

AQA Style

GCSE CHEMISTRY

Higher Tier

Chemistry Paper 2

H

Time allowed: 1 hour 45 minutes

Materials

- A ruler
- A pen and pencil
- A calculator
- Periodic Table of Elements

Instructions and Information

- Answer all the questions using a black pen.
- Answer the questions in the space available and cross out any work you do not want to be marked.
- In any calculations make sure you show your working out.
- The marks for each question are shown in brackets.
- The maximum mark for the paper is 100.
- You must make your work as neat as possible and use good English in your answers.
- You should make sure you leave time to check your answers.

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Name _____

Date _____

0 1

Medicines are designed to treat symptoms or cure illness.

Most medicines contain an active ingredient along with other compounds. The active ingredient is the substance that has the desired effect in the body.

Medicines are formulations.

0 1 . 1

What is a formulation?

[1 mark]

Each batch of medicine must be tested to make sure it contains the correct ingredients.

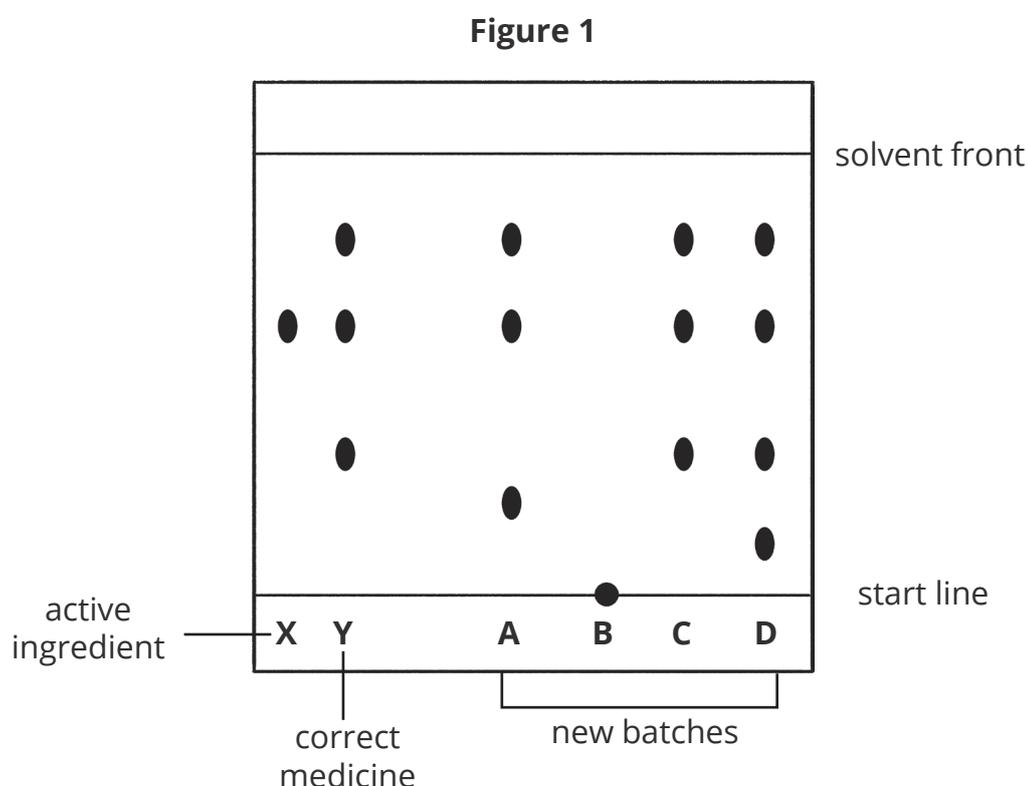
Chromatography is used to compare four new batches of a medicine.

Figure 1 shows the results.

Sample **X** is the active ingredient.

Sample **Y** is the correct medicine.

Samples **A - D** are the four new batches that were tested.



0 1 . 2 Which of the samples in **Figure 1** is a pure substance?

Tick **one** box.

[1 mark]

C

D

X

Y

0 1 . 3 Explain whether the new batches **A**, **B**, **C** and **D** contain the correct ingredients.

[4 marks]

0 1 . 4 Explain the result for batch **B**.

[2 marks]

Question 1 continues on the next page.

0 1 . 5 A scientist takes measurements for sample **X**. The results are shown in **Table 1**.

Table 1

	Distance (mm)
Distance Moved by Sample X	8
Distance Moved by the Solvent	40

Calculate the R_f value for sample **X**.

Use the results in **Table 1**.

[2 marks]

R_f value = _____

10

0 2

Life cycle assessments (LCAs) are carried out to assess the environmental impacts of products in each of four stages.

0 2 . 1

Give **two** of the stages that are considered in a life cycle assessment.

[2 marks]

1. _____

2. _____

0 2 . 2

Table 2 shows some information collected from life cycle assessments of shopping bags made of plastic and paper.

Table 2

Indicator of Environmental Impact (per 1000 bags)	Plastic Bag	Paper Bag
Volume of Water Used (l)	230	930
Mass of CO ₂ Released (kg)	1.5	4.5
Relative Risk of the Bag Becoming Litter	1	0.2

Compare the two types of shopping bag.

Use information from **Table 2**.

[4 marks]

0 2 . 3 Give **one** criticism of life cycle assessments.

[1 mark]

7

0 3 Carbon dioxide is a greenhouse gas.

0 3 . 1 Name **one** other greenhouse gas.

[1 mark]

0 3 . 2 Give **two** human activities that increase the amount of greenhouse gases in the Earth's atmosphere.

[2 marks]

1. _____

2. _____

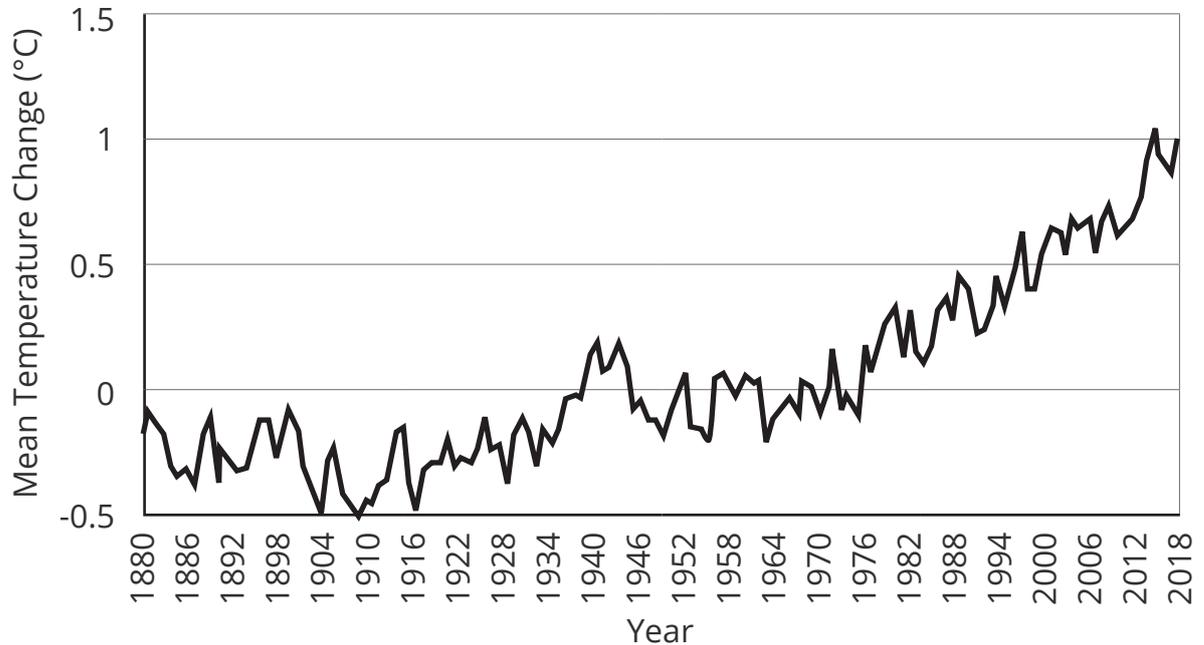
Question 3 continues on the next page.

03.3

The temperature of the Earth's atmosphere is measured in different locations around the Earth. The data from these locations is verified using multiple methods and then used to calculate the mean temperature change per year.

Figure 2 shows the mean yearly temperature change over the last 140 years.

Figure 2



The measurements and methods used to collect the data are published in scientific journals.

Explain why it is important that the data is published in scientific journals.

[2 marks]

0 4 Propane (C₃H₈) burns in oxygen.

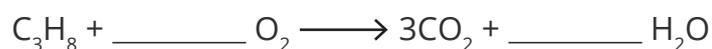
0 4 . 1 Describe the test for oxygen.

You should include the result you would expect to see.

[2 marks]

0 4 . 2 Balance the symbol equation for the complete combustion of propane.

[1 mark]



0 4 . 3 Calculate the percentage by mass of carbon in propane (C₃H₈).

Give your answer to 3 significant figures.

Relative atomic masses (A_r): H = 1, C = 12

Relative formula mass (M_r): C₃H₈ = 44

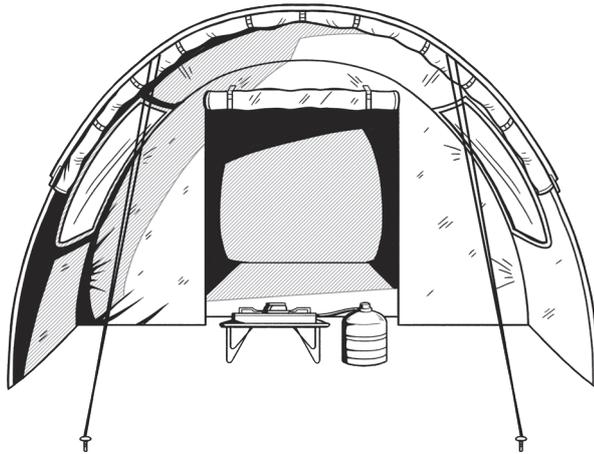
[3 marks]

percentage by mass of carbon = _____ %

0 4 . 4

Propane canisters are used to fuel camping stoves. Camping stoves are often set up in a tent porch as shown in **Figure 4**.

Figure 4



If the camping stove was set up inside the tent, there would be less air available to the stove.

Explain why the stove should **not** be set up inside the tent

[4 marks]

10

0 5 . 2 Potassium chloride and potassium sulfate are obtained by mining. These compounds are used to make NPK fertilisers.

Phosphate rock is also obtained by mining. Phosphate rock must be processed before it can be used to produce NPK fertilisers.

Describe the steps required to make ammonium phosphate from phosphate rock.

You should name all the compounds produced during the process.

[4 marks]

10

Turn over for the next question

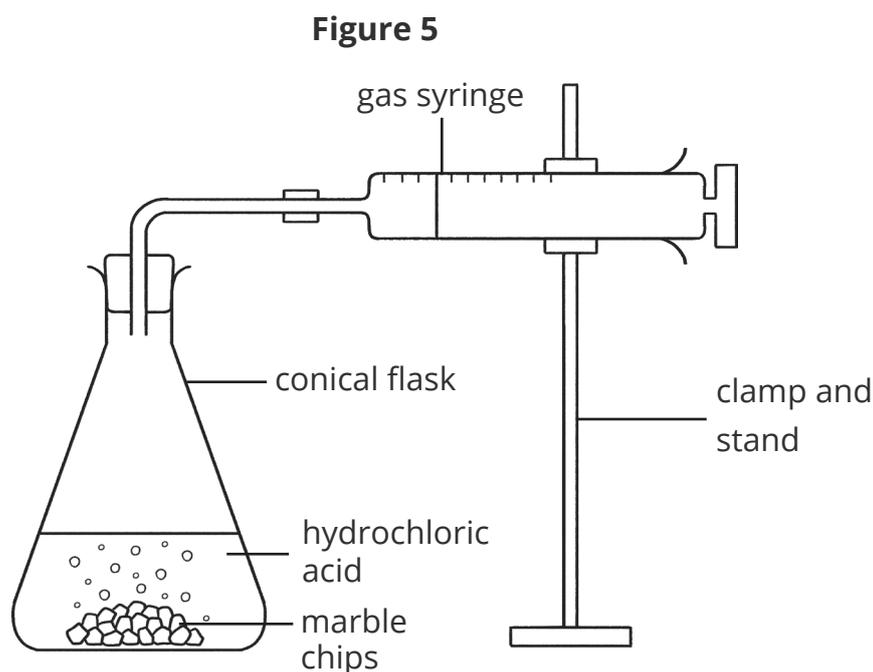
06

A student investigated the effect of the concentration of acid on the rate of the reaction between marble chips and hydrochloric acid.

They used the following method:

1. Pour 50cm³ of hydrochloric acid into a conical flask.
2. Add 10g of marble chips to the conical flask.
3. Connect a gas syringe to the conical flask.
4. Record the volume of gas produced every 20 seconds.
5. Repeat steps 1 to 4 with different concentrations of acid.

A diagram of the equipment is shown in **Figure 5**.



06.1

Give **two** control variables in this investigation.

[2 marks]

1. _____

2. _____

06.2

Give **one** source of error in this investigation.

[1 mark]

06.3 Table 3 shows the student's results for 1 mol/dm³ hydrochloric acid.

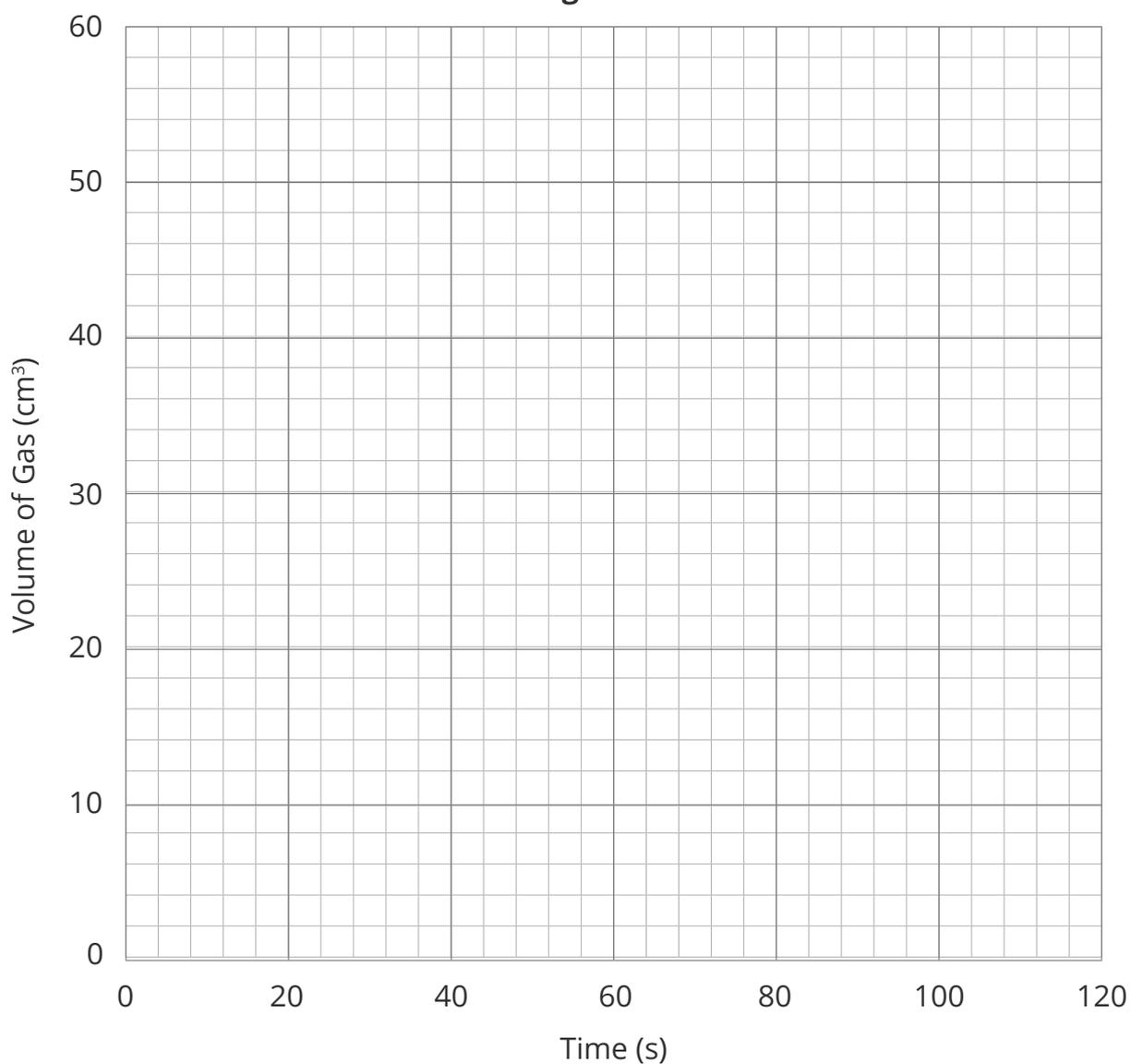
Table 3

Time (s)	Volume of Gas (cm ³)
0	0
20	15
40	30
60	35
80	50
100	52
120	52

- Plot the data from **Table 3** on **Figure 6**.
- Draw a line of best fit, ignoring any anomalous results.

[3 marks]

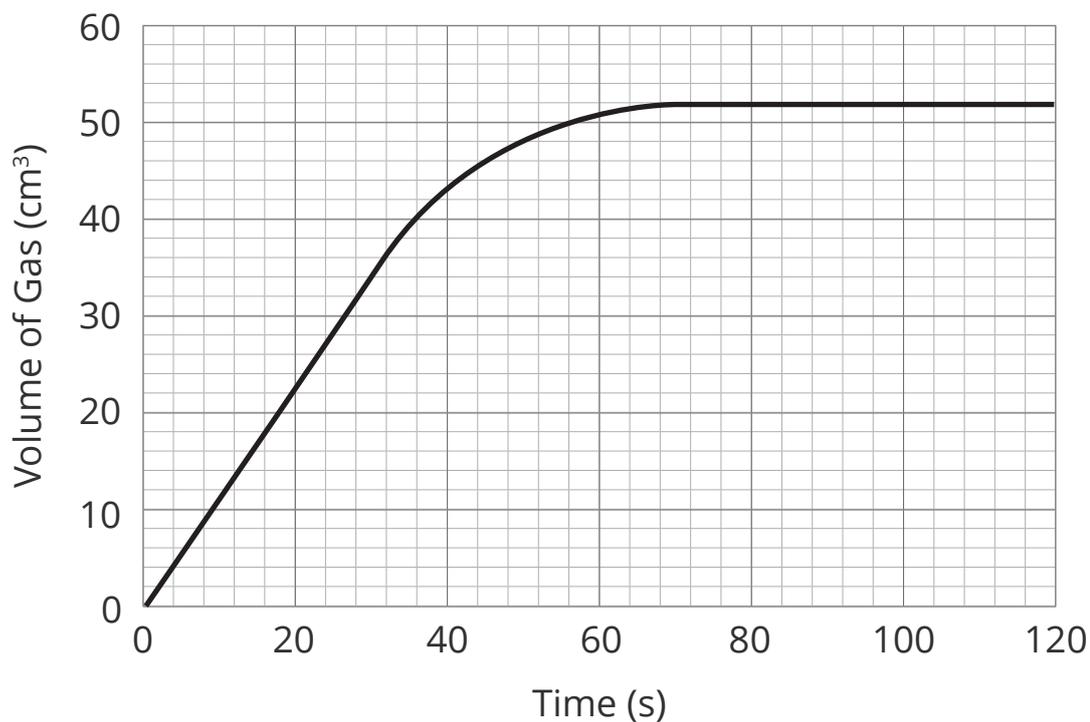
Figure 6



06.4 The student repeated the investigation using 1.5mol/dm^3 hydrochloric acid.

Figure 7 shows a graph of their results.

Figure 7



Describe how the rate of the reaction changes over time.

[3 marks]

06.5 Calculate the rate of the reaction at 40 seconds.

Give the unit.

[4 marks]

rate of reaction = _____ unit _____

07

Tooth decay causes holes (cavities) in teeth. These holes need to be filled as soon as possible.

One type of tooth filling is called a composite filling.

A composite filling has a matrix made of a polymer resin. The reinforcement material is glass or silica particles.

07.1

Explain the role of the polymer resin in the composite filling.

[1 mark]

07.2

Food and drink can have large variations in temperature, from cold ice cream to hot coffee.

Explain why a thermosoftening polymer would not be suitable for use as a tooth filling.

[2 marks]

Question 7 continues on the next page.

07.3 Another type of filling that dentists can use is an amalgam filling.

Table 4 gives some information about amalgam fillings and composite fillings.

Table 4

Property	Amalgam Filling	Composite Filling
Average Lifetime (years)	15	7 – 10
Colour	silver	can be matched to teeth
Durability	strong and resistant to wear	cannot withstand the chewing forces on teeth at the back of the mouth
Preparation	requires a large hole to be drilled in the tooth	only a small amount of the tooth needs to be removed

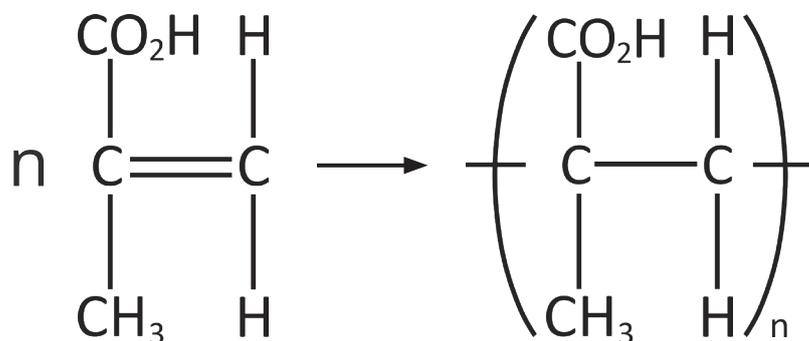
Evaluate the use of each type of material to fill a tooth cavity.

[4 marks]

- 07.4 The polymer resin used in the composite filling is based on a polymer made from methacrylic acid.

Figure 8 represents the equation for the polymerisation of methacrylic acid.

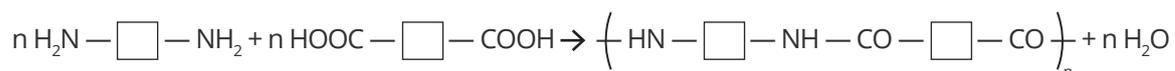
Figure 8



Using dental floss can reduce the chance of cavities developing. Dental floss is made from a polymer called nylon.

Figure 9 represents the equation for the formation of nylon.

Figure 9



Compare the reaction used to produce poly(methacrylic acid) with the reaction used to produce nylon.

[3 marks]

0 8 Biological methods are being introduced to extract copper.

0 8 . 1 Give **two** reasons why biological methods are being used for extracting copper.

[2 marks]

1. _____

2. _____

0 8 . 2 Biological methods of copper extraction produce compounds such as copper sulfate.

Explain why copper can be extracted from copper sulfate solution by adding iron.

[2 marks]

0 8 . 3 A solution of copper sulfate (CuSO_4) has a concentration of 0.957g/dm^3 .

Relative atomic masses (A_r): Cu = 63.5, O = 16, S = 32

Calculate the number of moles of copper that can be produced from 1dm^3 of the solution.

[3 marks]

number of moles = _____ mol

0 8 . 4 When anhydrous copper sulfate (white) reacts with water it forms hydrated copper sulfate (blue).

The equation for the reaction is:



The forward reaction is exothermic.

Predict the effect of increasing the temperature on the amount of hydrated copper sulfate produced at equilibrium.

Explain your answer using Le Chatelier's principle.

[2 marks]

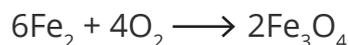
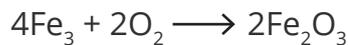
9

Turn over for the next question

09

Banded iron formations are sedimentary rocks that contain layers of iron oxide, Fe_3O_4 or Fe_2O_3 .

The equations for the reactions that form these sediments are:



09.1

Explain why there are no banded iron formations older than 2.7 billion years old.

[2 marks]

09.2

Limestone is another type of sedimentary rock.

A source rock is a rock with a high concentration of organic material that can be transformed into crude oil at high temperatures.

Explain why limestone is a good source rock for crude oil.

[1 mark]

09.3

Most of the hydrocarbons in crude oil are alkanes.

Write down the general formula for an alkane.

[1 mark]

0 9 . 4 Hydrocarbon fuels are produced from crude oil.

Crude oil is separated into fractions by fractional distillation.

Explain why petrol is collected at a higher level of the fractionating column than kerosene.

[4 marks]

0 9 . 5 **Table 5** shows some information about petrol and kerosene.

Table 5

	Percentage in Crude Oil (%)	Percentage Demand (%)
Petrol	9	23
Kerosene	14	8

Suggest how the demand for petrol can be met.

[2 marks]

1 | 0

A student reacts ethene with bromine water to form dibromoethane.

The equation for the reaction is:



1 | 0 | 1

Draw the fully displayed structural formula of dibromoethane.

[2 marks]

1 | 0 | 2

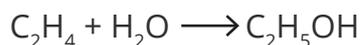
Describe what the student would observe when the reaction takes place.

[1 mark]

1 | 0 | 3

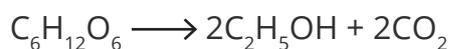
The hydration of ethene produces ethanol.

The equation for the reaction is:



Ethanol can also be produced by fermentation of sugar solution.

The equation for the reaction is:



Compare the two methods of producing ethanol.

[3 marks]

1 0 . 4 Ethanol is used to make alcoholic drinks such as wine.

If wine is left open to the air it starts to smell like vinegar. Vinegar contains ethanoic acid.

Name the type of reaction causes the wine to smell like vinegar.

[1 mark]

1 0 . 5 Ethanol and ethanoic acid react in the presence of a sulfuric acid catalyst.

Name the product of this reaction.

[1 mark]

1 0 . 6 Explain why a solution of ethanoic acid has a higher pH than a solution of sulfuric acid.

[2 marks]

10

END OF QUESTIONS