AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.2.3

Alcohols

Past-paper questions

Tier	**Foundation**
Question groups	**34**
Available paper years	**2007–2023**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.7.2.3 Alcohols

Question 01

March 2007 | CHY1A | Original Q8 | Legacy

QUESTION EIGHT

Crude oil is a non-renewable energy source. Petrol is a fuel obtained from the fractional distillation of crude oil.

Gasohol is also a fuel. It is a mixture of 90 % petrol and 10 % ethanol. The ethanol can be produced from the waste stems and leaves when crops have been harvested. So ethanol is a renewable energy source.

	Mass in grams of gas produced by completely burning 10 cm^3 of fuel		
Fuel	Carbon dioxide from petrol	Carbon dioxide from ethanol	Water vapour
Petrol	26.4	0	12.6
Gasohol	23.8	1.5	12.2

8A What is the total mass of carbon dioxide produced when 10 cm^3 of gasohol is burned?

1 22.3 g

2 23.8 g

3 25.3 g

4 26.4 g

8B How much more carbon dioxide is produced when 10 cm^3 of petrol is burned than when 10 cm^3 of gasohol is burned?

1 0.4 g

2 1.1 g

3 1.6 g

4 24.9 g

4.7.2.3 Alcohols

8C Why is the water vapour produced by burning fuels not a problem?

1 It condenses to a liquid.

2 It does not cause corrosion.

3 It is not a pollutant.

4 Very little is produced.

8D Carbon dioxide causes environmental problems.

Why is carbon dioxide from burning ethanol thought to be less of a problem than carbon dioxide from burning petrol?

1 Not as much carbon dioxide is produced.

2 The carbon dioxide produced has different chemical properties.

3 It is just recycling carbon dioxide removed from the air by plants.

4 The ethanol is not produced from crude oil.

4.7.2.3 Alcohols

Question 02

March 2007 | CHY1B | Original Q3 | Legacy

QUESTION THREE

This question is about four chemical substances.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A ethanol

B ethene

C helium

D poly(propene)

	What we can say about the substance
1	It is an unreactive gas.
2	It is produced when an alkene reacts with steam.
3	It is a polymer.
4	It belongs to a group of hydrocarbons with the general formula C_nH_{2n}

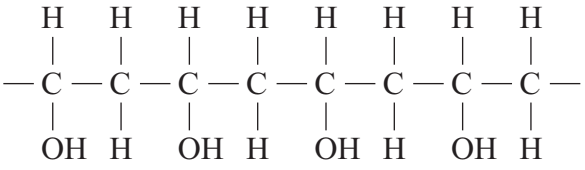
4.7.2.3 Alcohols

Question 03

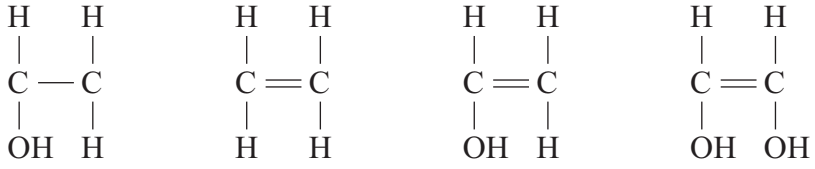
June 2007 | CHY1B | Original Q9 | Legacy

QUESTION NINE

Poly(vinyl alcohol) has this structure:



9A The monomer from which poly(vinyl alcohol) is made can be represented by . . .



1 **2** **3** **4**

Poly(vinyl alcohol) reacts with a solution of sodium borate to form 'slime'.
Slime can be fluid or, when almost solid, it can retain its shape.

A student measured the relationship between the spread of a lump of slime and the concentration of the sodium borate solution used to make it.
She called this 'the slump test'.

The student followed this procedure:

- make a sample of slime using 50 cm^3 of 4 % poly(vinyl alcohol) solution and 5 cm^3 of a 1 % solution of sodium borate
- stir the mixture for 2 minutes
- measure out 50 cm^3 of the slime produced and make this into a disc shape
- place this disc on paper and mark its outline with a pencil line
- leave for 5 minutes
- mark the new outline of the slime with a pencil
- calculate the increase in area of the disc
- repeat, using different concentrations of sodium borate to make the slime.

9B The student would have achieved greater accuracy in the test if she had . . .

1 used a smaller piece of slime.

2 stirred the reacting mixture for more than 2 minutes.

3 allowed the slime to spread for less than 5 minutes.

4 controlled the starting area of the slime discs.

Question 03 · continued

9C One variable that she did not control was . . .

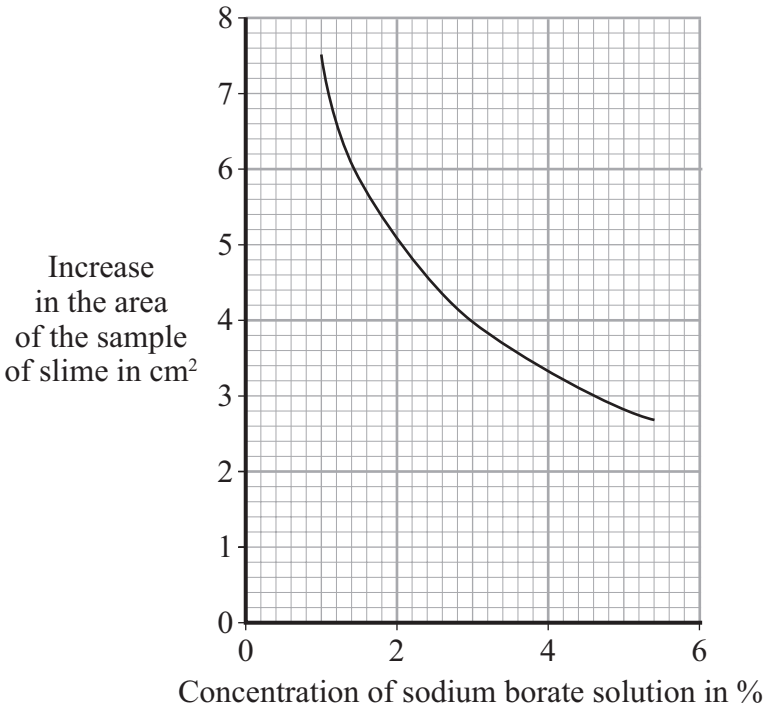
1 the concentration of the poly(vinyl alcohol).

2 the room temperature during the slump test.

3 the volume of the sodium borate solution.

4 the volume of the slime.

9D The student's results are shown on the graph.



The graph shows that . . .

1 the increase in area is directly proportional to the concentration of the sodium borate solution.

2 there is a linear relationship between the increase in area and the concentration of the sodium borate solution.

3 the increase in area is reduced as the sodium borate solution becomes more concentrated.

4 there is no relationship between the size of the disc and the concentration of the sodium borate solution.

END OF TEST

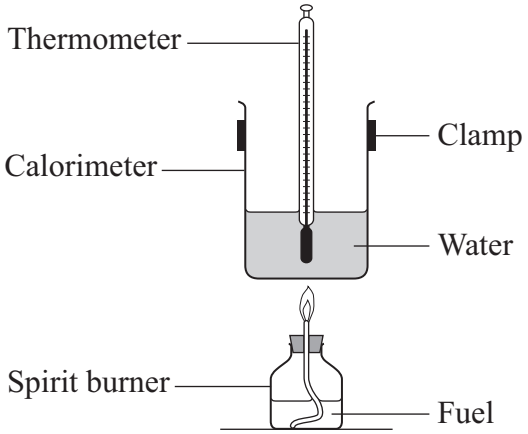
4.7.2.3 Alcohols

Question 04

January 2008 | CHY3F | Original Q5 | Legacy

5 A student burned four fuels and compared the amounts of energy they produced.

The student set up the apparatus as shown in the diagram.



The heat produced when each fuel was burned was used to raise the temperature of 100 g of water. The student noted the mass of fuel burned, the increase in temperature and whether the flame was smoky.

The results are shown in the table.

Fuel	Mass of fuel burned (g)	Temperature increase (°C)	Type of flame
Ethanol	4	24	Not smoky
Methanol	3	9	Not smoky
Peanut oil	2	20	Smoky
Vegetable oil	1	15	Smoky

(a) The student suggested that the vegetable oil was the best fuel for producing heat.

Explain why.

.....

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.....

.....

(2 marks)

Question 04 · continued

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(b) Suggest an environmental problem that could be caused when large amounts of vegetable oil are burned. Suggest how the problem could be overcome.

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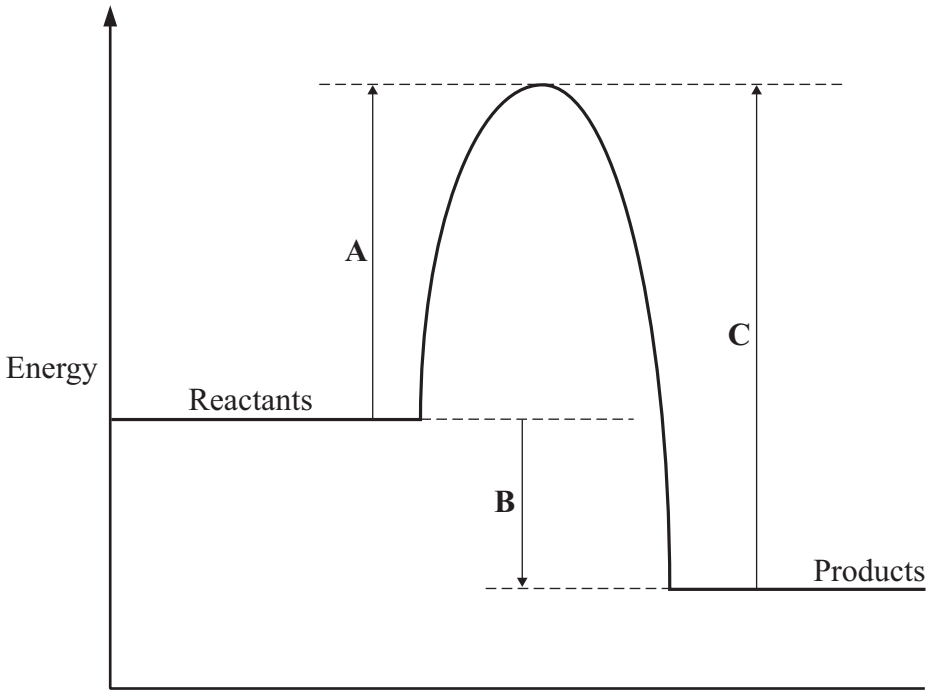
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(2 marks)

(c) An energy level diagram for the burning of vegetable oil is shown below.



Which of the energy changes **A**, **B** or **C**:

(i) represents the activation energy .....

(1 mark)

(ii) shows the amount of energy given out during the reaction? .....

(1 mark)

6

4.7.2.3 Alcohols

Question 05

June 2008 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Scientists are researching new catalysts to convert compounds in coal into small hydrocarbon molecules.

These small molecules can be used to make liquid fuels such as petrol.

9A Scientists are trying to develop processes that convert coal into liquid fuels, such as petrol, because . . .

1 they have found new supplies of catalysts.

2 oil reserves are running out quickly.

3 there is no alternative to using coal.

4 catalysts are being used up.

9B Petrol is made from small molecules and **not** large molecules because hydrocarbons with small molecules . . .

1 have a higher boiling point.

2 are more viscous.

3 are darker in colour.

4 ignite more easily.

9C Both petrol and coal produce carbon dioxide when burned.

To compare the volume of the gas produced by a sample of coal with the volume of gas produced by a sample of petrol, a control variable would be . . .

1 how much carbon dioxide is produced.

2 the amount of coal and petrol used.

3 the speed at which each fuel is set alight.

4 the time taken to burn all the fuel.

4.7.2.3 Alcohols

9D Ethanol, made from plant material, is another liquid fuel used in cars.

Ethanol and petrol produce similar amounts of carbon dioxide when they burn.

Burning ethanol made from plant material, in cars, is thought to be less of an environmental problem than burning petrol.

This is because . . .

1 ethanol does **not** produce water when it burns.

2 using ethanol made from plants as a fuel does **not** change the amount of carbon dioxide in the atmosphere.

3 ethanol will burn without using oxygen.

4 in the car engine, only partial combustion of the ethanol occurs.

END OF TEST

4.7.2.3 Alcohols

Question 06

June 2008 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

This question is about unsaturated hydrocarbons.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A catalysis

B polymerisation

C combustion

D thermal decomposition

Heating large hydrocarbon molecules so that they break down into smaller molecules, such as ethene, is an example of . . . **1** . . . .

Ethanol is formed when ethene reacts with steam. The reaction is speeded up using phosphoric acid. This reaction is an example of . . . **2** . . . .

Individual ethene molecules can be made to link together to form very long chains in a process called . . . **3** . . . .

Ethene reacts with oxygen to produce carbon dioxide and water. This reaction is an example of . . . **4** . . . .

4.7.2.3 Alcohols

Question 07

June 2008 | CHY3F | Original Q4 | Legacy

4 (a) The table shows the amount of energy produced by some food components.

Food component	Energy in kilocalories per gram
Carbohydrates	4
Dietary fibre	2
Ethanol	7
Fats	9
Sugar-free sweeteners	2.4

4 (a) (i) Which food component produces the most energy per gram?

.....

(1 mark)

4 (a) (ii) A packet of vegetable soup contains 25 g of carbohydrates.

Calculate the number of kilocalories produced by the carbohydrates in this packet of soup.

.....

Answer = ... kilocalories

(1 mark)

4 (a) (iii) Dietary information is usually given in kilocalories.

Which other energy unit is also used?

Draw a ring around your answer.

kilograms **kilojoules** **kilometres**

(1 mark)

4.7.2.3 Alcohols

Question 07 · continued

for mark

4 (b) (i) Suggest why chips have more energy than the same mass of boiled potatoes.

.....

.....

.....

.....

(2 marks)

4 (b) (ii) Suggest why eating too many chips could be unhealthy.

.....

.....

(1 mark)

6

Turn over for the next question

4.7.2.3 Alcohols

Question 08

November 2008 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

Hydrocarbon fuels, **K**, **L**, **M** and **N**, were burned and the products were collected and identified.

The results are shown in the table below.

	Hydrocarbon fuels			
Products of burning	**K**	**L**	**M**	**N**
Carbon monoxide	✓	✓	✓	✗
Carbon dioxide	✓	✓	✓	✓
Water vapour	✓	✓	✓	✓
Soot	✓	✓	✗	✗
Sulfur dioxide	✗	✗	✓	✓

Key:
✓ indicates that the substance is one of the products
✗ indicates that the substance is **not** one of the products.

8A The results show that combustion was **only** complete for . . .

1 hydrocarbon fuel **K**.

2 hydrocarbon fuel **L**.

3 hydrocarbon fuel **M**.

4 hydrocarbon fuel **N**.

8B The table of results shows that the hydrocarbon fuels that do **not** contain sulfur are . . .

1 **M** and **N**.

2 **K** and **L**.

3 **L** and **M**.

4 **K** and **M**.

4.7.2.3 Alcohols

Question 08 · continued

8C When hydrocarbon fuels are burned, some of the products cause problems.

Which one of the following statements correctly describes a problem that is caused by the products of burning?

1 Sulfur dioxide in the air causes heavier rainfall.

2 Releasing large amounts of carbon dioxide into the atmosphere produces ‘acid rain’.

3 A build-up of particles in the air causes ‘global dimming’.

4 Releasing large amounts of carbon dioxide into the atmosphere causes ‘global dimming’.

8D Ethanol is a compound of carbon, hydrogen and oxygen.
Ethanol can be used as a fuel in vehicles together with, or in place of, hydrocarbon fuels.

An advantage of ethanol as a fuel is that when it burns . . .

1 no carbon dioxide is produced.

2 carbon dioxide and water are produced.

3 no sulfur dioxide is produced.

4 only water is produced.

4.7.2.3 Alcohols

Question 09

November 2008 | CHY1BP | Original Q3 | Legacy

QUESTION THREE

This question is about four substances.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A argon

B bromine

C ethanol

D nickel

1	It is an unreactive gas.
2	It is produced when ethene reacts with steam.
3	It will be turned from red-brown to colourless by unsaturated oils.
4	It acts as a catalyst in the reaction to hydrogenate unsaturated oils.

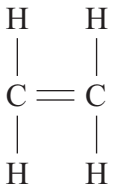
4.7.2.3 Alcohols

Question 10

June 2009 | CHY1F | Original Q5 | Legacy

5 Crude oil is used to make useful substances such as alkenes and plastics.

5 (a) The alkene shown is ethene.



5 (a) (i) Tick (✓) the correct formula for ethene.

Formula	(✓)
CH_4	
C_2H_4	
C_2H_6	

(1 mark)

5 (a) (ii) Tick (✓) the name of the plastic formed when many ethene molecules join together.

Name of plastic	(✓)
Poly(ethene)	
Poly(ethanol)	
Poly(propene)	

(1 mark)

4.7.2.3 Alcohols

Question 10 · continued

for mark

5 (b) Read the article about plastics and then answer the questions.

THE PROBLEM WITH PLASTIC WASTE

The UK produces about 3 million tonnes of plastics from crude oil every year.
Most of the litter found on UK beaches is plastic waste.
80% of the plastics produced end up in landfill sites.
The UK recycles only 7% of plastic waste.

5 (b) (i) Draw a ring around the correct answer in the box to complete the sentence.

Litter that is plastic waste needs to be removed from beaches

because it

- decomposes.
- is flammable.
- is not biodegradable.

(1 mark)

5 (b) (ii) Suggest a problem caused by 80% of the plastics going to landfill sites.

.....

.....

(1 mark)

5 (b) (iii) The UK government has set a target to recycle 30% of plastic waste.

How are resources saved by recycling more plastics?

.....

.....

(1 mark)

5

4.7.2.3 Alcohols

Question 11

June 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The table shows information about four fuels, **A**, **B**, **C** and **D**.

	Fuel	Type of substance	Number of carbon atoms per molecule	Energy per g of fuel	Mass of carbon dioxide per g of fuel
A	LPG	Alkanes	3 or 4	50 kJ	3.0 g
B	Diesel	Alkanes	16–20	53 kJ	3.1 g
C	Ethanol	Alcohol	2	30 kJ	1.9 g
D	Hydrogen	Element	0	118 kJ	0.0 g

Match fuels, **A**, **B**, **C** and **D**, with the numbers **1–4**.

1 This fuel has the lowest boiling point of the fuels that are alkanes.

2 This fuel does not produce carbon dioxide when burned.

3 This fuel gives the least amount of energy per gram when burned.

4 This fuel has the most carbon atoms in its molecules.

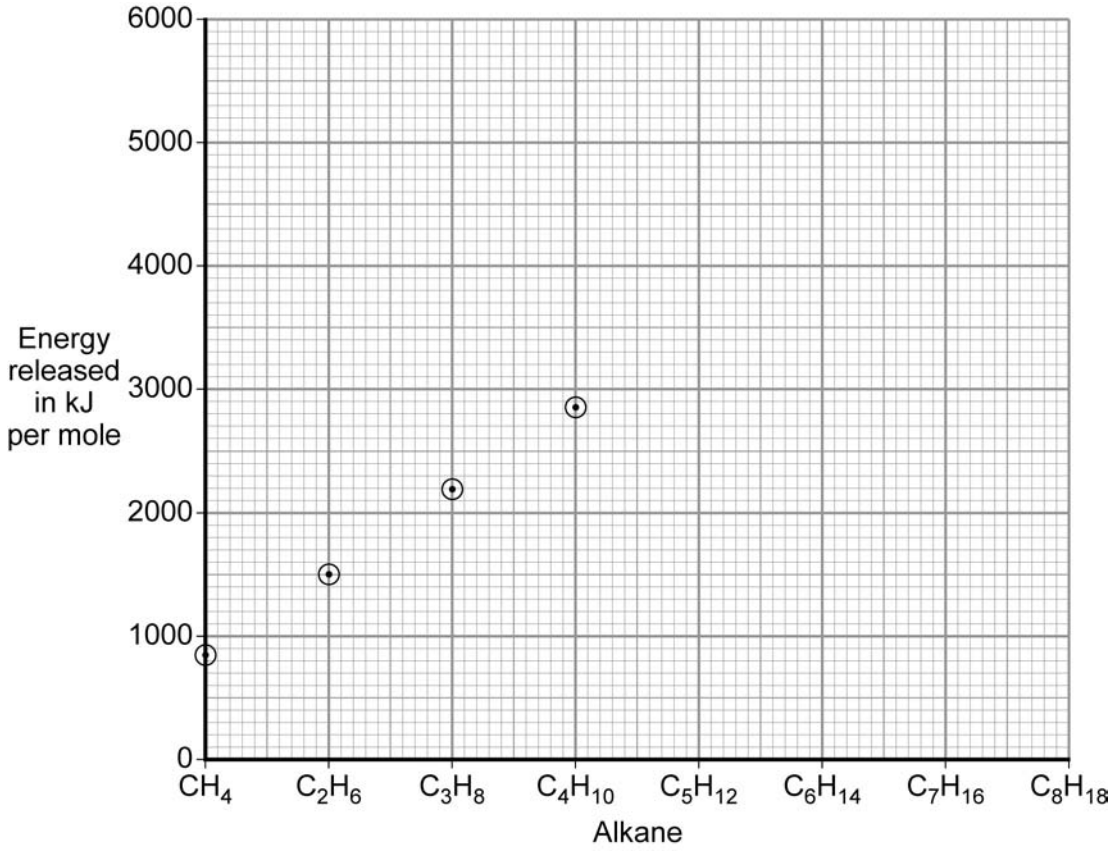
4.7.2.3 Alcohols

Question 12

June 2010 | CHY3F | Original Q6 | Legacy

6 (a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



6 (a) (i) Draw a line through the points and extend your line to the right-hand edge of the graph.

(1 mark)

6 (a) (ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned.

Energy released = ... kJ

(1 mark)

4.7.2.3 Alcohols

Question 12 · continued

6 (a) (iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}).

.....

.....

(1 mark)

6 (a) (iv) A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as butane (C_4H_{10}), and made the following prediction:

"When burned, 1 mole of octane releases twice as much energy as 1 mole of butane."

Use the graph to decide if the student's prediction is correct. You **must** show your working to gain credit.

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

4.7.2.3 Alcohols

Question 12 · continued

6 (b) Some information about four fuels is given in the table.

Fuel	Type	Heat released in kJ per g	Combustion products			Type of flame
			CO_2	SO_2	H_2O	
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct **and** explain your answer.

6 (b) (i) "Renewable fuels release more heat per gram than non-renewable fuels."

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(2 marks)

6 (b) (ii) "Non-renewable fuels are better for the environment than renewable fuels."

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.....

(2 marks)

4.7.2.3 Alcohols

Question 13

January 2011 | CHY2F | Original Q2 | Legacy

2 The picture shows a wooden bowl.
The pieces of wood used for this bowl were dyed different colours.



The artist who made the bowl explained why he dissolved the coloured dyes in methanol.

I use different coloured dyes dissolved in methanol. I use methanol because with dyes dissolved in water the wood needs to be soaked for a longer time. The bowl dries more quickly if I use methanol instead of water.

2 (a) The artist uses methanol instead of water.

Give **two** reasons why.

1 .....

.....

2 .....

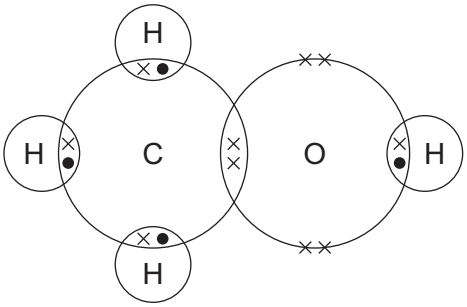
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(2 marks)

4.7.2.3 Alcohols

Question 13 · continued

2 (b) The diagram shows how the atoms are bonded in methanol.



Draw a ring around:

2 (b) (i) the formula of methanol

CH_4O **CH^4O** **CHO_4**

(1 mark)

2 (b) (ii) the type of bonding in methanol.

covalent **ionic** **metallic**

(1 mark)

2 (c) Methanol has a low boiling point.

Tick (✓) the reason why.

Reason why	Tick (✓)
It has a giant covalent structure.	
It is made of small molecules.	
It has a giant metallic structure.	

(1 mark)

5

4.7.2.3 Alcohols

Question 14

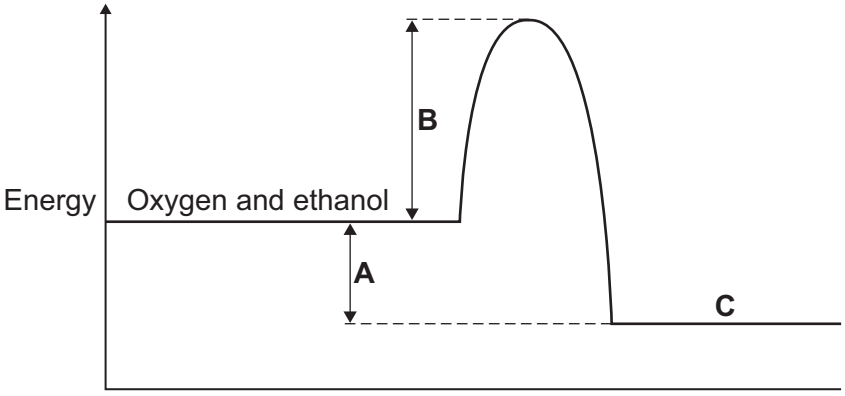
January 2011 | CHY3F | Original Q7 | Legacy

7 V2 rockets were used during the Second World War.



V2 rockets were powered by liquid oxygen and ethanol. Oxygen and ethanol react to produce carbon dioxide and water.

The energy level diagram represents the energy changes during this reaction.



7 (a) On the energy level diagram what is represented by the letter:

A .....

B .....

C .....

(3 marks)

7 (b) What type of reaction is represented by this energy level diagram?

.....

.....

(1 mark)

4

4.7.2.3 Alcohols

Question 15

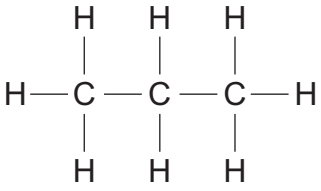
March 2011 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

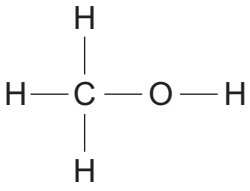
This question is about the formulae of four compounds.

Match formulae, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

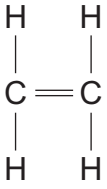
A



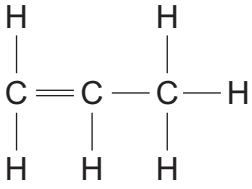
B



C



D



1	It is the alkene used to make ethanol.
2	It is a saturated hydrocarbon useful as a fuel.
3	It is not a hydrocarbon but burns to produce carbon dioxide and water vapour.
4	It belongs to the group with the general formula C_nH_{2n} where n = 3.

4.7.2.3 Alcohols

Question 16

June 2011 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Crude oil is a mixture made up mainly of alkanes.

9A The alkanes are a series of hydrocarbons . . .

1 all of which are gases at room temperature (20 °C).

2 that have the general formula C_nH_{2n}.

3 in which the molecules have a carbon : hydrogen ratio of 1 : 4.

4 that are saturated.

Crude oil can be separated into fractions by fractional distillation.

9B In the fractionating column, the crude oil separates into fractions because . . .

1 the crude oil changes from a liquid into a vapour.

2 the alkanes condense at different temperatures.

3 the crude oil decomposes when it is heated.

4 the alkanes have different densities.

9C The petrol fraction has a boiling range from 40 °C to 70 °C.

The fraction does not have a fixed boiling point because it . . .

1 contains only one alkane.

2 contains several alkanes.

3 collects near the top of the column.

4 decomposes at 40 °C.

9D The petrol fraction is used as a fuel. Ethanol (C_2H_5OH), made from plant material, can be used as a fuel instead of petrol.

One advantage of ethanol over petrol is that ethanol . . .

1 does not produce carbon dioxide when it burns.

2 is a renewable fuel.

3 produces only water when it burns.

4 is a compound, not a mixture.

END OF TEST

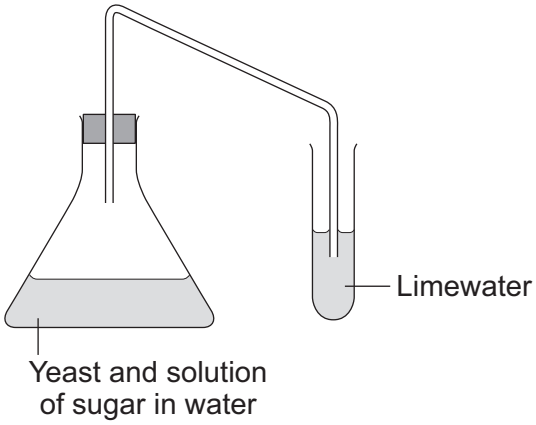
4.7.2.3 Alcohols

Question 17

4 Two fuels that can be used for cars are:

- petrol from crude oil
- ethanol made from sugar in plants.

4 (a) A student used the apparatus shown to investigate the reaction to make ethanol from sugar.



4 (a) (i) Draw a ring around the correct answer to complete the sentence.

This reaction to make ethanol from sugar is

combustion.

decomposition.

fermentation.

(1 mark)

4 (a) (ii) Complete the sentences.

The limewater turns ..... .

This happens because ..... .

(2 marks)

4.7.2.3 Alcohols

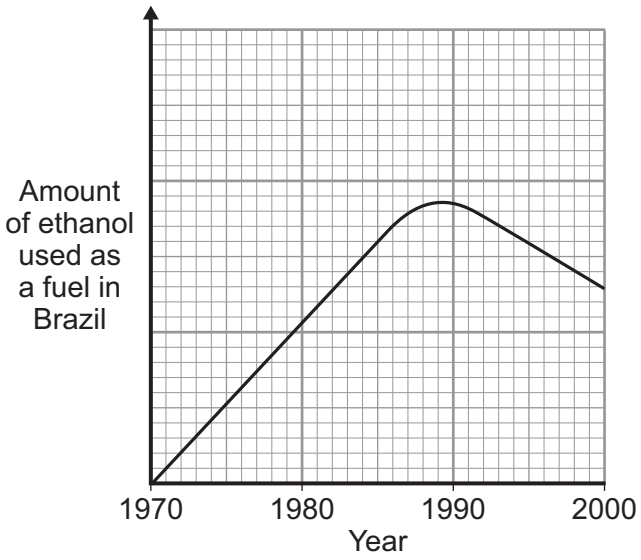
Question 17 · continued

4 (b) In 1970, the Brazilian Government stated that all petrol must contain more than 25 % ethanol.

The reasons for this statement in 1970 were:

- Brazil did not have many oilfields
- Brazil has a climate suitable for growing sugar cane.

The graph shows the amount of ethanol used as a fuel in Brazil from 1970 to 2000.



4 (b) (i) Use the graph to describe the changes in the amount of ethanol used as a fuel in Brazil from 1970 to 2000.

.....

.....

.....

.....

(2 marks)

4 (b) (ii) In 2011, the Brazilian Government decided to reduce the amount of ethanol in petrol to 18 %.

Suggest **one** reason for their decision.

.....

.....

(1 mark)

6

4.7.2.3 Alcohols

Question 18

June 2012 | CH1FP | Original Q6 | Legacy

6 Ethanol (C_2H_5OH) can be made from ethene or from sugar.

6 (a) Complete the table which shows the number of atoms of each element in the formula of ethanol.

Use the Chemistry Data Sheet to help you to complete the table.

Element	Symbol	Number of atoms in the formula C_2H_5OH
Carbon	C	2
Hydrogen	H	.....
.....	O	1

(2 marks)

6 (b) Ethene (C_2H_4) is produced when hydrocarbons are cracked.

6 (b) (i) Tick (✓) **two** conditions needed to crack a hydrocarbon.

Condition	Tick (✓)
The presence of an emulsifier.	
Heating the hydrocarbon to a high temperature.	
Adding oxygen to the hydrocarbon.	
The presence of a catalyst.	

(2 marks)

6 (b) (ii) Draw the missing bonds to complete the displayed structure of ethene.

H H

C C

H H

(1 mark)

6 (b) (iii) Name the substance added to ethene (C_2H_4) to produce ethanol (C_2H_5OH).

.....

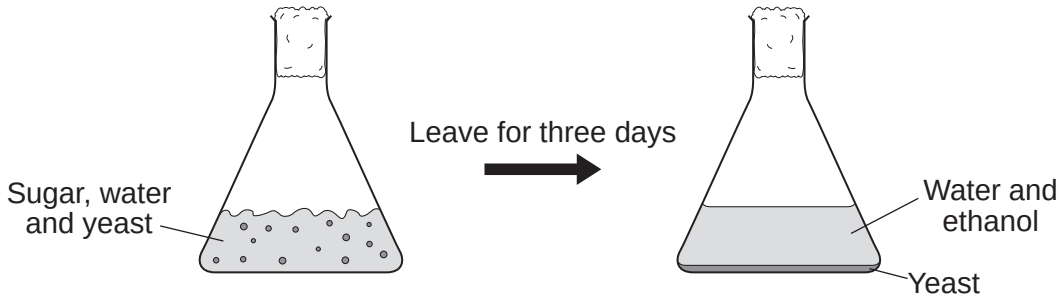
(1 mark)

4.7.2.3 Alcohols

Question 18 · continued

6 (c) The diagram shows how a solution of ethanol is made from sugar dissolved in water.

The boiling point of ethanol is 78°C and the boiling point of water is 100°C.



6 (c) (i) Name the gas produced during this reaction.

.....

(1 mark)

6 (c) (ii) What are the main steps needed to obtain pure ethanol from the mixture produced after three days?

.....

.....

.....

.....

(2 marks)

9

4.7.2.3 Alcohols

Question 19

January 2013 | CH1FP | Original Q5 | Legacy

5 This question is about compounds produced from crude oil.

The table below shows four of these compounds.

Compound	Melting point in °C	Boiling point in °C
methane (CH_4)	–183	–164
ethene (C_2H_4)	–169	–104
decane ($C_{10}H_{22}$)	–30	+174
icosane ($C_{20}H_{42}$)	+37	+343

5 (a) Tick (✓) **two** correct statements about the four compounds.

Statement	Tick (✓)
Methane has the lowest melting point and icosane has the highest boiling point.	
Ethene and methane are alkanes.	
Methane and decane are gases at room temperature (20 °C).	
Decane and icosane are liquid at 100 °C.	

(2 marks)

5 (b) Petrol contains a mixture of compounds, including octane (C_8H_{18}).

Complete the word equation for the complete combustion of octane.

octane + oxygen → ..... + ...

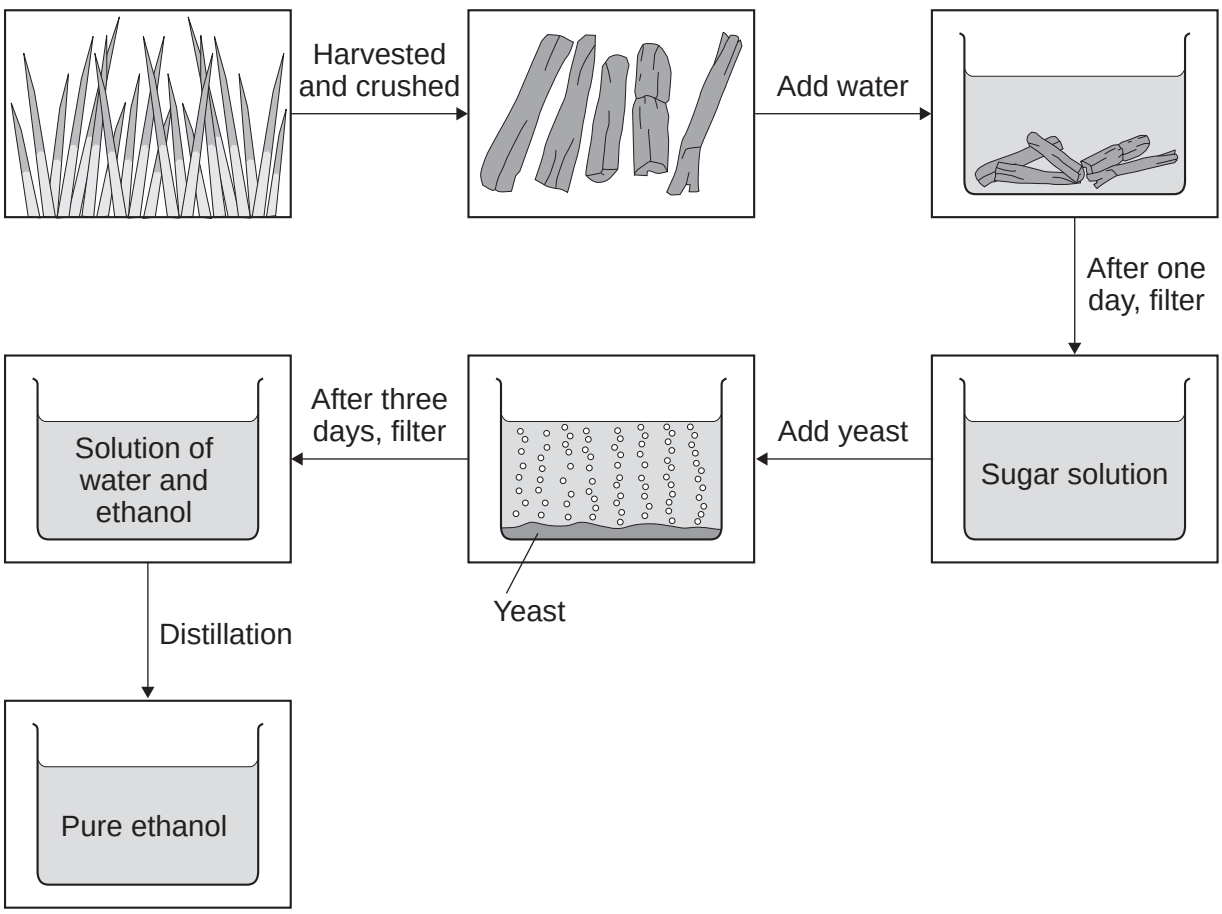
(2 marks)

Question 5 continues on the next page

4.7.2.3 Alcohols

Question 19 · continued

5 (c) Most petrol used in cars contains about 5% ethanol (C_2H_5OH).
Ethanol can be produced from sugar cane.



5 (c) (i) Draw a ring around the correct answer to complete the sentence.

The reaction to produce ethanol from sugar solution is

combustion.

displacement.

fermentation.

(1 mark)

4.7.2.3 Alcohols

Question 19 · continued

5 (c) (ii) Some people say that increasing the production of ethanol from sugar cane will be **good** for the environment.

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

5 (c) (iii) Other people say that increasing the production of ethanol from sugar cane will be **bad** for the environment.

Suggest **two** reasons why.

1 .....

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2 .....

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(2 marks)

9

4.7.2.3 Alcohols

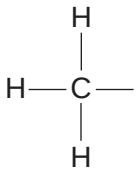
Question 20

June 2013 | CH3FP | Original Q8 | Legacy

8 This question is about organic compounds.

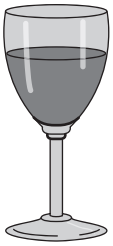
8 (a) Wine contains ethanol (CH_3CH_2OH).

8 (a) (i) Complete the displayed structure of ethanol.



(1 mark)

8 (a) (ii) Wine left in a glass for several days turns sour.
The sour taste is caused by ethanoic acid.



Complete the sentences.

The ethanoic acid is produced from a reaction between ethanol

and ..... .

This type of reaction is ..... .

(2 marks)

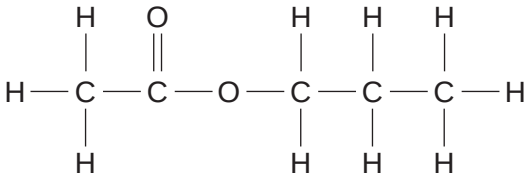
4.7.2.3 Alcohols

Question 20 · continued

8 (b) Propyl ethanoate, a fragrance, can be produced by reacting ethanoic acid with an alcohol.

Propyl ethanoate is a member of a series of organic compounds. The members of the series all have the same functional group.

The displayed structure of propyl ethanoate is:



8 (b) (i) Draw a ring around the functional group for this series on the displayed structure of propyl ethanoate.

(1 mark)

8 (b) (ii) Name the series of organic compounds with this functional group.

.....

(1 mark)

8 (b) (iii) The alcohol used to make propyl ethanoate has the formula $CH_3CH_2CH_2OH$

Name this alcohol.

.....

(1 mark)

6

4.7.2.3 Alcohols

Question 21

June 2014 | CH1FP | Original Q7 | Legacy

7 Ethanol and vegetable oil are used as fuels.

7 (a) There are two different ways to produce ethanol:

- using ethene from crude oil
- using sugar from plants.

7 (a) (i) Ethanol is produced from ethene by **hydration** in the presence of a catalyst.

What is **hydration**?

[1 mark]

.....

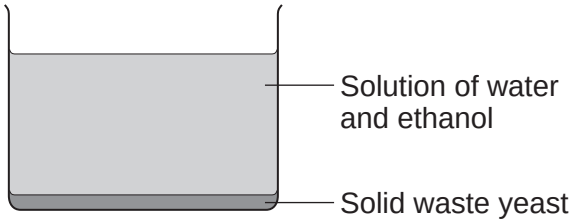
.....

7 (a) (ii) Fermentation is used to produce ethanol from sugar by:

- dissolving the sugar in water
- adding yeast to the sugar solution
- leaving the mixture for three days.

Figure 8 shows the substances after three days.

Figure 8



Suggest:

- how the solid waste yeast is removed
- how ethanol is obtained from the solution.

[2 marks]

.....

.....

.....

.....

4.7.2.3 Alcohols

Question 21 · continued

7 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

Table 4 shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

Table 4

	Carbon dioxide in ppm	Nitrogen oxides in ppm	Sulfur dioxide in ppm	Particulates in g per m^3
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

[6 marks]

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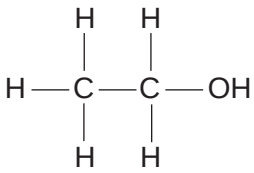
4.7.2.3 Alcohols

Question 22

June 2014 | CH3FP | Original Q8 | Legacy

8 (a) The structure of an alcohol is shown in **Figure 10**.

Figure 10



8 (a) (i) Draw a circle around the functional group in the structure of the alcohol.

[1 mark]

8 (a) (ii) What is the chemical name of this alcohol?

[1 mark]

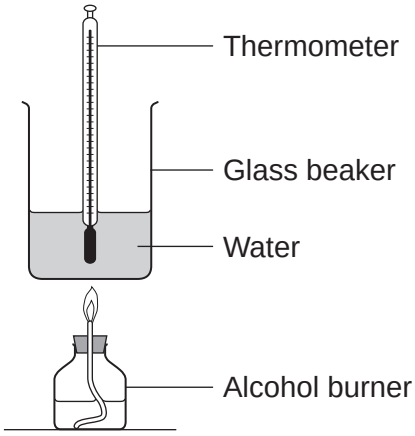
.....

8 (b) Alcohols are used as fuels.

A student plans an experiment to find the energy released per gram of alcohol burned.

The student uses the apparatus shown in **Figure 11**.

Figure 11



8 (b) (i) Suggest **two** ways that this apparatus could be improved to obtain accurate results.

[2 marks]

.....

.....

.....

.....

4.7.2.3 Alcohols

Question 22 · continued

8 (b) (ii) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how the student should do this experiment.

You should include any measurements the student should make.

Do **not** describe any improvements to the apparatus.

Do **not** describe how to do any calculations.

[6 marks]

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Extra space .....

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10

4.7.2.3 Alcohols

Question 23

June 2015 | CH3FP | Original Q5 | Legacy

5 This question is about organic compounds.

5 (a) Ethanol burns in air.

Use the correct answer from the box to complete the word equation for the reaction.

[1 mark]

carbon	hydrogen	oxygen

ethanol + ... → carbon dioxide + water

5 (b) Use the correct answer from the box to complete the sentence.

[1 mark]

milk	hard water	vinegar

Ethanoic acid is in ..... .

5 (c) Ethanoic acid is a carboxylic acid.

Which diagram, **A**, **B** or **C**, has a ring around the functional group of a carboxylic acid?

Write your answer in the box.

[1 mark]

Diagram A

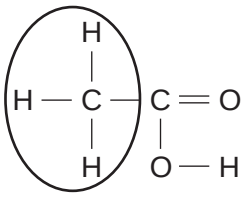


Diagram B

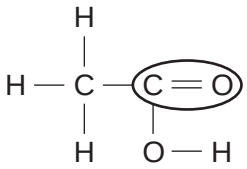


Diagram C

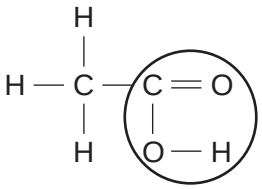


Diagram ☐

4.7.2.3 Alcohols

Question 23 · continued

5 (d) Ethyl propanoate is produced by reacting ethanol with propanoic acid.

What type of organic compound is ethyl propanoate?

[1 mark]

Tick (✓) **one** box.

Alcohol ☐

Carboxylic acid ☐

Ester ☐

5 (e) Organic compounds such as ethyl propanoate are used in perfumes.

Give **two** properties of these compounds that make them suitable for use in perfumes.

[2 marks]

.....

.....

6

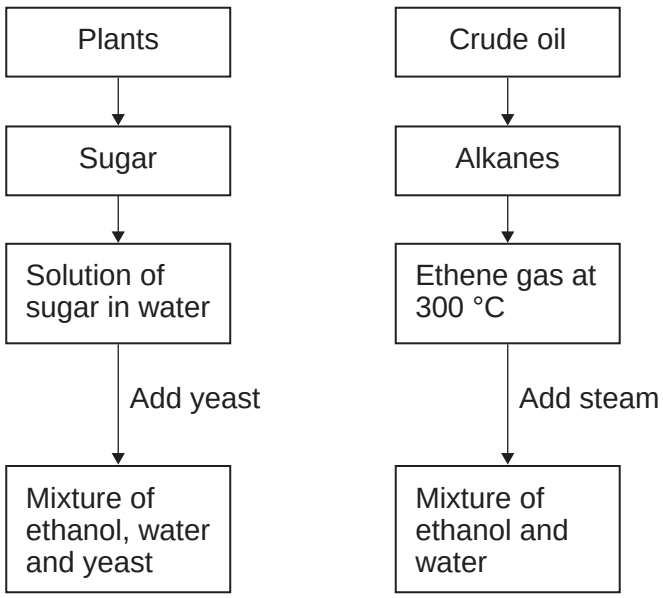
4.7.2.3 Alcohols

Question 24

June 2016 | CH1FP | Original Q4 | Legacy

4 **Figure 8** shows how ethanol is made from plants and from crude oil.

Figure 8



4 (a) (i) What is the name of the reaction to produce ethanol from sugar?

[1 mark]

Tick (✓) **one** box.

- fermentation ☐
- polymerisation ☐
- reduction ☐

4 (a) (ii) What is the name of the reaction to produce ethanol from ethene?

[1 mark]

Tick (✓) **one** box.

- bioleaching ☐
- displacement ☐
- hydration ☐

4.7.2.3 Alcohols

Question 24 · continued

4 (a) (iii) A lot of the ethanol produced is used as a fuel for cars.

What are **two** reasons why most of this ethanol is made from plants and **not** from crude oil?

[2 marks]

Tick (✓) **two** boxes.

- Resources of crude oil are non-renewable. ☐
- Ethanol from plants is more flammable. ☐
- Producing ethanol from plants is not sustainable. ☐
- Ethanol from plants has a different formula. ☐
- Producing ethanol from plants uses less energy. ☐

Question 4 continues on the next page

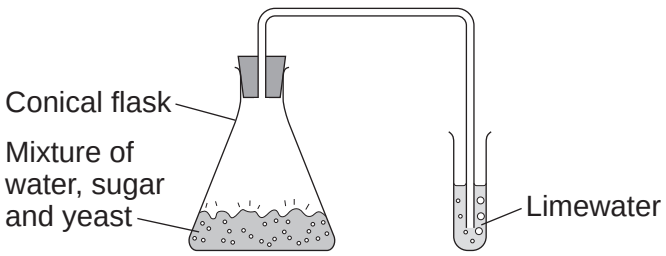
4.7.2.3 Alcohols

Question 24 · continued

4 (b) A student made ethanol from sugar.

Figure 9 shows the apparatus used.

Figure 9



4 (b) (i) What change is seen in the limewater?

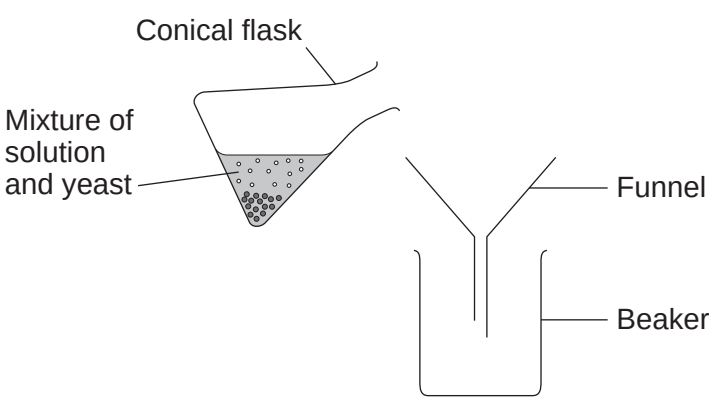
Give a reason for your answer.

[2 marks]

4 (b) (ii) The student wanted to separate the solid yeast from the solution.

Figure 10 shows the apparatus used.

Figure 10



What is missing from the apparatus in **Figure 10**?

[1 mark]

4.7.2.3 Alcohols

Question 24 · continued

4 (c) Vegetable oils are made from plants.

4 (c) (i) Which statement is correct?

[1 mark]

Tick (✓) **one** box.

Vegetable oils have lower boiling points than water. ☐

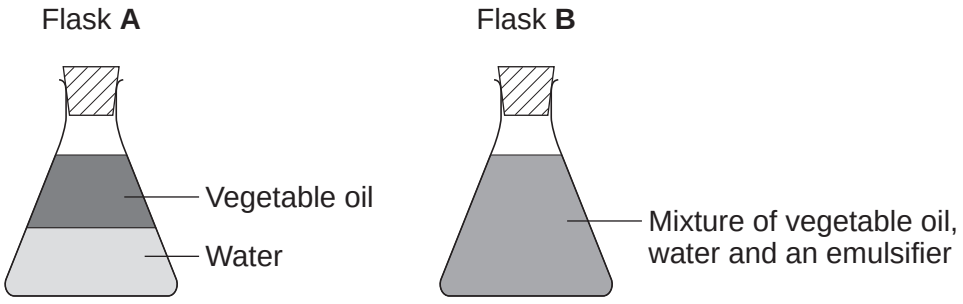
Vegetable oils cook foods at higher temperatures than boiling water. ☐

Cooking in vegetable oils decreases the energy content of the food. ☐

4 (c) (ii) A student puts different mixtures into two flasks, **A** and **B**. The student shakes the flasks.

Figure 11 shows the two flasks after they have been shaken and left to stand for one minute.

Figure 11



Complete the sentences.

[2 marks]

The mixture in flask **A** separates because _____

_____

The mixture in flask **B** does not separate because _____

_____

10

4.7.2.3 Alcohols

Question 25

June 2016 | CH3FP | Original Q3 | Legacy

3 This question is about energy changes in chemical reactions.

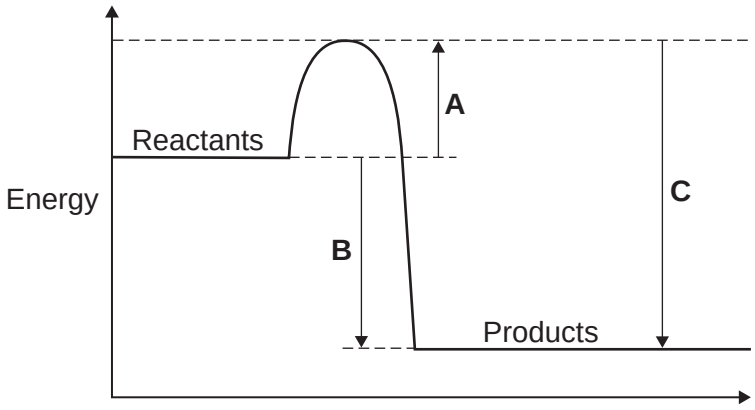
3 (a) Complete the word equation for the combustion of hydrogen.

[1 mark]

hydrogen + oxygen ⟶ _____

3 (b) **Figure 3** shows a simple energy level diagram.

Figure 3



3 (b) (i) Which arrow, **A**, **B** or **C**, shows the activation energy?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

3 (b) (ii) What type of reaction is shown by the energy level diagram in **Figure 3**?
Give a reason for your answer.

[2 marks]

Type of reaction _____

Reason _____

_____

4.7.2.3 Alcohols

Question 25 · continued

3 (b) (iii) For a reaction, the value of **A** is 1370 kJ and **C** is 3230 kJ.
Calculate the value of **B**.

[1 mark]

_____

_____

B = _____ kJ

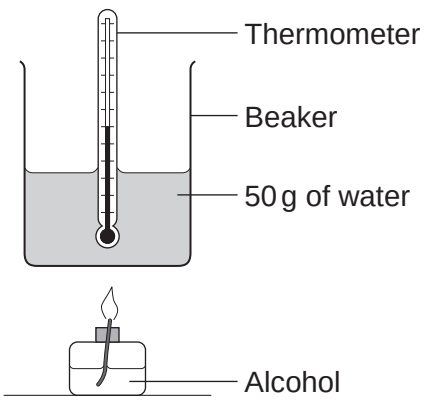
Question 3 continues on the next page

Question 25 · continued

3 (c) Alcohols are used as fuels.

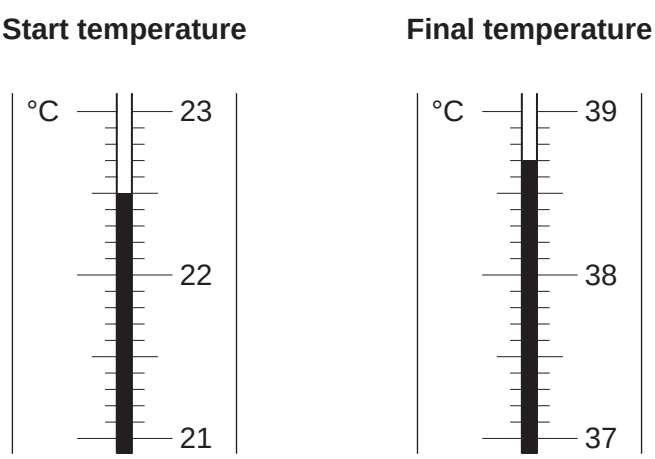
A group of students investigated the amount of energy released when different alcohols are burned.
The students used the apparatus shown in **Figure 4**.

Figure 4



3 (c) (i) **Figure 5** shows the start temperature and the final temperature of the water.

Figure 5



Write the start temperature and the final temperature of the water in **Table 1**.
Work out the increase in temperature to complete **Table 1**.

[3 marks]

Table 1

Start temperature of the water in °C	
Final temperature of the water in °C	
Increase in temperature in °C	

Question 25 · continued

3 (c) (ii) The students worked out the heat energy released by burning 1 g of each alcohol. The students used the equation:

Heat energy released = m × 4.2 × increase in temperature

Look at **Figure 4**. What is the value of m?

[1 mark]

m = _____ g

3 (c) (iii) **Table 2** shows the students' results.

Table 2

Name of alcohol	Number of carbon atoms in one molecule of alcohol	Heat energy released when 1 g of alcohol is burned in kJ
Methanol	1	11.4
Ethanol	2	14.5
Propanol	3	20.1
Butanol	4	16.8
Pentanol	5	17.2

Which value of heat energy released is anomalous?

[1 mark]

_____

3 (c) (iv) Look at **Table 2**.
What is the relationship between the number of carbon atoms in one molecule of alcohol and the heat energy released when 1 g of the alcohol is burned?

[1 mark]

_____

_____

Question 3 continues on the next page

4.7.2.3 Alcohols

Question 25 · continued

3 (c) (v) The value in a data book for the amount of heat energy released when 1 g of butanol is burned completely is 36.2 kJ.

Suggest **two** reasons why the students' result for butanol is lower than the data book value.

[2 marks]

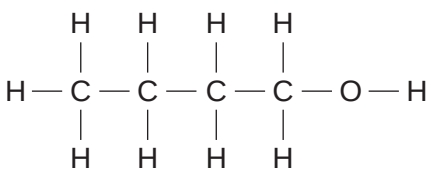
1 _____

_____

2 _____

_____

3 (c) (vi) The displayed structure of butanol is:



What is the functional group of the alcohol?

[1 mark]

Tick (✓) **one** box.

— C — C ☐

— C — H ☐

— O — H ☐

14

4.7.2.3 Alcohols

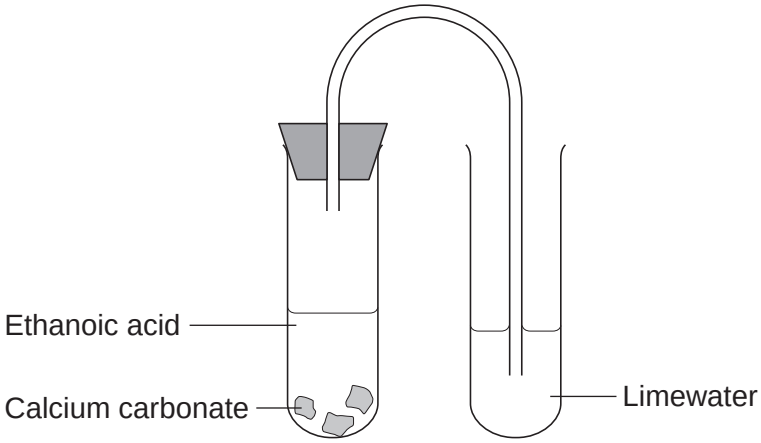
Question 26

June 2016 | CH3FP | Original Q5 | Legacy

5 This question is about reactions of ethanoic acid and the analysis of salts.

5 (a) **Figure 7** shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

Figure 7



5 (a) (i) Describe a change that would be seen in each test tube.

Give a reason for each change.

[4 marks]

Test tube 1 _____

_____

_____

_____

Test tube 2 _____

_____

_____

_____

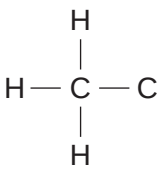
Question 5 continues on the next page

4.7.2.3 Alcohols

Question 26 · continued

5 (a) (ii) Complete the displayed structure of ethanoic acid.

[1 mark]



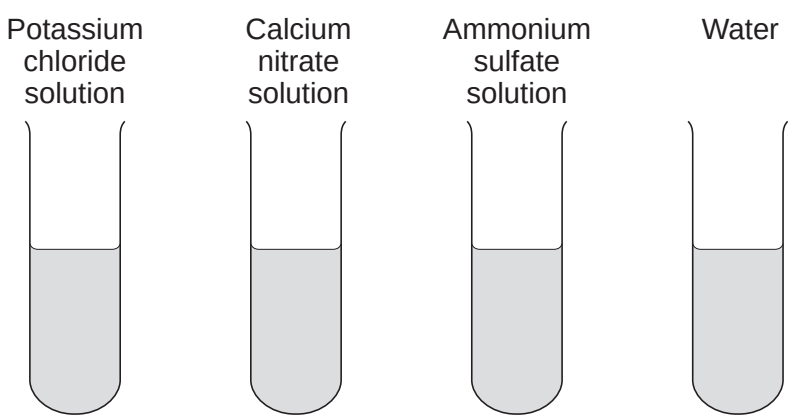
5 (a) (iii) Ethanoic acid is a carboxylic acid.
Complete the sentence.

[2 marks]

Carboxylic acids react with alcohols in the presence of an _____ catalyst to produce pleasant-smelling compounds called _____ .

5 (b) **Figure 8** shows four test tubes containing three different salt solutions and water.

Figure 8



Each solution and the water was tested with:

- silver nitrate in the presence of dilute nitric acid
- barium chloride in the presence of dilute hydrochloric acid.

4.7.2.3 Alcohols

Question 26 · continued

Complete the table of results.

[2 marks]

	Potassium chloride solution	Calcium nitrate solution	Ammonium sulfate solution	Water
Test with silver nitrate in the presence of dilute nitric acid			no change	no change
Test with barium chloride in the presence of dilute hydrochloric acid		no change	white precipitate	

5 (c) Flame tests can be used to identify metal ions.

5 (c) (i) Complete the following sentences.

[2 marks]

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

5 (c) (ii) Give **one** reason why a flame test would **not** show the presence of both potassium ions and calcium ions in a mixture.

[1 mark]

_____

_____

_____

12

4.7.2.3 Alcohols

Question 27

June 2017 | CH3FP | Original Q1 | Legacy

1 This question is about elements and compounds.

1 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

densities	numbers	weights

The elements in the modern periodic table are arranged in order of their atomic _____ .

1 (a) (ii) Use the correct answer from the box to complete the sentence.

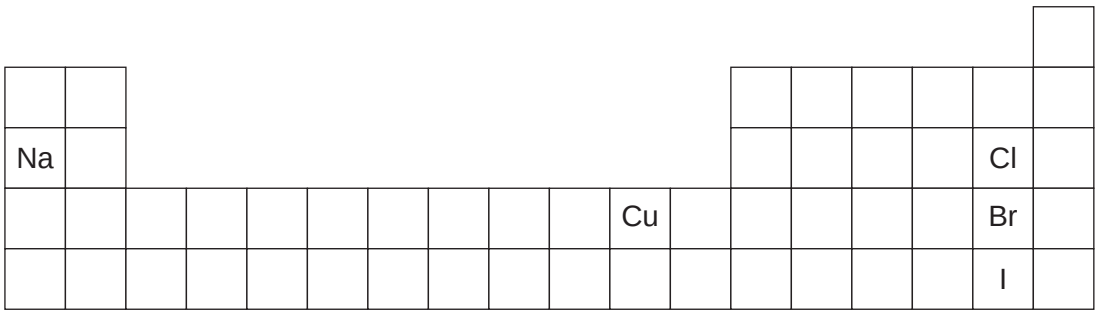
[1 mark]

electrons	neutrons	protons

The outer shells of atoms of elements in the same group have the same number of _____ .

1 (b) **Figure 1** shows the position of five elements in the modern periodic table.

Figure 1



1 (b) (i) Which **one** of the elements in **Figure 1** is a gas at room temperature?

[1 mark]

_____

4.7.2.3 Alcohols

Question 27 · continued

1 (b) (ii) Which **one** of the elements in **Figure 1** is a transition metal?

[1 mark]

_____

1 (b) (iii) Complete the sentence.

[1 mark]

In the modern periodic table, bromine (Br) is in Group _____ .

1 (c) Bromine reacts with sodium iodide to produce iodine.

The word equation for the reaction is:

bromine + sodium iodide ⟶ iodine + sodium bromide

1 (c) (i) What type of reaction is this?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

1 (c) (ii) Use the Chemistry Data Sheet to help you answer this question.

Which halogen would react with sodium chloride solution to produce chlorine?

[1 mark]

Tick (✓) **one** box.

Bromine ☐

Fluorine ☐

Iodine ☐

Question 1 continues on the next page

4.7.2.3 Alcohols

Question 27 · continued

1 (d) Silver nitrate in the presence of dilute nitric acid is used to test for iodide ions.

What colour precipitate is produced?

[1 mark]

Tick (✓) **one** box.

Cream ☐

White ☐

Yellow ☐

4.7.2.3 Alcohols

Question 27 · continued

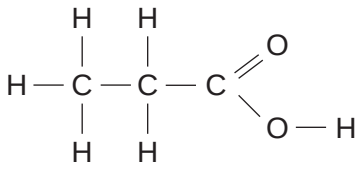
1 (e) Propanoic acid is a compound containing carbon atoms.

1 (e) (i) **Figure 2** shows the displayed structure of propanoic acid.

Draw a ring around the functional group of propanoic acid in **Figure 2**.

[1 mark]

Figure 2



1 (e) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

carbon dioxide	hydrogen	oxygen

Propanoic acid reacts with carbonates to produce _____ .

1 (e) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	esters	fuels

Propanoic acid reacts with alcohols to produce pleasant smelling compounds called _____ .

11

4.7.2.3 Alcohols

Question 28

June 2017 | CH3FP | Original Q6 | Legacy

6 This question is about the combustion of alcohols.

6 (a) What is the structure of methanol?

[1 mark]

Tick (✓) **one** box.

CH_3OH ☐

CH_3CH_2OH ☐

$CH_3CH_2CH_2OH$ ☐

$CH_3CH_2CH_2CH_2OH$ ☐

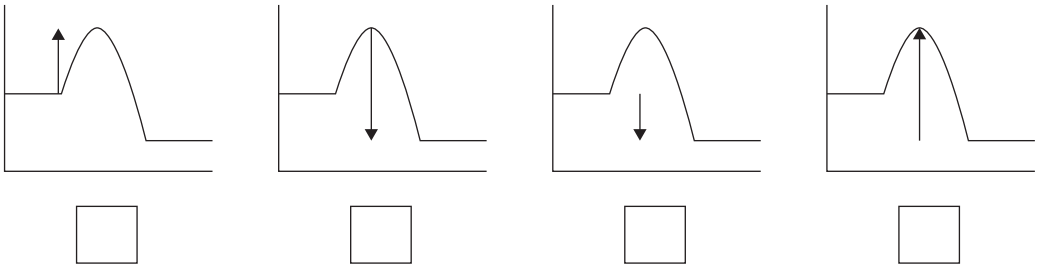
6 (b) **Figure 8** shows four energy level diagrams for the combustion of an alcohol.

Which diagram, **A**, **B**, **C**, or **D**, shows an arrow for the overall energy change?

[1 mark]

Tick (✓) **one** box.

Figure 8



☐ **A** ☐ **B** ☐ **C** ☐ **D**

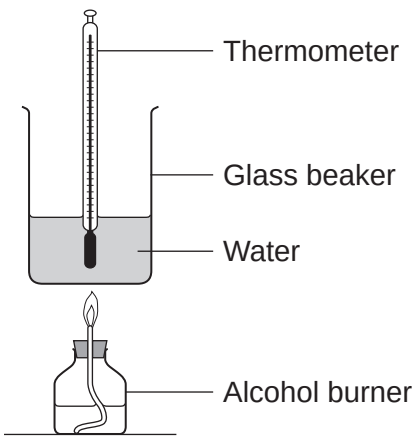
Question 6 continues on the next page

4.7.2.3 Alcohols

Question 28 · continued

6 (c) **Figure 9** shows apparatus used to measure the energy released when an alcohol is burned.

Figure 9



6 (c) (i) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate**.

Describe how a student could use the apparatus in **Figure 9** to compare the energy released when methanol and ethanol are burned.

You should include any measurements the student would need to make.

Do **not** describe how to do any calculations.

Do **not** describe any improvements to the apparatus.

[6 marks]

4.7.2.3 Alcohols

Question 28 · continued

Extra space

6 (c) (ii) The student calculated the energy released by the alcohols.

The calculated values were less than the values in a data book.

Explain how the apparatus in **Figure 9** could be improved to obtain more accurate results.

[2 marks]

10

4.7.2.3 Alcohols

Question 29

June 2018 | 8462/2F | Original Q9

0 9 Methylated spirit is a useful product made from a mixture of substances.

Table 6 shows the mass of the substances in a sample of methylated spirit.

Table 6

Substance	Mass in grams
Ethanol	265.5
Methanol	23.3
Pyridine	3.0
Methyl violet	1.5

0 9 . 1 What name is given to a useful product such as methylated spirit?

[1 mark]

_____

0 9 . 2 Calculate the percentage by mass of methanol in methylated spirit.

Use **Table 6**.

[2 marks]

_____

_____

_____

_____

Percentage = _____ %

Question 9 continues on the next page

4.7.2.3 Alcohols

Question 29 · continued

Methylated spirit contains ethanol and is available cheaply.

Methylated spirit also contains:

- pyridine which has a very unpleasant smell
- methyl violet which makes the mixture purple.

0 9 . 3 Suggest why pyridine and methyl violet are added to ethanol to make methylated spirit.

[1 mark]

0 9 . 4 Suggest **one** use of methylated spirit.

[1 mark]

0 9 . 5 Describe how ethanol is produced from sugar solution.

Give the name of this process.

[3 marks]

4.7.2.3 Alcohols

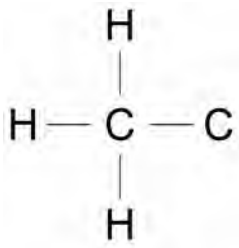
Question 29 · continued

0 9 . 6 **Figure 9** shows part of the displayed formula for ethanol.

Complete **Figure 9**.

[1 mark]

Figure 9



0 9 . 7 Name the gas produced when sodium is added to ethanol.

[1 mark]

0 9 . 8 Methanol is used to produce methanoic acid.

What type of substance reacts with methanol to produce methanoic acid?

[1 mark]

4.7.2.3 Alcohols

Question 30

June 2019 | 8462/2F | Original Q4

0 4 Titan is a moon of the planet Saturn.

Table 2 shows the percentages of some gases in the atmosphere of Titan and in the atmosphere of the Earth.

Table 2

Gas	Percentage of gas in atmosphere (%)	
	Titan	Earth
Nitrogen	98	78
Oxygen	Zero	21
Methane	1.4	0.0002
Argon	0.14	0.9
Carbon dioxide	0.0001	0.04

0 4 . 1 Which **two** gases are present in smaller percentages on the Earth than on Titan?

[1 mark]

_____ and _____

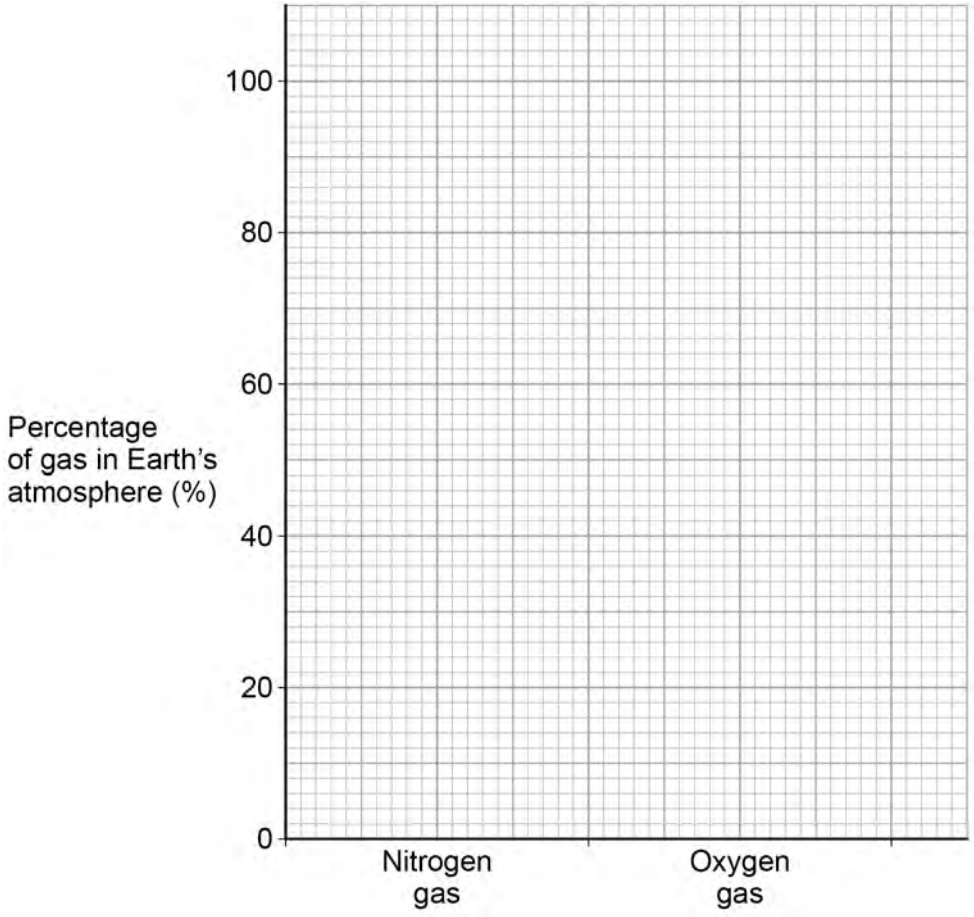
4.7.2.3 Alcohols

Question 30 · continued

0 4 . 2 Complete the bar chart in **Figure 2** to show the percentages of nitrogen gas and oxygen gas in the Earth's atmosphere.

[2 marks]

Figure 2



0 4 . 3 Why are algae less likely to photosynthesise on Titan than Earth?

Use **Table 2**.

[1 mark]

Tick (✓) **one** box.

Titan's atmosphere contains too little argon. ☐

Titan's atmosphere contains too little carbon dioxide. ☐

Titan's atmosphere contains too little methane. ☐

Titan's atmosphere contains too little nitrogen. ☐

Question 30 · continued

0 4 . 4 Titan is warmer than the other moons of Saturn because of the greenhouse effect.

How do greenhouse gases trap energy from the sun?

[1 mark]

Tick (✓) **one** box.

All wavelengths of radiation are reflected back to the surface of Titan. ☐

Long wavelength radiation is reflected back to the surface of Titan. ☐

Short wavelength radiation is reflected back to the surface of Titan. ☐

As well as methane, the atmosphere of Titan contains small amounts of propene gas. Methane is an alkane and propene is an alkene.

0 4 . 5 Bromine water is an orange solution used to identify alkenes.

Draw **one** line from each gas to its effect on bromine water.

[2 marks]

Gas	Effect on bromine water
	Forms a blue solution
Methane	Forms a colourless solution
	Forms a green solution
Propene	Forms a white precipitate
	No effect

4.7.2.3 Alcohols

Question 30 · continued

0 4 . 6 Propene reacts with water (steam) to make propanol.

The ratio of the masses of propene and water that react is:

propene : water

7 : 3

Calculate the mass of propene that reacts with 21 g water.

[2 marks]

Mass = _____ g

9

Turn over for the next question

4.7.2.3 Alcohols

Question 31

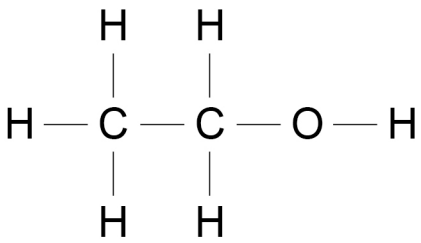
November 2020 | 8462/2F | Original Q7

0 7 This question is about ethanol and ethanoic acid.

Ethanol is an alcohol.

0 7 . 1 **Figure 7** shows the displayed structural formula of ethanol.

Figure 7



Draw a circle on **Figure 7** around the alcohol functional group.

[1 mark]

0 7 . 2 An ethanol molecule contains atoms of three different elements.

Complete **Table 5** to show:

- the name of each element
- the symbol for each element
- the number of atoms of each element in one molecule of ethanol.

Use **Figure 7**.

[3 marks]

Table 5

Name of element	Symbol for element	Number of atoms in one molecule of ethanol
Carbon	C	
Hydrogen		6
	O	1

4.7.2.3 Alcohols

Question 31 · continued

0 7 . 3 Ethanol removes grass stains from clothes.

What type of substance is ethanol when used to remove grass stains?

[1 mark]

Tick (✓) **one** box.

A solute ☐

A solution ☐

A solvent ☐

Wine contains ethanol.

Wine is produced from grape juice by fermentation.

0 7 . 4 Complete the sentence.

[1 mark]

Grape juice can be fermented to produce wine because

grape juice contains _____.

0 7 . 5 What is added to grape juice to cause fermentation?

[1 mark]

_____

4.7.2.3 Alcohols

Question 31 · continued

0 7 . 6 Ethanol reacts with ethanoic acid to produce an ester.

What is the name of the ester produced when ethanol reacts with ethanoic acid?

[1 mark]

Tick (✓) **one** box.

Ethane ☐

Ethene ☐

Ethyl ethanoate ☐

0 7 . 7 Ethanoic acid reacts with sodium carbonate.

The equation for the reaction is:

$$2\,CH_3COOH(aq) + Na_2CO_3(s) \rightarrow 2\,CH_3COONa(aq) + H_2O(l) + CO_2(g)$$

What is the name of the liquid produced by this reaction?

[1 mark]

_____

0 7 . 8 Vinegar is a solution that contains ethanoic acid.

400 cm^3 of vinegar contains 20 g of ethanoic acid.

Calculate the mass of ethanoic acid in 1.0 dm^3 of vinegar.

[3 marks]

_____

_____

_____

_____

_____

_____

Mass = _____ g

12

4.7.2.3 Alcohols

Question 32

November 2021 | 8462/2F | Original Q7

0 7 This question is about organic compounds.

0 7 . 1 Butane is an alkane with small molecules.

Complete the sentence.

Choose the answer from the box.

[1 mark]

fertiliser	**formulation**	**fuel**

Butane can be used as a _____.

0 7 . 2 Poly(propene) is a polymer.

What is the name of the monomer used to produce poly(propene)?

[1 mark]

Tick (✓) **one** box.

Propane ☐

Propanoic acid ☐

Propanol ☐

Propene ☐

4.7.2.3 Alcohols

Question 32 · continued

Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:

ethene + steam ⇌ ethanol

0 7 . 3 The reaction produces a maximum theoretical mass of 400 kg of ethanol from 243 kg of ethene and 157 kg of steam.

A company produces 380 kg of ethanol from 243 kg of ethene and 157 kg of steam.

The percentage yield of ethanol is less than 100%

Calculate the percentage yield of ethanol.

Use the equation:

$$\text{percentage yield of ethanol} = \frac{\text{mass of ethanol actually made}}{\text{maximum theoretical mass of ethanol}} \times 100$$

[2 marks]

Percentage yield = _____ %

0 7 . 4 What are **two** possible reasons why the percentage yield of ethanol is less than 100%?

[2 marks]

Tick (✓) **two** boxes.

- Ethanol is the only product of the reaction. ☐
- Ethanol is very unreactive. ☐
- Some ethanol changes back into ethene and steam. ☐
- Some ethanol escapes from the apparatus. ☐
- Some ethanol reacts with steam. ☐

4.7.2.3 Alcohols

Question 32 · continued

0 7 . 5 Ethanol burns in oxygen.

Balance the equation for the reaction.

[1 mark]

$$C_2H_5OH + ___ O_2 \rightarrow 3H_2O + 2CO_2$$

0 7 . 6 Two processes for producing ethanol are:

- fermentation
- hydration (reacting ethene with steam).

Table 5 shows information about the processes.

Table 5

Feature	Process	
	Fermentation	Hydration
Raw material	sugar	crude oil
Energy usage	low	high
Rate of reaction	slow	fast
Purity of ethanol	15%	98%

Give **two** advantages and **two** disadvantages of using fermentation to produce ethanol.

[4 marks]

Advantage of fermentation 1 _____

_____

Advantage of fermentation 2 _____

_____

Disadvantage of fermentation 1 _____

_____

Disadvantage of fermentation 2 _____

_____

11

4.7.2.3 Alcohols

Question 33

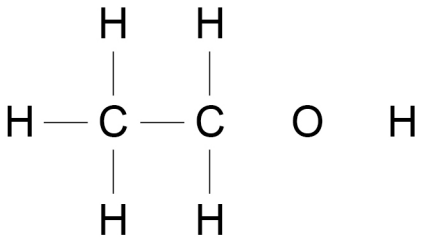
June 2022 | 8462/2F | Original Q4

0 4 This question is about ethanol.

0 4 . 1 The formula of ethanol is C_2H_5OH

Complete the displayed structural formula of ethanol.

[1 mark]



0 4 . 2 Which is **one** use of ethanol?

[1 mark]

Tick (✓) **one** box.

As a protective coating on aluminium ☐

In hand gel to kill microbes ☐

To test for the presence of hydrogen gas ☐

4.7.2.3 Alcohols

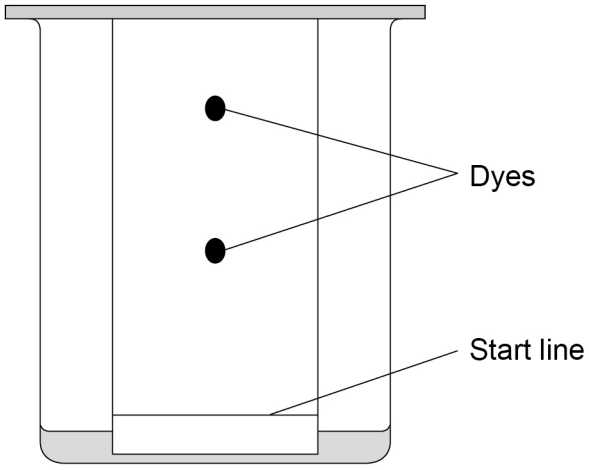
Question 33 · continued

0 4 . 3 Ethanol is used as a solvent in some inks.

A student used paper chromatography to show that an ink contained two different dyes.

Figure 4 shows the apparatus at the end of the investigation.

Figure 4



Describe a method the student could have used for the investigation.

[4 marks]

4.7.2.3 Alcohols

Question 33 · continued

0 4 . 4 Ethanol can be produced from sugar solution by fermentation.

What must be added to sugar solution to produce ethanol?

[1 mark]

E5 and E10 are types of fuel used in cars.

These fuels contain ethanol and petrol.

Table 6 shows information about E5 and E10.

Table 6

Fuel	Percentage (%) by mass of ethanol	Percentage (%) by mass of petrol
E5	5	95
E10	10	90

0 4 . 5 Calculate the mass of ethanol in 4.4 kg of E5.

Give your answer in grams.

Use **Table 6**.

[3 marks]

Mass = _____ g

4.7.2.3 Alcohols

Question 33 · continued

0 4 . 6 The ethanol in E5 and E10 is produced from sugar.

Sugar is produced from plants.

Explain why the production of E10 removes more carbon dioxide from the atmosphere than the production of E5.

Use **Table 6**.

[3 marks]

0 4 . 7 **Table 7** shows the energy content of ethanol and petrol.

Table 7

	Energy content in MJ (megajoules) per kg
Ethanol	30.0
Petrol	46.4

Suggest **one** disadvantage of using E10 instead of E5.

Complete the sentence.

[1 mark]

A disadvantage of using E10 is that _____

14

4.7.2.3 Alcohols

Question 34

June 2023 | 8462/2F | Original Q9

0 9 This question is about alcohols and carboxylic acids.

Alcohols are used as fuels.

A student burned 1.00 g of six alcohols and determined the energy released from each.

Table 8 shows the results.

Table 8

Alcohol	Formula of one molecule of the alcohol	Energy released in kJ/g
Ethanol	C_2H_5OH	29.6
Propanol	C_3H_7OH	33.6
Butanol	C_4H_9OH	36.1
Pentanol	$C_5H_{11}OH$	37.7
Hexanol	$C_6H_{13}OH$	38.9
Heptanol	$C_7H_{15}OH$	39.8

0 9 . 1 Calculate the mass of ethanol that must be burned to release the same amount of energy as burning 1.00 g of heptanol.

[2 marks]

Mass = _____ g

0 9 . 2 The energy released in kJ/g varies with the number of carbon atoms in one molecule of each alcohol.

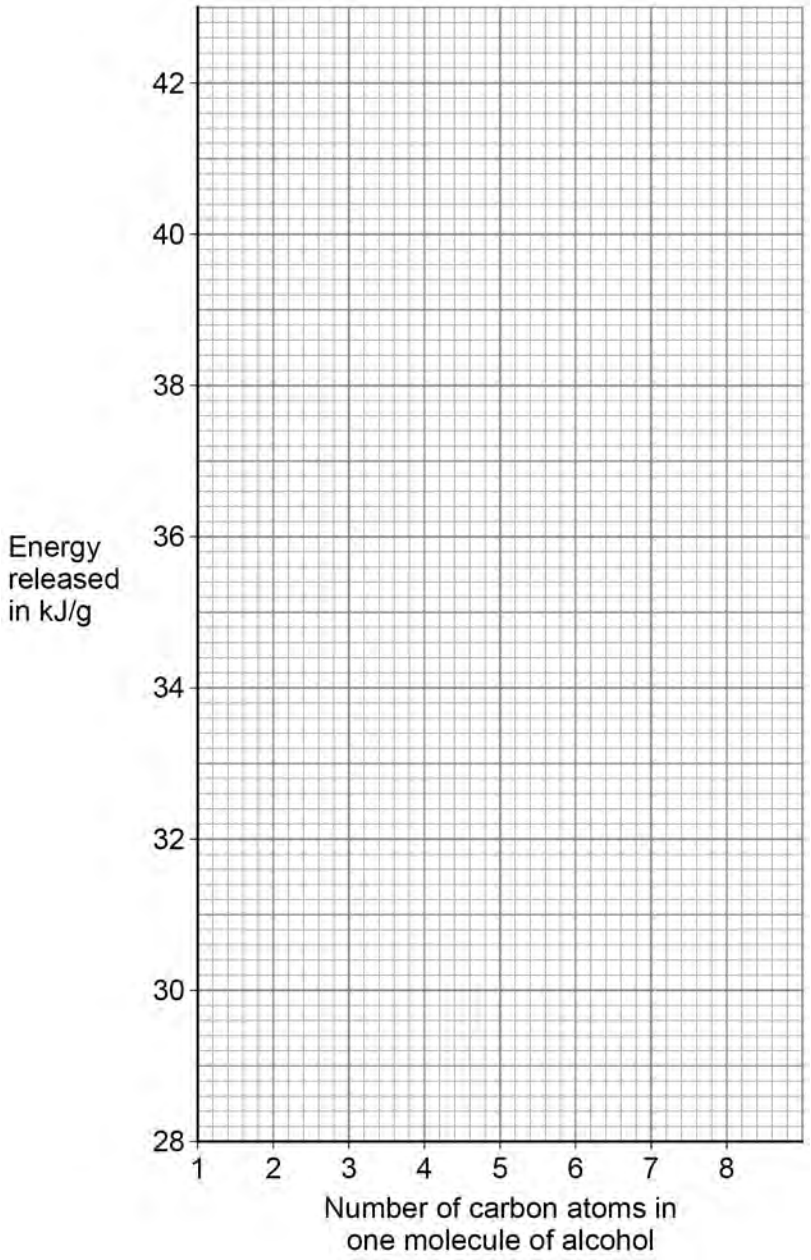
Plot the data from **Table 8** on **Figure 8**.

[2 marks]

4.7.2.3 Alcohols

Question 34 · continued

Figure 8



0 9 . 3 Estimate the energy released in kJ when 1.00 g of octanol ($C_8H_{17}OH$) is burned.

Use **Figure 8**.

[1 mark]

Energy released = _____ kJ

4.7.2.3 Alcohols

Question 34 · continued

Carbon dioxide is produced when alcohols are burned.

Carbon dioxide is identified by bubbling the gas through limewater.

0 9 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

calcium chloride	**calcium hydroxide**	**calcium nitrate**	**calcium sulfate**

Limewater is an aqueous solution of _____.

0 9 . 5 Give the result of the test when carbon dioxide is bubbled through limewater.

[1 mark]

_____

_____

4.7.2.3 Alcohols

Question 34 · continued

Ethanoic acid can be produced from ethanol.

0 9 . 6 What is reacted with ethanol to produce ethanoic acid?

[1 mark]

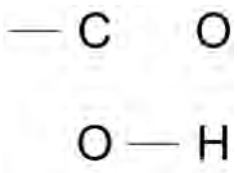
Tick (✓) **one** box.

- A halogen ☐
- An alkali metal ☐
- An oxidising agent ☐
- Water ☐

0 9 . 7 Ethanoic acid contains the functional group –COOH

Complete the displayed structural formula of this functional group.

[1 mark]



Question 9 continues on the next page

4.7.2.3 Alcohols

Question 34 · continued

0 9 . 8 Ethanoic acid reacts with different compounds.

Draw **one** line from each compound to a product of the reaction of the compound with ethanoic acid.

[2 marks]

Compound	Product of the reaction with ethanoic acid
Ethanol	Carbon dioxide
Sodium carbonate	Ethene
	Ethyl ethanoate
	Hydrogen
	Poly(ethene)

11