/> A	3	3	4
<input type="checkbox"/> B	3	4	3
<input type="checkbox"/> C	4	3	7
<input type="checkbox"/> D	7	4	3

- (b) Lithium, sodium and potassium are in group 1 of the periodic table.

State, in terms of the electrons in their atoms, what the atoms of lithium, sodium and potassium have in common.

(1)

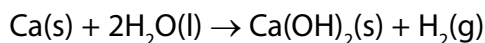
- (c) Magnesium has atomic number 12.  
Magnesium exists as magnesium-24, magnesium-25 and magnesium-26 atoms.

Explain, in terms of protons and neutrons, why these atoms are isotopes of magnesium.

(2)

- (d) Magnesium and calcium are in group 2 of the periodic table. They are less reactive than the metals in group 1.

Calcium reacts with water to form calcium hydroxide,  $\text{Ca(OH)}_2$ , and hydrogen,  $\text{H}_2$ .



Describe what would be **seen** when a piece of calcium is dropped into a container of water.

(2)

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- (e) Magnesium reacts very slowly with cold water but it reacts faster with steam,  $\text{H}_2\text{O}$ , to form magnesium oxide,  $\text{MgO}$ , and hydrogen.

Write the balanced equation for the reaction between magnesium and steam.

(2)

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- (f) The electronic configurations of magnesium and calcium are

magnesium 2.8.2  
calcium 2.8.8.2

When magnesium and calcium react with water they form positive ions.

Suggest an explanation, in terms of their electronic configurations, why calcium is more reactive than magnesium.

(2)

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(g) A sample of calcium bromide contains 0.2 g calcium and 0.8 g bromine by mass.

Calculate the empirical formula of calcium bromide.

(relative atomic masses: Ca = 40, Br = 80)

(3)

empirical formula = .....

**(Total for Question 7 = 13 marks)**

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**8** Crude oil is a mixture of hydrocarbons.

It can be separated into fractions.

(a) Which of these mixtures shows formulae of substances that could be in the gaseous fraction of crude oil?

(1)

- A**  $C_2H_4$ ,  $C_3H_8$ ,  $C_4H_{10}O$
- B**  $C_2H_4$ ,  $C_3H_7Br$ ,  $C_4H_{10}$
- C**  $C_2H_6$ ,  $C_3H_8$ ,  $C_4H_{10}$
- D**  $C_2H_6$ ,  $C_3H_7Br$ ,  $C_4H_{10}O$

(b) Figure 11 shows the percentages of the fractions in crude oil from three different oil wells.

fraction	percentage of fraction in crude oil from		
	oil well A	oil well B	oil well C
gases	1	6	9
petrol	2	15	24
kerosene	6	14	20
diesel oil	7	10	16
fuel oil	26	28	30
bitumen	58	27	1

**Figure 11**

(i) State which oil well produces a crude oil containing the highest percentage of the high boiling point fractions.

(1)

(ii) A barrel of crude oil from oil well B weighs 130 kg.

Calculate the mass of kerosene in this barrel.

(1)

..... kg

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\*(c) Diesel is the fuel used in most bus engines.

Research is being carried out into the use of hydrogen, instead of diesel, as a fuel for buses.

Discuss the advantages and disadvantages of using hydrogen, rather than diesel, as a fuel for buses.

(6)

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(d) Fractions of crude oil contain alkanes.

A sample of decane,  $C_{10}H_{22}$ , was cracked using the apparatus in Figure 12.

This produced a mixture of products, including ethene.

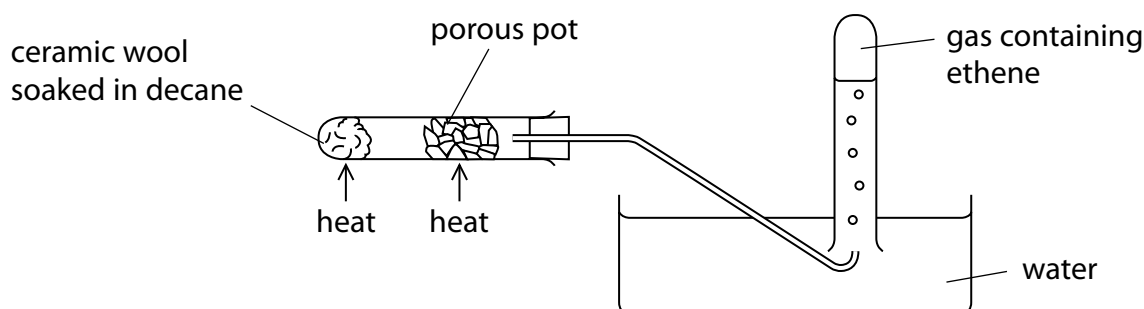


Figure 12

(i) Explain how ethene is produced using the apparatus in Figure 12.

(3)

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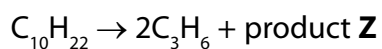
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(ii) One molecule of decane produced two molecules of propene,  $C_3H_6$ , and one molecule of product Z.



What is the formula of product Z?

(1)

- A  $C_4H_8$
- B  $C_4H_{10}$
- C  $C_7H_{14}$
- D  $C_7H_{16}$

(Total for Question 8 = 13 marks)

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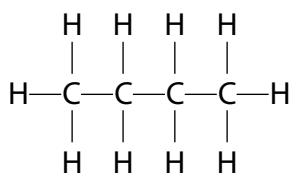
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9 Alkanes and alkenes are hydrocarbons.

The structure of a molecule of butane is shown.



(a) Which of the following is the empirical formula for butane?

(1)

- A CH
- B CH<sub>2</sub>
- C C<sub>2</sub>H<sub>5</sub>
- D C<sub>4</sub>H<sub>10</sub>

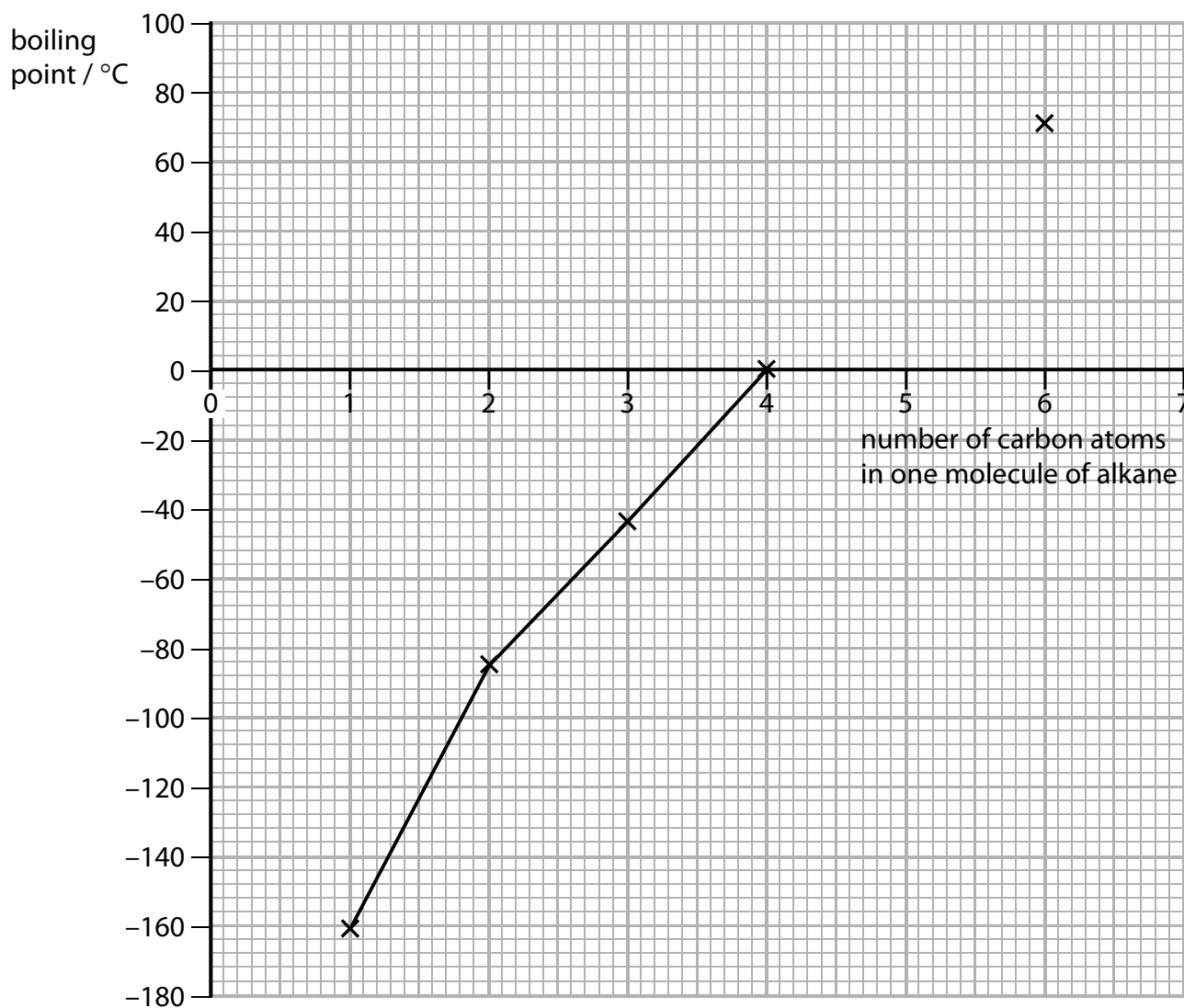
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(b) The graph in Figure 13 shows the boiling points of some alkanes plotted against the number of carbon atoms in one molecule of each alkane.



**Figure 13**

A molecule of pentane contains five carbon atoms.  
Use the graph to estimate the boiling point of pentane.

(1)

boiling point of pentane = ..... °C

(c) Figure 14 shows some information about the alkenes, ethene and propene.

Complete the table. The structure of propene must show all covalent bonds.

(2)

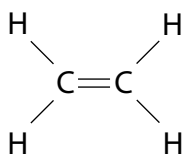
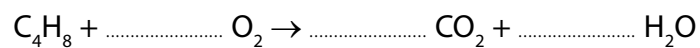
name of alkene	molecular formula	structure
ethene		
propene	$C_3H_6$	

Figure 14

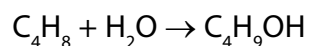
(d) Alkenes burn completely to produce carbon dioxide and water.

Balance the equation for the complete combustion of butene gas,  $C_4H_8$ .

(1)



(e) Butene reacts with steam to produce butanol.



- (i) Calculate the maximum mass of butanol,  $\text{C}_4\text{H}_9\text{OH}$ , that can be produced when 1.4 kg of butene,  $\text{C}_4\text{H}_8$ , reacts with excess steam.

(relative atomic masses: H = 1, C = 12, O = 16  
relative molecular mass of butene,  $\text{C}_4\text{H}_8$  = 56)

(3)

mass of butanol = ..... kg

- (ii) What type of reaction takes place between butene and steam?

(1)

- A addition
- B dehydration
- C neutralisation
- D substitution

- (f) A sample of each of three hydrocarbons, **X**, **Y** and **Z**, was shaken with bromine water. Bromine water is orange coloured.

The results are:

- X** orange mixture becomes colourless  
**Y** orange mixture becomes colourless  
**Z** mixture remains orange

Using the results, comment on the structures of the hydrocarbons **X**, **Y** and **Z**.

(2)

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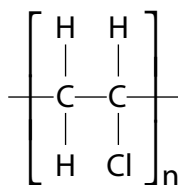
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- (g) Alkenes are used to make polymers.

Figure 15 shows the repeating unit of a polymer.



**Figure 15**

Draw the structure of a molecule of the monomer that was used to produce this polymer.

(1)

(h) Bottles can be made of polymers, such as poly(ethene), and of glass.

Give **one** advantage of a bottle made of a polymer rather than a bottle made of glass.

(1)

**(Total for Question 9 = 13 marks)**

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10 Qualitative tests can be used to identify ions in substances.

- (a) Sodium hydroxide solution is warmed with a solution of ammonium ions.  
Ammonia gas is given off.

Describe the test to show the gas is ammonia.

(2)

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- (b) Two tests were carried out on copper sulfate solution.

- (i) Sodium hydroxide solution was added to a small amount of copper sulfate solution.  
A blue precipitate of copper hydroxide formed.

Complete the word equation for the reaction.  
Include state symbols.

(2)

copper sulfate (aq) + sodium hydroxide (aq) → ..... (.....) + ..... (.....)

- (ii) Dilute hydrochloric acid was added to a different sample of copper sulfate solution. Barium chloride solution was then added.

State what would be **seen**.

(1)

.....



# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0	
	7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>O</b> oxygen 8	16 <b>F</b> fluorine 9	18 <b>Ar</b> argon 18
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>Sc</b> scandium 21	24 <b>Ti</b> titanium 22	25 <b>V</b> vanadium 23	26 <b>Cr</b> chromium 24	27 <b>Mn</b> manganese 25	28 <b>Fe</b> iron 26	29 <b>Co</b> cobalt 27
	37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium 43	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109
	133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77
	85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45
	119 <b>Sr</b> strontium 38	120 <b>Ca</b> calcium 20	121 <b>Sc</b> scandium 21	122 <b>Ti</b> titanium 22	123 <b>V</b> vanadium 23	124 <b>Cr</b> chromium 24	125 <b>Mn</b> manganese 25	126 <b>Fe</b> iron 26	127 <b>Co</b> cobalt 27
	115 <b>In</b> indium 49	116 <b>Sn</b> tin 50	117 <b>Pb</b> lead 82	118 <b>Hg</b> mercury 80	119 <b>Tl</b> thallium 81	120 <b>Pb</b> lead 82	121 <b>Bi</b> bismuth 83	122 <b>Po</b> polonium 84	123 <b>At</b> astatine 85
	112 <b>Cd</b> cadmium 48	113 <b>In</b> indium 49	114 <b>Sn</b> tin 50	115 <b>Pb</b> lead 82	116 <b>Bi</b> bismuth 83	117 <b>Po</b> polonium 84	118 <b>At</b> astatine 85	119 <b>Rn</b> radon 86	120 <b>Rn</b> radon 86
	65 <b>Zn</b> zinc 30	66 <b>Ga</b> gallium 31	67 <b>Ge</b> germanium 32	68 <b>As</b> arsenic 33	69 <b>Se</b> selenium 34	70 <b>Br</b> bromine 35	71 <b>Kr</b> krypton 36	72 <b>Xe</b> xenon 54	73 <b>Kr</b> krypton 36
	108 <b>Ag</b> silver 47	109 <b>Cd</b> cadmium 48	110 <b>In</b> indium 49	111 <b>Sn</b> tin 50	112 <b>Pb</b> lead 82	113 <b>Bi</b> bismuth 83	114 <b>Po</b> polonium 84	115 <b>At</b> astatine 85	116 <b>Rn</b> radon 86
	197 <b>Au</b> gold 79	198 <b>Hg</b> mercury 80	199 <b>Tl</b> thallium 81	200 <b>Pb</b> lead 82	201 <b>Bi</b> bismuth 83	202 <b>Po</b> polonium 84	203 <b>At</b> astatine 85	204 <b>Rn</b> radon 86	205 <b>Rn</b> radon 86
	[272] <b>Rg</b> roentgenium 111	[271] <b>Ds</b> darmstadtium 110	[270] <b>Uue</b> unbinetium 109	[269] <b>Uub</b> unbibium 108	[268] <b>Uuq</b> unquincium 107	[267] <b>Uuq</b> unquincium 106	[266] <b>Uuq</b> unquincium 105	[265] <b>Uuq</b> unquincium 104	[264] <b>Uuq</b> unquincium 103
	Elements with atomic numbers 112-116 have been reported but not fully authenticated								

1	<b>H</b>	1
	hydrogen	

relative atomic mass
atomic symbol
name
atomic (proton) number

Key

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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