

Chemistry Paper 2 for All Boards

1.1 A student is using marble chips in an investigation into how the concentration of hydrochloric acid affects the rate of reaction.

What is the independent variable? Tick **one** box. (1 mark)

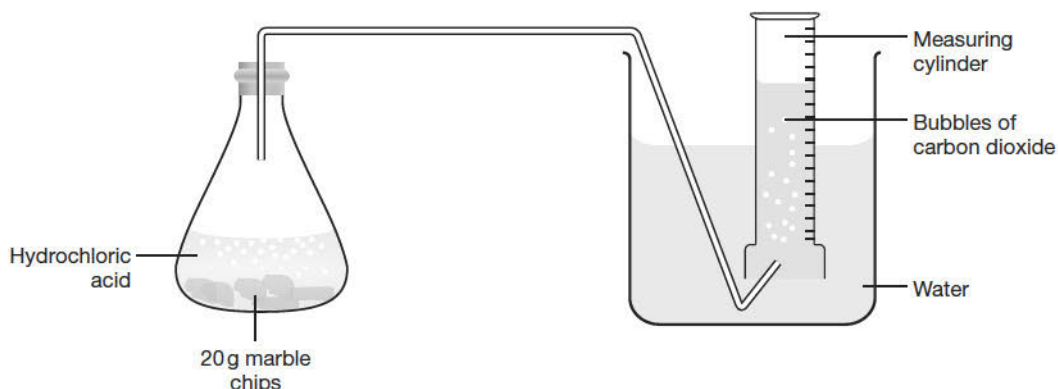
Temperature	<input type="checkbox"/>
Concentration of hydrochloric acid	<input type="checkbox"/>
Size of marble chips	<input type="checkbox"/>
Volume of carbon dioxide	<input type="checkbox"/>

1.2 The student predicted that the rate of reaction would decrease as the concentration of hydrochloric acid was increased.

Give **two** reasons the student's prediction is not correct. Tick **two** boxes. (2 marks)

There are more particles to react	<input type="checkbox"/>
The particles have more energy	<input type="checkbox"/>
The particles move faster	<input type="checkbox"/>
The rate of collisions increases	<input type="checkbox"/>

The student set up the equipment as shown below.



1.3 Explain how the student will record the rate of the reaction. (2 marks)

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1.4 The student recorded the results as shown in table 1.

Table 1

Time (s)	Volume of gas (dm ³)	
	0.5 mol/dm ³ HCl	1 mol/dm ³ HCl
0	0.00	0.00
20	0.03	0.06
40	0.05	0.08
60	0.07	0.09
80	0.08	0.09
100	0.09	0.09
120	0.09	0.09

On a piece of graph paper:

- Draw and label your axis
- Plot both sets of data in the table
- Draw lines of best fit for both sets of data. (4 marks)

1.5 Use your graph to determine the volume of gas produced at 50 seconds for both tests. (2 marks)

0.5 mol/dm³ HCl

1 mol/dm³ HCl

1.6 Explain what effect increasing the temperature would have on the rate of the reaction. (3 marks)

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1.7 The student was careful to make sure that the marble chips used in both tests were the same size. Explain why this is important. (2 marks)

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1.8 Use your graph to compare the rate of reaction as the reaction progresses when the students uses 20 dm³ of 0.5 mol/dm³ and 1 mol/dm³ hydrochloric acid with 20 g of marble chips. Explain your answer in terms of particles. (4 marks)

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2.1 Identify the alkane. Tick one box.

(1 mark)

C_4H_{10}	<input type="checkbox"/>
C_4H_6	<input type="checkbox"/>
C_2H_4	<input type="checkbox"/>
C_6H_{10}	<input type="checkbox"/>

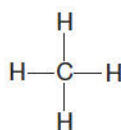
2.2 Identify the alkene. Tick one box.

(1 mark)

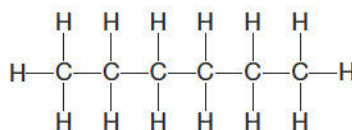
C_4H_{10}	<input type="checkbox"/>
CH_4	<input type="checkbox"/>
C_4H_8	<input type="checkbox"/>
C_6H_{10}	<input type="checkbox"/>

2.3 The structural formulae of two saturated hydrocarbons are shown below.

Compound A



Compound B

**a Identify compounds A and B. (1 mark)**

Compound A

Compound B

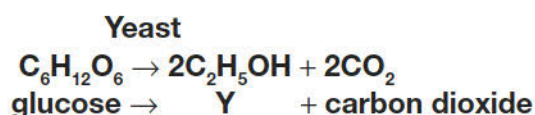
b Describe two ways in which they will differ in their physical properties. (2 marks)

i

ii

2.4 Compound Y is made by a process called X.

The reaction that occurs during process X is shown by the equation:

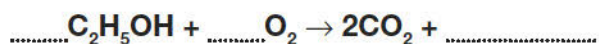
**a Name compound Y** (1 mark)**b Name process X** (1 mark)**2.5 Ethanol is a member of the homologous series of alcohols.****a Identify the correct general formula for alcohols. Tick one box. (1 mark)**

$C_nH_{2n}OH$	<input type="checkbox"/>
$C_{2n}H_{2n+1}OH$	<input type="checkbox"/>
$C_nH_{2n+2}OH$	<input type="checkbox"/>
$C_nH_{2n+1}OH$	<input type="checkbox"/>

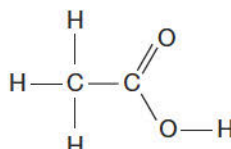
b What is the formula of the functional group for alcohols? (1 mark)

c Ethanol is used as a fuel because ethanol burns in oxygen.

Complete and balance the chemical equation for this reaction. (2 marks)



d Ethanol can be oxidised to produce the compound shown.



i What is the name of this compound? (1 mark)

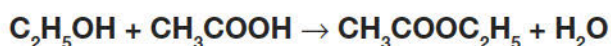
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ii When the compound shown dissolves in water, describe what would happen to the pH. (1 mark)

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e Ethanol reacts with this compound to produce the organic compound labelled C in the equation below.

Compound C



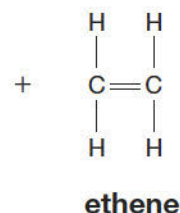
What type of organic compound is Compound C? (1 mark)

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2.6 Heptane (C_7H_{16}), is one of the hydrocarbons from crude oil used for the manufacture of poly ethene. The first stage of the process is the production of ethene and another hydrocarbon from heptane.

C_7H_{16}
heptane

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a In the box above, draw the structural formula of the other hydrocarbon produced. (2 marks)

b State **two** differences between the two products. (2 marks)

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- c i Name the process when ethene is produced from heptane. (1 mark)

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- ii Describe how this reaction is carried out. (2 marks)

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- d i Describe how the polymer poly ethene is produced from the monomer ethene. (2 marks)

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- ii Draw the equation for this reaction using displayed formulae. (2 marks)

- e Describe what is meant by the term 'condensation polymerisation'. Include in your answer how condensation polymers differ from those produced by the method you described in part (d (i)). (2 marks)

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- 3.1 Identify two substances that can be described as pure substances. Tick **two** boxes.

(2 marks)

Milk
Water
Steel
Air
Iron

3.2 What is the test for carbon dioxide? Tick **one** box. (1 mark)

Turns limewater cloudy	<input type="checkbox"/>
Turns litmus paper white	<input type="checkbox"/>
A glowing splint relights	<input type="checkbox"/>
A light splint pops	<input type="checkbox"/>

3.3 A student was given 5 unidentified metal ions to identify by carrying out flame tests.

- a The student carried out a series of tests to identify the metal ions, as shown in the table. Complete the table. (2 marks)

Metal ion	Flame colour
Copper	Green-blue
Calcium	
	Red
	Orange
Potassium	

- b Suggest **two** alternative methods the student could use to identify a mixture of metal ions. (2 marks)

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3.4 A student tested an unknown compound Z.

The student added water to compound Z.

The compound did not change the colour of a blue, roaring flame.

The student then added a solution of sodium hydroxide to compound Z. A white precipitate formed that dissolved when excess sodium hydroxide was added.

The student then added a solution of hydrochloric acid to compound Z. The mixture produced bubbles that turned limewater cloudy.

Identify substance Z. Explain your answer. (4 marks)

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4.1 Billions of years ago, the Earth's early atmosphere was probably like the atmosphere of Venus today.

The table below shows the temperature and the percentage composition of the atmospheres of the Earth and Venus today.

Name of gas	Percentage (%) composition of atmosphere	
	Earth today	Venus today
Nitrogen	78	3.5
Oxygen	20.5	trace
Argon	0.98	trace
Carbon dioxide	0.03	96.5
Water vapour	0.4	trace
Average surface temperature	20°C	460°C

a Use information from the table to help you to answer each question.

i In the Earth's atmosphere today, the main gas is (1 mark)

ii In the Earth's atmosphere billions of years ago the main gas was (1 mark)

b The Earth's surface is mainly covered with water.

There is no water on the surface of Venus. Suggest why. (3 marks)

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4.2 a Some scientists suggest that excess carbon dioxide should be prevented from entering the atmosphere. Explain why. (2 marks)

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b Explain what is meant by the term 'greenhouse effect'. (3 marks)

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c When fossil fuels are burned to release energy, some products are released into the atmosphere.

i Suggest **two** possible products, in addition to carbon dioxide, that may cause environmental or health problems. (2 marks)

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ii Suggest an environmental or health problem that may be caused by one of these products. (1 mark)

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5.1 In the UK, we use about 1.8 billion steel cans every year but only 25% are recycled.

Used steel cans are worth about £100 per tonne. Steel contains mostly iron.

Recycling saves raw materials and reduces waste that would end up in landfill. Producing steel by recycling used cans saves 75% of the energy that would be needed to produce steel from iron ore. This also reduces carbon dioxide emissions.

a Explain, in terms of atoms, why steel is stronger than iron. (3 marks)

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b Using the information given and your own knowledge and understanding of the extraction of iron from its ore, explain why the industry and consumers are encouraged to recycle used steel cans. (6 marks)

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5.2 Cassiterite is an ore of the metal tin.

a What is an ore? (2 marks)

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b Some metals are obtained by removing oxygen from the metal oxide.

What name do we give to this chemical reaction? (1 mark)

c Name one metal which must be extracted from its melted ore by electrolysis rather than by using carbon. (1 mark)

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5.3 In the United Kingdom, water is filtered and treated with chlorine to make it safe to drink.

Explain why the water is:

a Filtered (1 mark)

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b Treated with chlorine. (1 mark)

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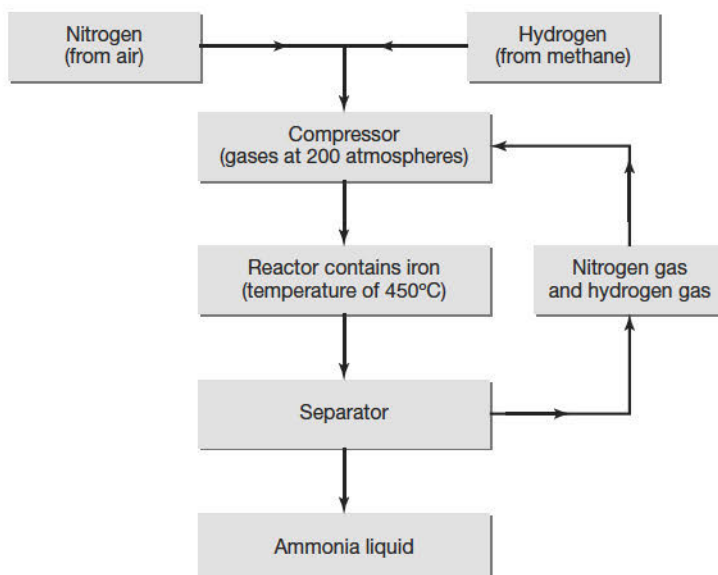
5.4 A student wanted to test the purity of a sample of water. Describe how the student could test that the water is pure. (2 mark)

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5.5. Ammonia is used in the production of fertilisers. This flow diagram shows the main stages in the manufacture of ammonia.

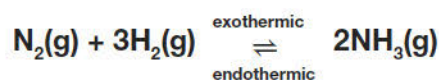
Study the flow diagram and then answer the questions below.



a What is the purpose of the iron in the reactor? (1 mark)

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b In the reactor the equation to produce ammonia is:



i The equation shows that the reaction is reversible.

Explain how the reaction reaches an equilibrium. (1 mark)

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ii The best yield of ammonia at equilibrium is produced at a low temperature. Explain why. (2 marks)

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iii The best yield of ammonia at equilibrium is produced at a high pressure. Explain why. (2 marks)

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