

Paper Reference(s) 1CH0/2F

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Chemistry

Paper 2

Foundation Tier

Wednesday 12 June 2019 – Morning

**Time: 1 hour 45 minutes plus your additional
time allowance**

INSTRUCTIONS TO CANDIDATES

**Write your centre number, candidate number,
surname, other names and your signature in
the boxes below. Check that you have the
correct question paper.**

Centre No.					
Candidate No.					
Surname					
Other names					
Signature					
Paper Reference	1	C	H	0	/ 2 F



Y56428A

Pearson

(Turn over)

- **Use BLACK ink or ball-point pen.**
- **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.**

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Periodic Table

(Instructions continue on next page)

(Turn over)

INFORMATION FOR CANDIDATES

- 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.
- A Periodic Table is provided.

ADVICE TO CANDIDATES

- 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)

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 (a) Plants release oxygen into the atmosphere.**

What is the name of the process that releases oxygen into the atmosphere? (1 mark)

- ☐ **A combustion**
- ☐ **B oxidation**
- ☐ **C photosynthesis**
- ☐ **D polymerisation**

(Question continues on next page)

(Turn over)

(b) The atmosphere contains 21% of oxygen.

(i) Figure 1 shows an incomplete bar chart of the main gases in the atmosphere.

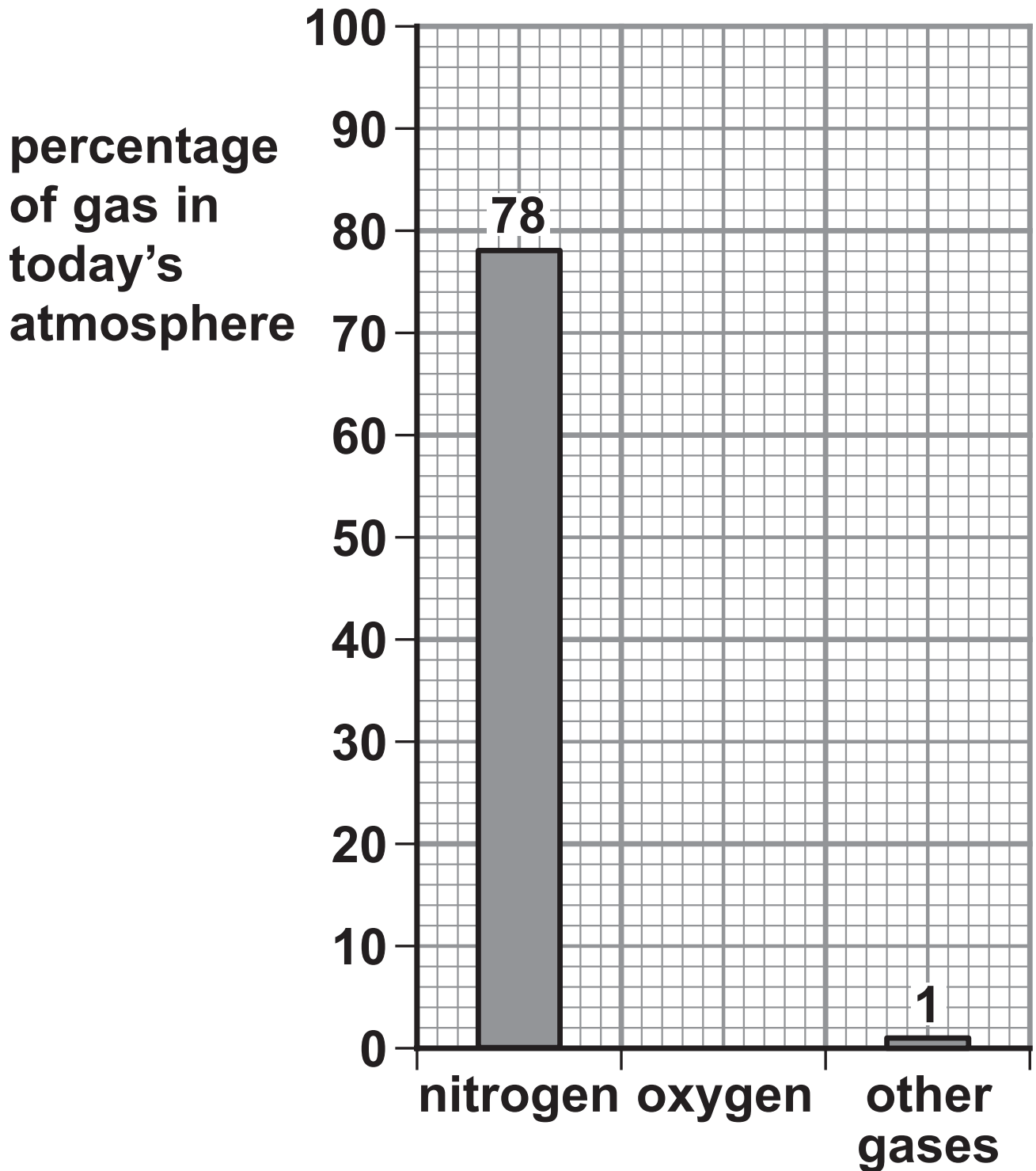


Figure 1

(Question continues on next page)

(Turn over)

**Complete the bar chart by showing the percentage of oxygen in the atmosphere.
(1 mark)**

- (ii) Calculate the volume of oxygen present in 300 cm^3 of air.**

(volumes are measured under the same conditions of temperature and pressure) (2 marks)

volume of oxygen = _____ cm^3

(Question continues on next page)

(Turn over)

(c) An atom of an element has an atomic number and a mass number.

Draw one straight line from each of these to the numbers of subatomic particles it shows to be present in an atom. (2 marks)

NUMBER OF SUBATOMIC PARTICLES IN AN ATOM

**atomic
number**

**mass
number**

• **number of protons**

• **number of neutrons**

• **total number of protons
and electrons**

• **total number of protons
and neutrons**

• **total number of protons,
neutrons and electrons**

(Question continues on next page)

(Turn over)

**(d) Which test shows a gas is oxygen?
(1 mark)**

- ☐ **A a few drops of limewater will turn cloudy when shaken with the gas**
- ☐ **B a glowing splint will relight when placed in the gas**
- ☐ **C a lighted splint placed in the gas will cause a pop**
- ☐ **D a piece of damp red litmus paper will turn blue when placed in the gas**

(TOTAL FOR QUESTION 1 = 7 MARKS)

(Questions continue on next page)

(Turn over)

2 (a) Complete the following sentences.

**(i) The name given to group 7 in the
periodic table is _____ .
(1 mark)**

**(ii) The name given to group 0 in the
periodic table is _____ .
(1 mark)**

(Question continues on next page)

(Turn over)

(b) Which of the following rows gives the colours of the group 7 elements chlorine and bromine at room temperature? (1 mark)

	chlorine	bromine
<input type="checkbox"/> A	red-brown	purple
<input type="checkbox"/> B	yellow-green	grey
<input type="checkbox"/> C	yellow-green	red-brown
<input type="checkbox"/> D	grey	red-brown

(Question continues on next page)

(Turn over)

(c) Figure 2 shows the melting and boiling points of bromine and iodine.

element	melting point in °C	boiling point in °C
bromine	-7	59
iodine	114	184

Figure 2

Using the information in Figure 2, which row shows the physical states of these elements at 50 °C? (1 mark)

<input type="checkbox"/>	A	bromine	iodine
<input type="checkbox"/>	B	liquid	gas
<input type="checkbox"/>	C	solid	liquid
<input type="checkbox"/>	D	gas	solid
<input type="checkbox"/>		liquid	solid

(Question continues on next page)

(Turn over)

(d) The densities of some elements in group 0 are shown in Figure 3.

name	density in g cm^{-3}
helium	0.15
neon	1.2
argon	1.4
krypton	
xenon	3.5

Figure 3

Use the information in Figure 3 to suggest the density of krypton.
(1 mark)

density of krypton = _____ g cm^{-3}

(Question continues on next page)

(Turn over)

- (e) For many years, argon was used to fill filament light bulbs.**

A filament light bulb is shown in Figure 4.

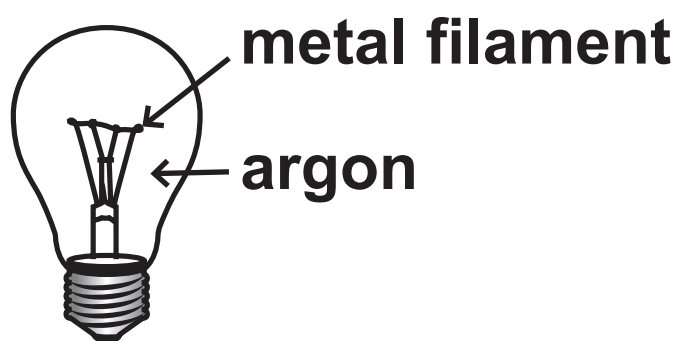


Figure 4

When the bulb is in use the metal filament becomes extremely hot.

(Question continues on next page)

(Turn over)

**Explain why argon, rather than air,
was used to fill filament light bulbs.
(2 marks)**

(TOTAL FOR QUESTION 2 = 7 MARKS)

(Questions continue on next page)

(Turn over)

3 Polymer molecules can be made by joining together large numbers of small molecules called monomers.

(a) Figure 5 on page 16 shows the names and structures of some polymers and the monomers used to make them.

Complete the table using the information given. (3 marks)

(Question continues on next page)

(Turn over)

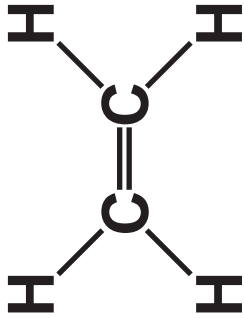
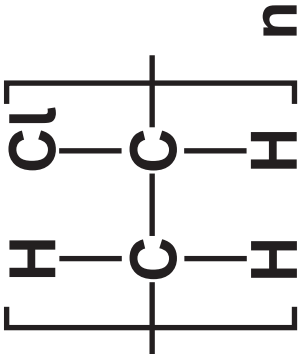
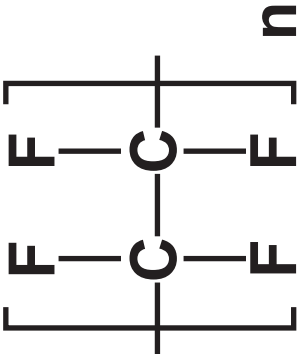
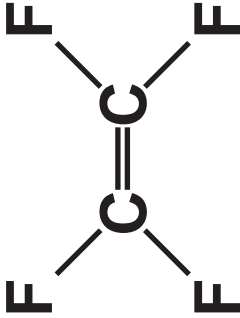
name of polymer	structure of polymer molecule	name of monomer	structure of monomer molecule
poly(ethene)		ethene	
poly-(chloroethene)		chloroethene	
		tetrafluoro-ethene	

Figure 5

(Question continues on next page)

(Turn over)

(b) Plastics are polymers.

State TWO problems caused by the disposal of polymers. (2 marks)

1 _____

2 _____

(Question continues on next page)

(Turn over)

(c) A molecule of propene has the structure shown in Figure 6.

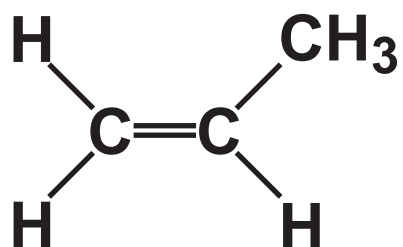
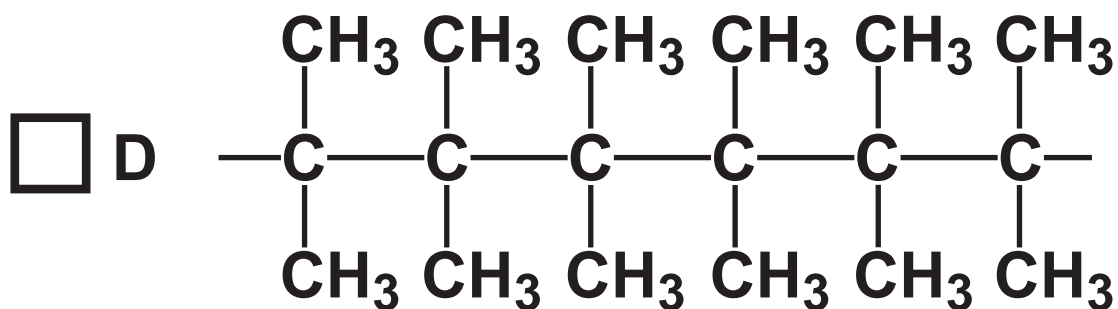
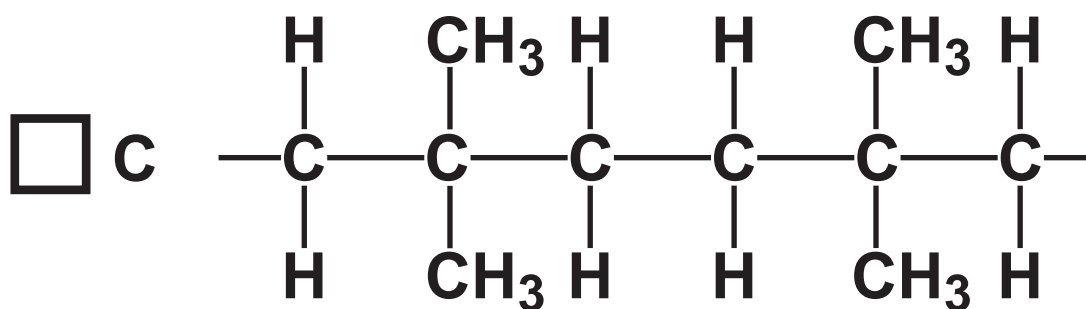
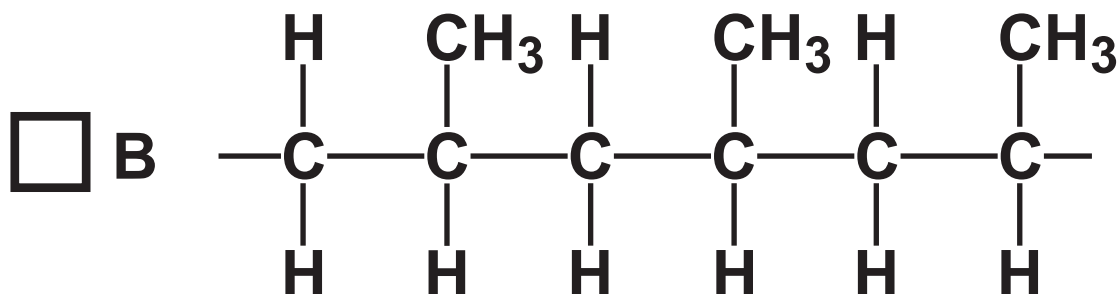
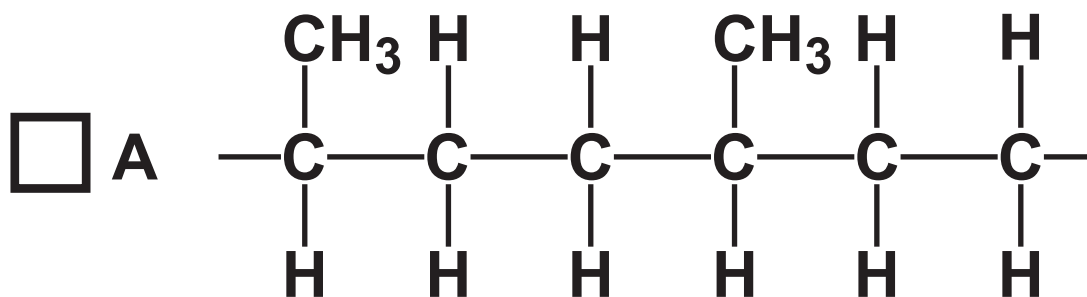


Figure 6

(Question continues on next page)

Which of the following shows the structure of part of a poly(propene) molecule? (1 mark)



(Question continues on next page)

(Turn over)

- (d) Calculate the relative formula mass of the poly(propene) molecule made from joining together 24 600 molecules of propene, C_3H_6 .
(relative formula mass: $\text{C}_3\text{H}_6 = 42.0$)

Give your answer to three significant figures. (2 marks)

relative formula mass = _____

(TOTAL FOR QUESTION 3 = 8 MARKS)

(Questions continue on next page)

(Turn over)

- 4 A student poured 50 cm^3 water into a beaker and measured the water's temperature.

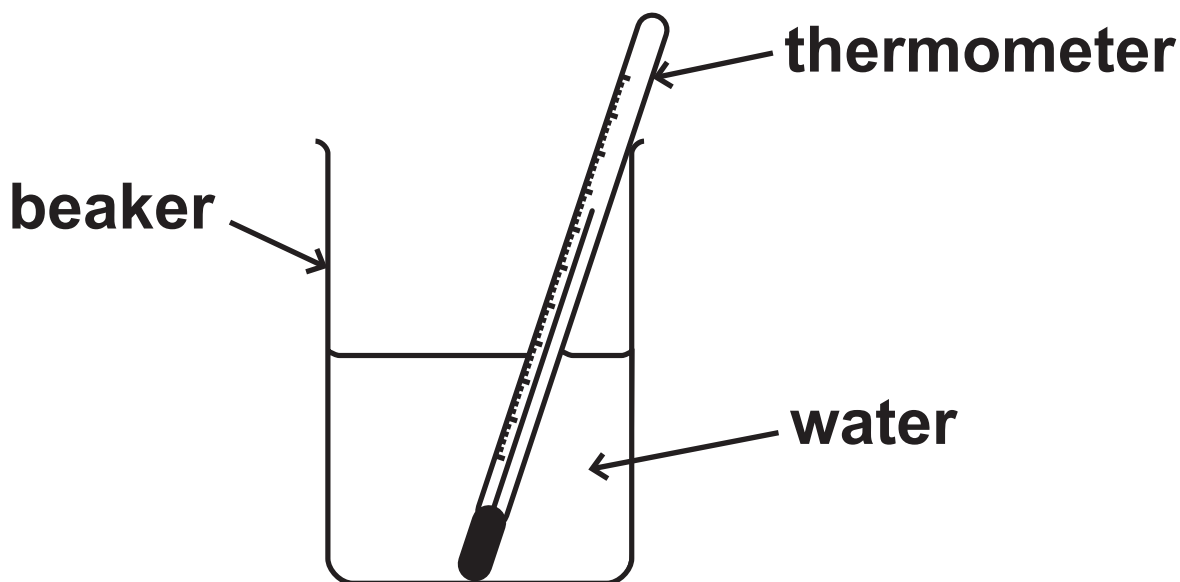


Figure 7

The student added 1.00 g calcium chloride to the water, stirred the mixture and then recorded the temperature.

(Question continues on next page)

(Turn over)

- (a) Give the name of the apparatus that could be used to measure 1.00 g of calcium chloride. (1 mark)**

(Question continues on next page)

(b) The student's results were

temperature of water at start = 21°C

**temperature of mixture after stirring
= 32°C**

**Explain, using these results, the type
of heat energy change that occurs
when calcium chloride dissolves in
water. (2 marks)**

(Question continues on next page)

(Turn over)

(c) Calcium chloride is hazardous to health.

- (i) Which hazard symbol on page 25 would be expected to be seen on a container of calcium chloride?
(1 mark)**

(Question continues on next page)



A



B



C



D



(Question continues on next page)

(Turn over)

- (ii) Give a safety precaution that the student should take during the experiment. (1 mark)**

- (d) State ONE way in which the apparatus could be changed to reduce the amount of heat energy lost during the experiment. (1 mark)**

(Question continues on next page)

(Turn over)

- (e) The concentration of a calcium chloride solution is 12 g dm^{-3} .

Calculate the volume of this solution, in cm^3 , that contains 9.0 g of calcium chloride.

(Question continues on next page)

**You must show your working.
(3 marks)**

volume of solution = _____ cm³

(TOTAL FOR QUESTION 4 = 9 MARKS)

(Questions continue on next page)

(Turn over)

- 5 (a) Propene can be produced by the cracking of some hydrocarbons obtained from crude oil.

The equation shows the cracking of one molecule of decane to produce one molecule of butene and one molecule of another product.



- (i) Calculate the values of x and y in C_xH_y . (2 marks)

$x =$ _____

$y =$ _____

- (ii) State the total mass of products formed if 25 g of decane is cracked in this way. (1 mark)

(Question continues on next page)

(Turn over)

(b) The structure of a molecule of ethene is shown in Figure 8.

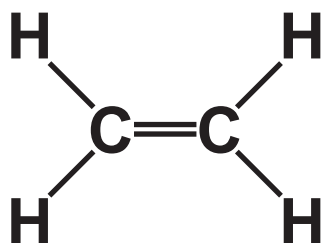


Figure 8

(i) Figure 9 shows the incomplete dot and cross diagram for a molecule of ethene.

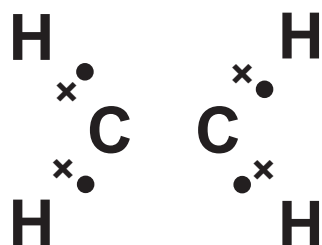


Figure 9

Complete Figure 9 to show the electrons of the C=C double bond. (1 mark)

(Question continues on next page)

(Turn over)

- (ii) The incomplete combustion of ethene in air produces water as one of the products.

Give the name of another product of the incomplete combustion of ethene. (1 mark)

(Question continues on next page)

(Turn over)

- (c) Substance X is an unsaturated hydrocarbon.
The structure of a molecule of substance X is shown in Figure 10.

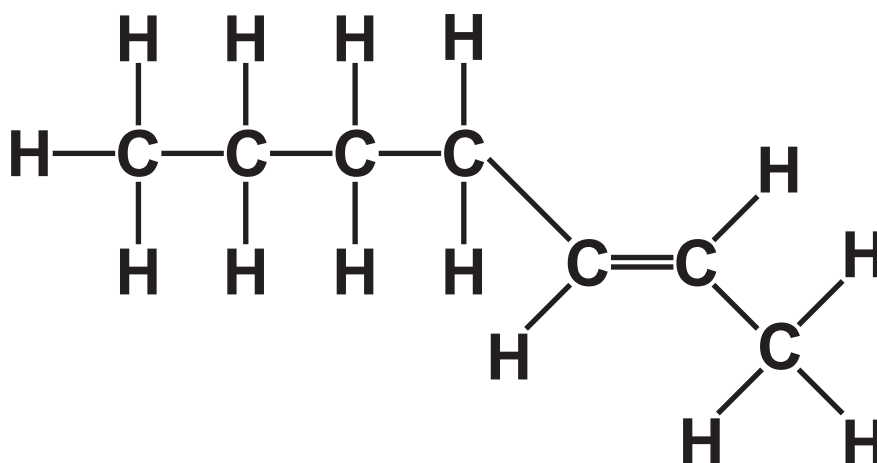


Figure 10

(Question continues on next page)

**Explain how the structure of substance X shows that it is an UNSATURATED HYDROCARBON.
(2 marks)**

(Question continues on next page)

(Turn over)

- (d) Two liquid hydrocarbons, A and B, were tested with bromine water. One hydrocarbon was known to be an alkane. The other hydrocarbon was known to be an alkene.**

Each hydrocarbon was shaken with a few drops of bromine water.

(Question continues on next page)

The results of the tests were
hydrocarbon A + bromine water:
the mixture turned from orange
to colourless.
hydrocarbon B + bromine water:
the orange colour remained.

Explain these results. (2 marks)

(TOTAL FOR QUESTION 5 = 9 MARKS)

(Questions continue on next page)

(Turn over)

6 The word equation for the reaction between magnesium and dilute hydrochloric acid is



The reaction was carried out using the apparatus shown in Figure 11.

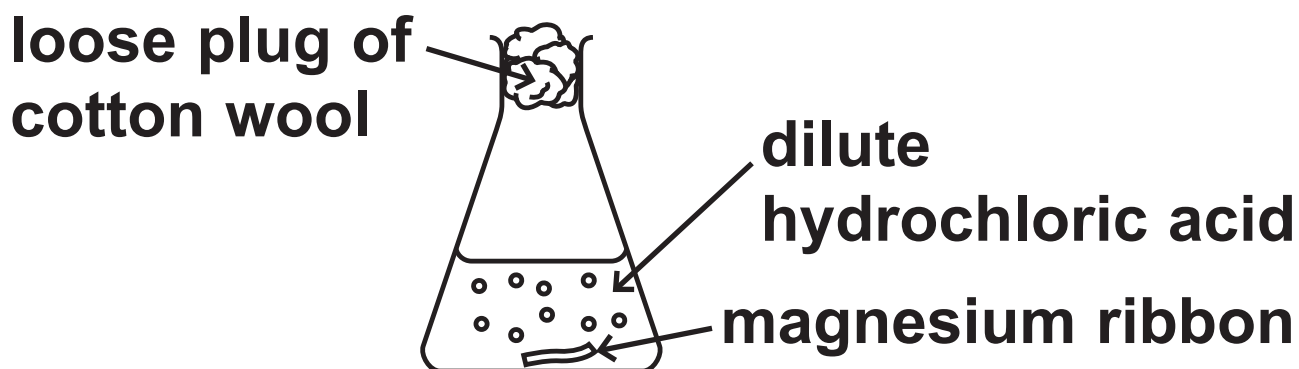


Figure 11

A strip of magnesium ribbon was placed in the conical flask.

100 cm³ of dilute hydrochloric acid was added to the conical flask.

The mass of the flask and contents was measured at regular intervals.

The loss in mass was calculated.

(Question continues on next page)

(Turn over)

Figure 12 shows a graph of the results.

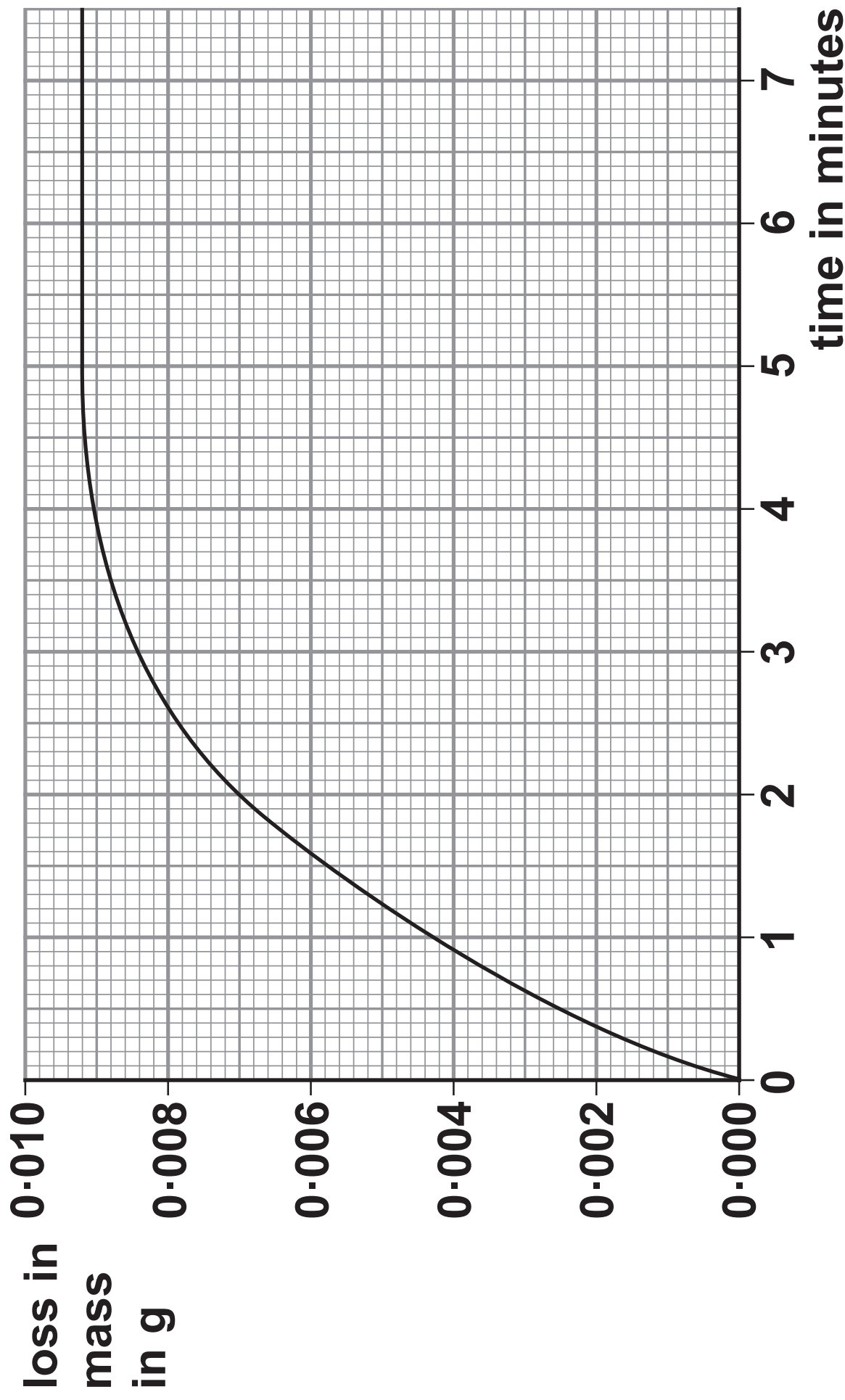


Figure 12

(Question continues on next page)

(Turn over)

(a) Name the apparatus that could be used to measure out 100 cm^3 of dilute hydrochloric acid. (1 mark)

(b) Explain why there is a loss in mass of the flask and contents. (2 marks)

(Question continues on next page)

(Turn over)

(c) The graph shows that the rate of reaction slows as the reaction takes place.

Explain, in terms of particles, why the rate of reaction between magnesium ribbon and dilute hydrochloric acid slows as the reaction takes place. (3 marks)

(Question continues on next page)

(Turn over)

- (d) The experiment was repeated using the acid at a higher temperature. All other conditions were kept the same.**

State the effect of the higher temperature on the mass loss after two minutes. (1 mark)

(Question continues on next page)

- (e) The original experiment was repeated using the same mass of magnesium powder instead of the magnesium ribbon.**

All other conditions were kept the same.

Sketch, on the graph in Figure 12 on page 37, the line you would expect for this experiment. (2 marks)

- (f) Some reactions are affected by the presence of a catalyst.**

- (i) State the effect of a catalyst on a reaction. (1 mark)**

(Question continues on next page)

(Turn over)

- (ii) Devise a simple experiment to find out what happens to the mass of a solid catalyst during a reaction. (3 marks)**

(Continue your answer on next page)

(Turn over)

(TOTAL FOR QUESTION 6 = 13 MARKS)

(Questions continue on next page)

(Turn over)

- 7 (a) Qualitative tests are carried out on ionic substances to identify the ions present in the substances.**

The test for a given ion must be unique to that ion.

- (i) Explain why the test for a given ion must be unique to that ion.
(2 marks)**

(Question continues on next page)

(Turn over)

- (ii) In the test for the carbonate ion, CO_3^{2-} , dilute hydrochloric acid is added to the solid being tested.

State the name of the gas produced in the test if carbonate ions are present. (1 mark)

(Question continues on next page)

(Turn over)

(iii) Tests for three ions are described.

Draw one straight line from the test for each ion to the observation that shows that ion to be present.

Each observation may be correct for one test, more than one test, or for none of the tests. (3 marks)

DESCRIPTION OF TEST	OBSERVATION
test for chloride ion: add dilute nitric acid followed by silver nitrate solution	green precipitate
test for iodide ion: add dilute nitric acid followed by silver nitrate solution	red precipitate
test for sulfate ion: add dilute hydrochloric acid followed by barium chloride solution	white precipitate
	yellow precipitate

(Question continues on next page)

(Turn over)

***(b) A white solid is known to be a chloride in which the metal ion is sodium, potassium, calcium or aluminium.**

A chemist was told to carry out a test for each metal ion that could be present in this white solid.

**Describe tests to show the presence of each of these metal ions.
(6 marks)**

(Continue your answer on next page)

(Turn over)

(Turn over)

(Turn over)

(Turn over)

(Turn over)

(Turn over)

8 Most of the fuels used today are obtained from crude oil.

(a) Which statement about crude oil is correct? (1 mark)

- ☐ **A crude oil is a compound of different hydrocarbons**
- ☐ **B crude oil is a mixture of hydrocarbons**
- ☐ **C crude oil contains different hydrocarbons, all with the same molecular formula**
- ☐ **D crude oil is an unlimited supply of hydrocarbons**

(Question continues on next page)

(Turn over)

(b) Crude oil is separated into several fractions by fractional distillation. Two of these fractions are kerosene and diesel oil.

(i) State a use for each of these fractions. (2 marks)

kerosene _____

diesel oil _____

(Question continues on next page)

(Turn over)

- (ii) Figure 13 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

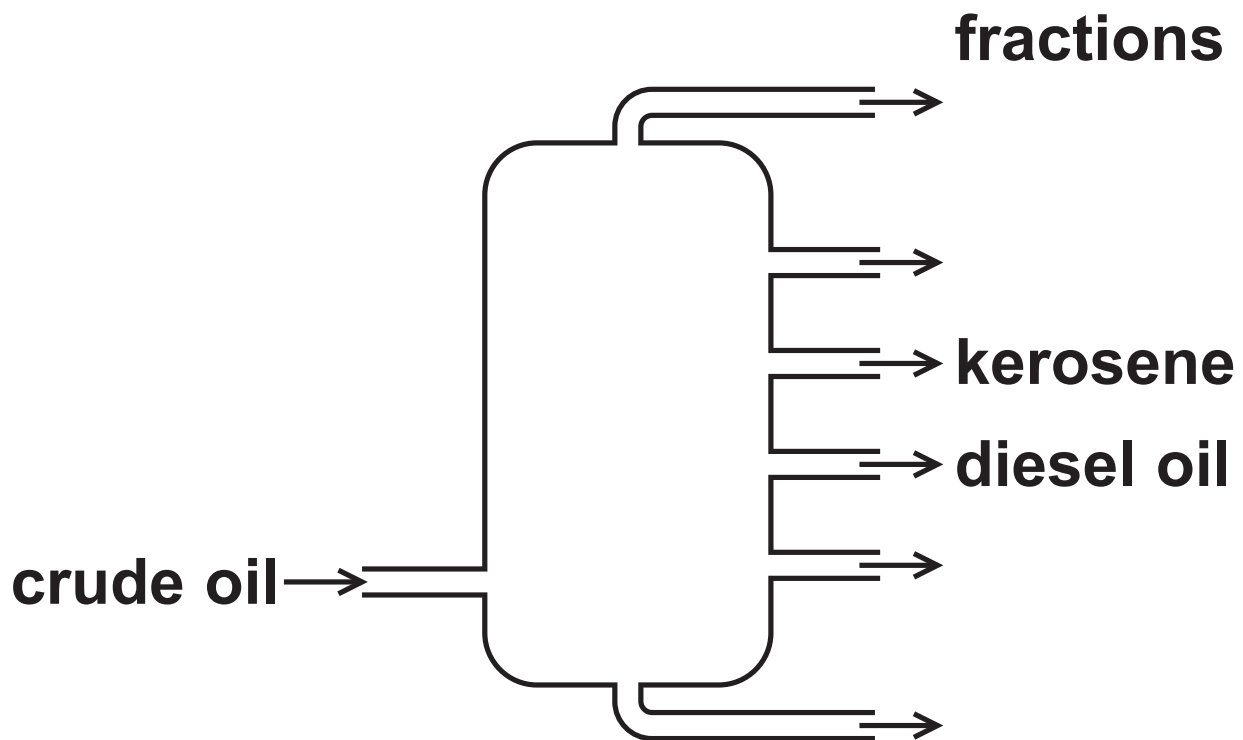


Figure 13

**Kerosene is obtained higher up the column than diesel oil.
Kerosene and diesel oil fractions have slightly different properties.**

(Question continues on next page)

(Turn over)

**Choose a property.
State how this property for
kerosene compares with the
property for diesel oil. (1 mark)**

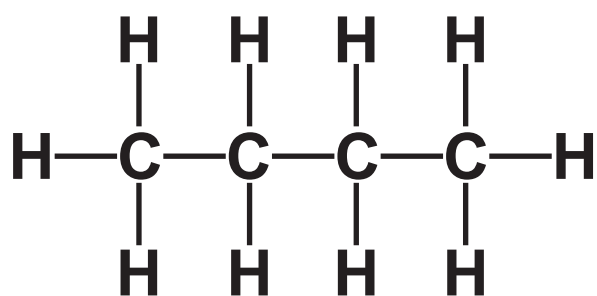
property _____

comparison _____

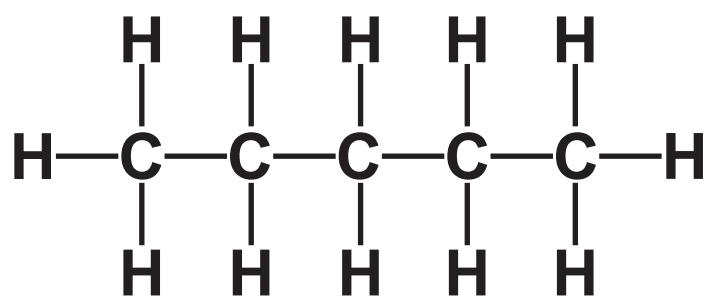
(Question continues on next page)

(c) Figure 14 shows the formulae of a molecule of butane and of a molecule of pentane.

Butane and pentane are neighbouring members of the same homologous series.



butane



pentane

Figure 14

(Question continues on next page)

(Turn over)

- (i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.
(2 marks)

(Question continues on next page)

(Turn over)

(ii) Butane has the formula C_4H_{10} .

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: $\text{H} = 1.00$,
 $\text{C} = 12.0$;

relative formula mass: $\text{C}_4\text{H}_{10} = 58.0$)

You must show your working.
(3 marks)

mass of carbon = _____ g

(Question continues on next page)

(Turn over)

(iii) Butane burns completely in air to form carbon dioxide and water.

Write the word equation for this reaction. (2 marks)

(TOTAL FOR QUESTION 8 = 11 MARKS)

(Questions continue on next page)

(Turn over)

- 9 (a) An aluminium atom has the atomic number 13 and the mass number 27.

Which row shows the numbers of subatomic particles present in an aluminium ion, Al^{3+} ? (1 mark)

	protons	neutrons	electrons
<input type="checkbox"/> A	13	14	13
<input type="checkbox"/> B	13	14	10
<input type="checkbox"/> C	14	13	10
<input type="checkbox"/> D	14	13	17

(Question continues on next page)

(Turn over)

- (b) Magnesium burns in excess oxygen to form magnesium oxide.
The balanced equation for this reaction is**



Starting with 1.35 g of magnesium, calculate the maximum mass of magnesium oxide that could be formed in this reaction.

**(relative atomic masses:
O = 16.0, Mg = 24.0)**

(Question continues on next page)

(Turn over)

**You must show your working.
(3 marks)**

mass of magnesium oxide = _____ g

(Question continues on next page)

(Turn over)

(c) Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction. (3 marks)

(Question continues on next page)

- *(d) Sodium chloride is an ionic compound, containing sodium ions, Na^+ , and chloride ions, Cl^- .**

Figure 15 shows the electronic configuration of sodium and chlorine.

	electron configuration
sodium	2.8.1
chlorine	2.8.7

Figure 15

Explain how sodium and chlorine atoms form the ions in sodium chloride and how the ions are arranged in the solid sodium chloride.

(Question continues on next page)

(Turn over)

**You may wish to use diagrams in
your answer. (6 marks)**

(Continue your answer on next page)
(Turn over)

(Continue your answer on next page)
(Turn over)

(Continue your answer on next page)
(Turn over)

(Continue your answer on next page)
(Turn over)

(Continue your answer on next page)
(Turn over)

(Turn over)

- 10 (a) Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.**

The reaction is carried out at 30 °C.

**Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.
(2 marks)**

(Question continues on next page)

(Turn over)

(b) Ethanol, $\text{C}_2\text{H}_5\text{OH}$, can be converted into ethanoic acid, CH_3COOH .

**(i) In this reaction ethanol is
(1 mark)**

- ☐ **A hydrated**
- ☐ **B oxidised**
- ☐ **C polymerised**
- ☐ **D reduced**

(Question continues on next page)

(Turn over)

- (ii) Draw the structure of a molecule of ethanoic acid, CH_3COOH , showing all covalent bonds. (2 marks)**

(Question continues on next page)

(Turn over)

- (c) (i) The apparatus in Figure 16 can be used to investigate the temperature rise produced in a known mass of water when a sample of ethanol is burned.

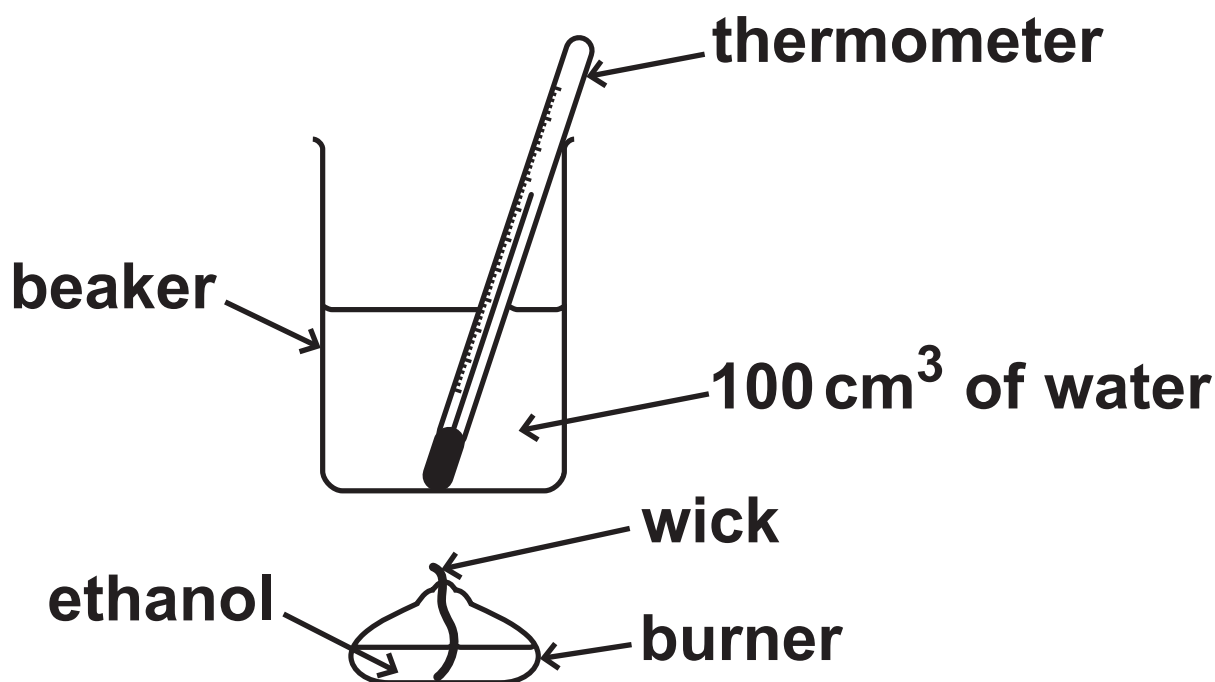


Figure 16

(Question continues on next page)

(Turn over)

The first steps of the method are

- 1. put 100 cm^3 of water into a beaker**
- 2. determine the mass of the burner containing ethanol**
- 3. measure the initial temperature of the water**
- 4. place the burner under the beaker of water**
- 5. light the wick**

(Question continues on next page)

(Turn over)

Describe the remaining steps of the method that are needed to determine the mass of ethanol required to raise the temperature of the water by 30 °C. (3 marks)

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

(Turn over)

- (ii) In a different experiment, separate samples of the alcohols methanol, ethanol, propanol, butanol and pentanol were burned to determine the mass of each alcohol that needs to be burned to raise the temperature of 100 cm^3 water by 10°C .

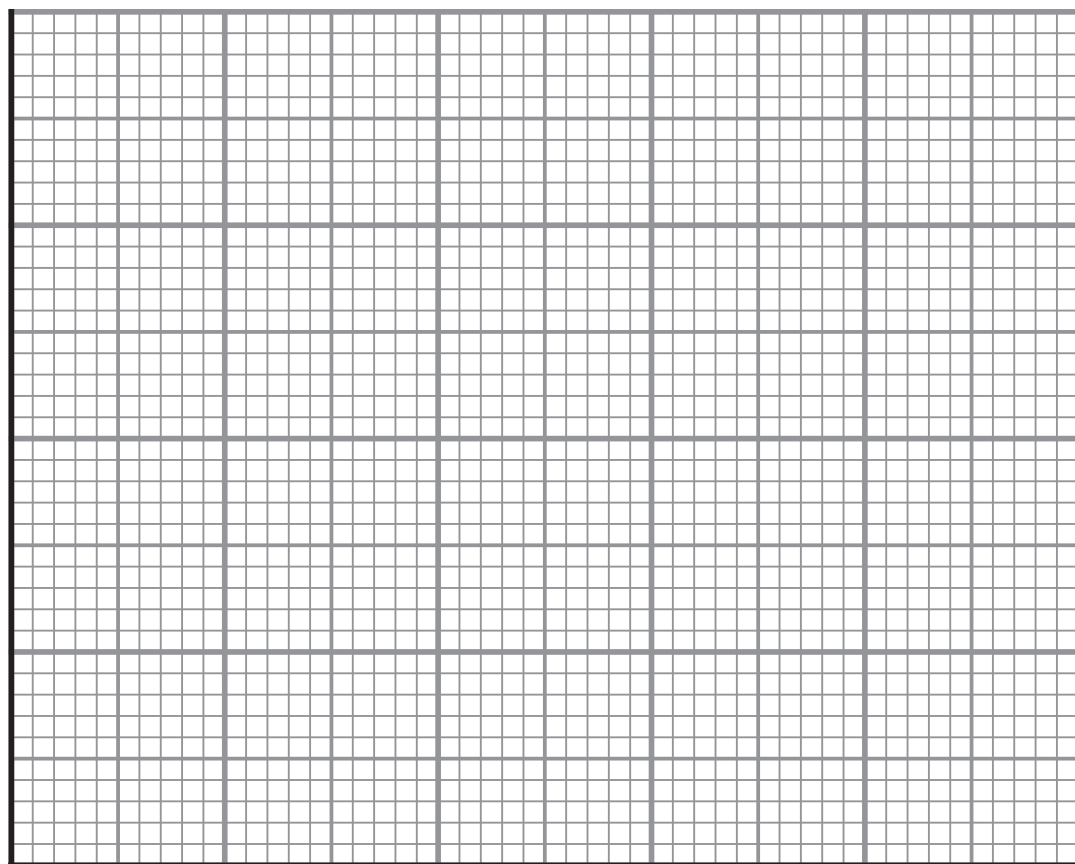
alcohol	number of carbon atoms in one molecule of alcohol	mass of alcohol burned in g
methanol	1	0.37
ethanol	2	0.28
propanol	3	0.25
butanol	4	0.23
pentanol	5	0.22

(Question continues on next page)

(Turn over)

Draw a graph of the mass of each alcohol required to raise the temperature of 100 cm^3 of water by 10°C against the number of carbon atoms in one molecule of that alcohol. (3 marks)

**mass of
alcohol
burned
in g**



**number of carbon atoms
in one molecule of alcohol**

(TOTAL FOR QUESTION 10 = 11 MARKS)

**TOTAL FOR PAPER = 100 MARKS
END**