AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.1.1

Crude oil, hydrocarbons and alkanes

Past-paper questions

Tier	**Foundation**
Question groups	**109**
Available paper years	**2007–2025**

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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 01

January 2007 | CHY1F | Original Q5 | Legacy

5 Polymers are used to make many materials that people need.

(a) Plastic bags are used to carry, protect and store food. Plastic bags are made from polymers.



Plastic bag made from a polymer

(i) Ethene is the small molecule (the monomer) used to make the polymer for this plastic bag.

Name the polymer that is made from ethene.

.....

(1 mark)

(ii) Use the correct word from the box to complete the sentence about ethene.

condensing	corroding	cracking

Ethene is made by breaking down large hydrocarbon molecules into smaller hydrocarbon molecules by a process called ..... .

(1 mark)

(iii) The hydrocarbon ethene has the formula C_2H_4

Complete the sentence about ethene.

Ethene is a hydrocarbon made up of carbon and ..... atoms.

(1 mark)

Question 5 continues on the next page

Question 01 · continued

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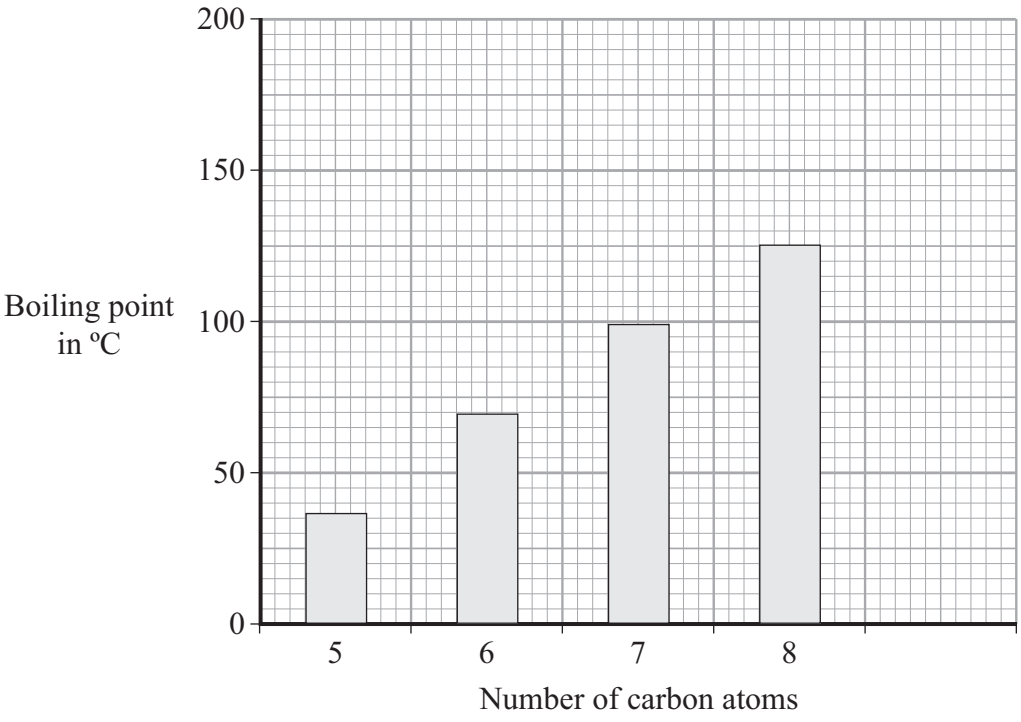
(b) The hydrocarbons used to make ethene come from crude oil.
The properties of hydrocarbons are linked to the number of carbon atoms in their molecules.

Number of carbon atoms	5	6	7	8	9
Boiling point in °C	36	69	99	125	151

(i) Use the data in the table to complete the bar chart.



(2 marks)

(ii) What happens to the boiling point of a hydrocarbon as the number of carbon atoms increases?

.....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 01 · continued

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(iii) All the hydrocarbons in the table are found in petrol. Petrol is one of the fractions separated from crude oil.

Describe how the fractions are separated from crude oil.

.....

.....

.....

.....

.....

(2 marks)

(c) Most plastic bags that are made of hydrocarbons are not biodegradable.

Used plastic bags can be:

- dumped into large holes, which is called landfill
- burned to give out heat energy, which would produce large amounts of gases.

Would burning used plastic bags be better for the environment than dumping them in landfill?

Explain your answer.

.....

.....

.....

.....

(2 marks)

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 02

March 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

This question is about crude oil.

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

A an alkane

B carbon

C crude oil

D sulfur dioxide

An example of a mixture is . . . **1** . . . .

An example of an element is . . . **2** . . . .

An example of a hydrocarbon is . . . **3** . . . .

An example of an acidic gas often made when a fuel burns is . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

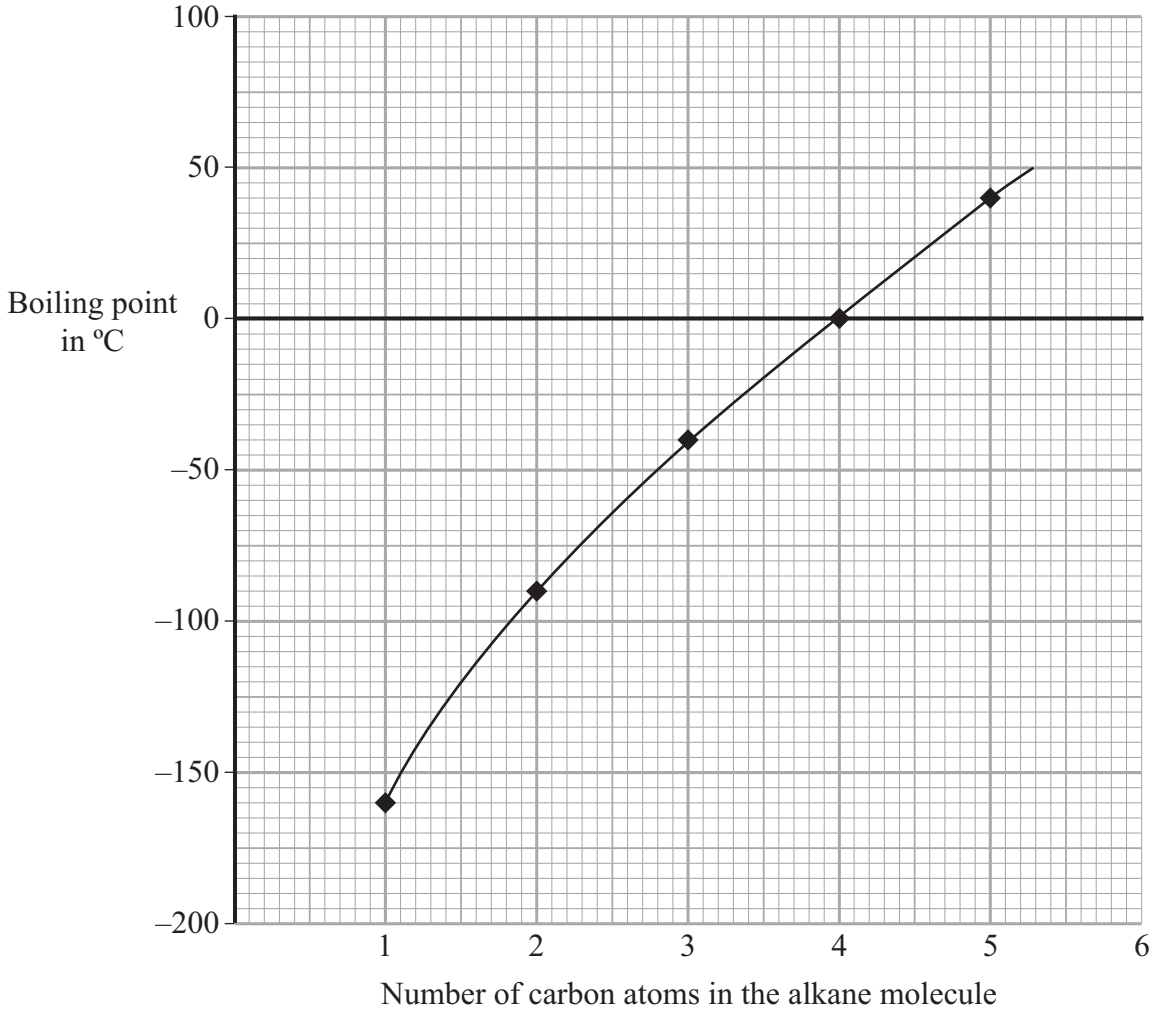
Question 03

March 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The graph shows the boiling points of five alkanes.

The general formula for the alkanes is C_nH_{2n+2}



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

A 0

B 5

C 8

D 70

The alkane plotted on the graph which is a liquid at 10 °C has . . . **1** . . . carbon atoms in each molecule.

Propane has three carbon atoms and . . . **2** . . . hydrogen atoms in each molecule.

The boiling point of the alkane with four carbon atoms in each molecule is . . . **3** . . . °C.

The boiling point of the alkane with six carbon atoms in each molecule is likely to be about . . . **4** . . . °C.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 04

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 04 · continued

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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 05

March 2007 | CHY1B | Original Q1 | Legacy

QUESTION ONE

This question is about hydrocarbons.

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

A alkanes

B fuels

C monomers

D polymers

Hydrocarbons are cracked to produce smaller molecules.

Some of the products of cracking can be used in cars as . . . **1** . . . .

The products of cracking include alkenes and saturated hydrocarbons called . . . **2** . . . .

Alkenes can be used in reactions to make . . . **3** . . . such as poly(ethene) and poly(propene).

In these reactions, many small molecules known as . . . **4** . . . join together to form very large molecules.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 06

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}

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 07

March 2007 | CHY1B | Original Q6 | Legacy

QUESTION SIX

The flow chart shows the stages in the breakdown of large hydrocarbon molecules.

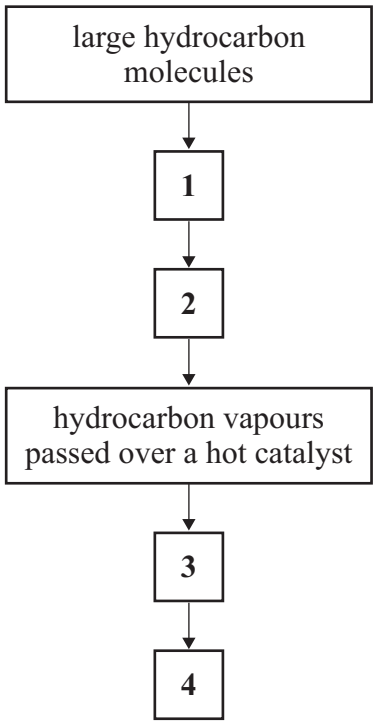
Match phrases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A hydrocarbons undergo thermal decomposition

B hydrocarbons are heated

C hydrocarbons vaporise

D small hydrocarbon molecules



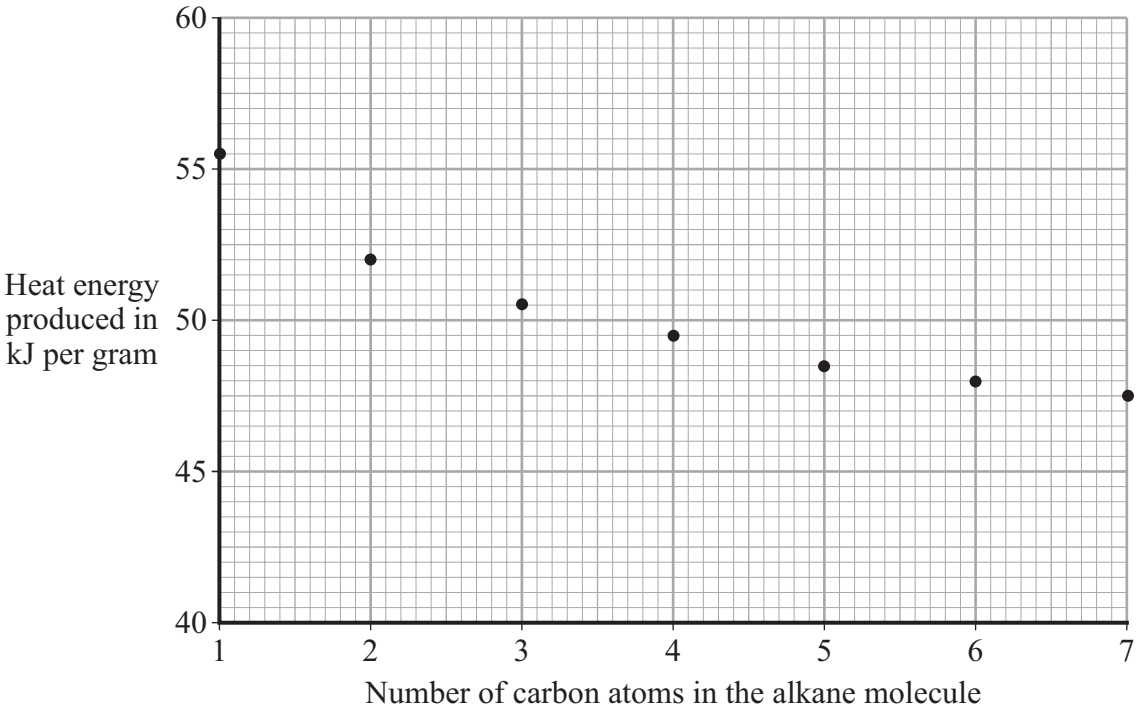
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 08

June 2007 | CHY1A | Original Q5 | Legacy

QUESTION FIVE

The graph shows how much heat energy is produced when 1 gram of each of seven alkanes is burned.



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

A one

B four

C five

D seven

The alkane that burns to give out 48.5 kJ of heat per gram has a molecule with . . . **1** . . . carbon atom(s).

The alkane that burns to give out most heat per gram has a molecule with . . . **2** . . . carbon atom(s) and . . . **3** . . . hydrogen atom(s).

The alkane with six carbon atoms in each molecule will have a lower boiling point than the alkane with . . . **4** . . . carbon atom(s) in each molecule.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 09

June 2007 | CHY1B | Original Q1 | Legacy

QUESTION ONE

This question is about oils and food additives.

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

A an additive

B a catalyst

C an emulsion

D a mixture

Crude oil is . . . **1** . . . .

Droplets of vegetable oil in a solution of vinegar with water form . . . **2** . . . that we call salad cream.

Monosodium glutamate is . . . **3** . . . used to add flavour to some foods.

Nickel is . . . **4** . . . used to speed up the reaction between vegetable oils and hydrogen.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10

June 2007 | CHY1F | Original Q3 | Legacy

3 Crude oil is a natural resource from which useful fuels can be separated.

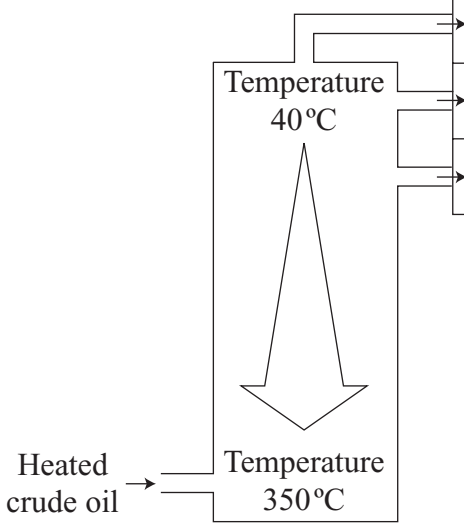
(a) Crude oil is a mixture of hydrocarbons.

Complete the sentence about a hydrocarbon molecule.

A hydrocarbon molecule is made up of ..... and carbon atoms only.

(1 mark)

(b) Many fuels come from crude oil. Some of these fuels are shown in the diagram.



Fraction	Number of carbon atoms in each molecule
gases	1–4
petrol	5–12
diesel	15–25

Suggest **two** properties of these fuels that allow them to be separated from crude oil.

.....

.....

.....

.....

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10 · continued

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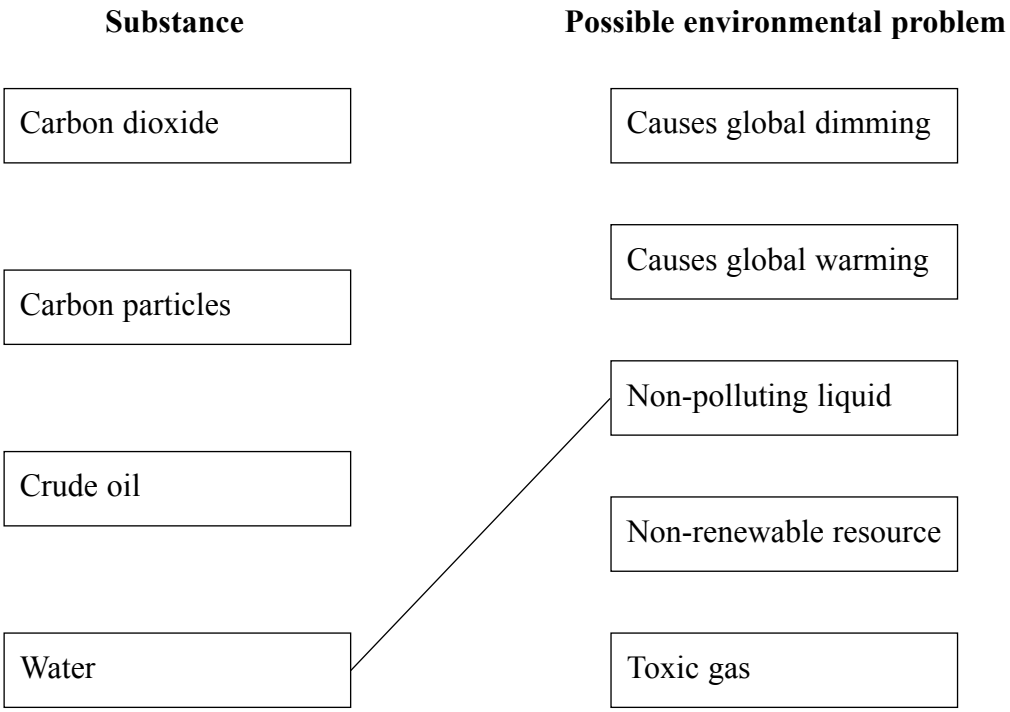
(c) Fuels from crude oil burn to provide heat energy.

When a fuel burns, it combines with oxygen in the air and produces carbon dioxide and water. When there is not enough oxygen, the fuel burns and also produces carbon monoxide and carbon particles.

Draw a straight line from each substance that links it to a possible environmental problem.

One has been done for you.



(3 marks)

6

4.7.1.1 Crude oil, hydrocarbons and alkanes

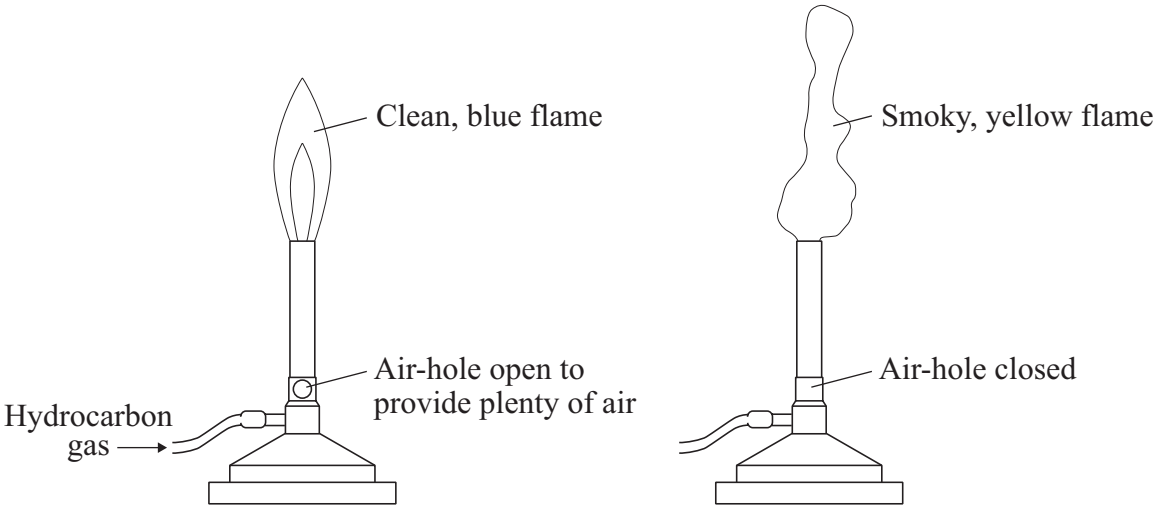
Question 11

November 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The diagram shows a hydrocarbon gas burning in a Bunsen burner.

The flame is different when the air-hole is open compared with when it is closed.



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

A carbon

B carbon monoxide

C carbon dioxide

D oxygen

With the air-hole open, the two main products of combustion are water and . . . **1** . . . .

Water is formed when hydrogen in the hydrocarbon gas reacts with . . . **2** . . . .

With the air-hole closed, another gas that is produced during combustion is . . . **3** . . . .

The yellow flame contains black specks of . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 12

November 2007 | CHY1A | Original Q6 | Legacy

QUESTION SIX

This question is about fractional distillation of crude oil.

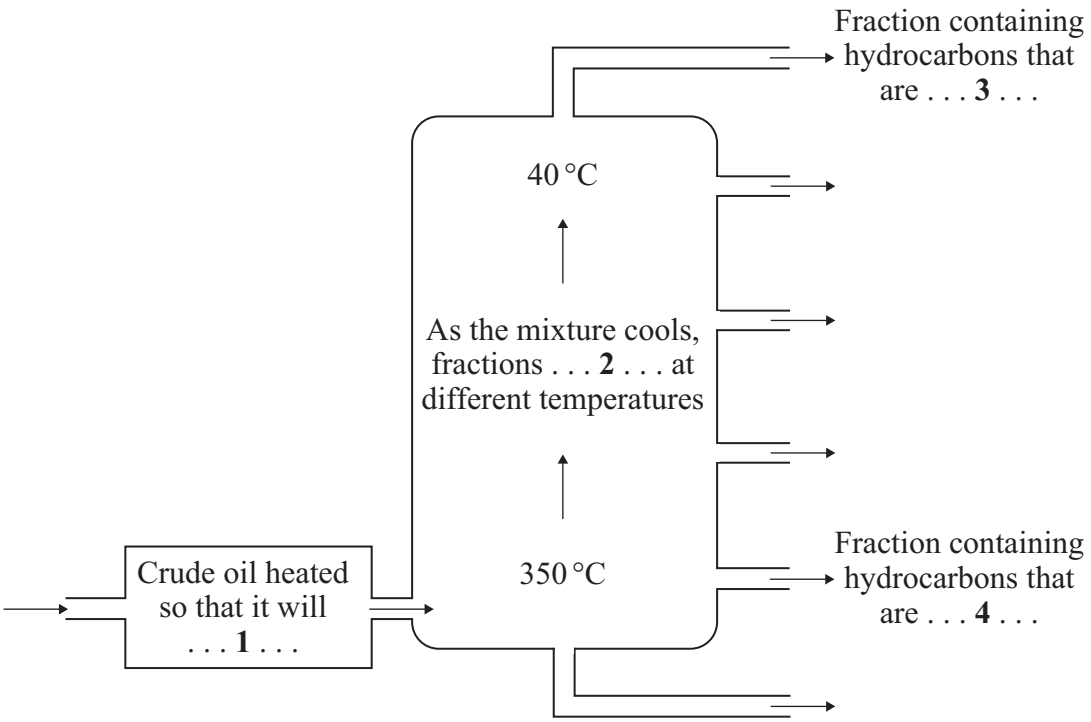
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences on the diagram.

A condense

B vaporise

C viscous

D volatile



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 13

November 2007 | CHY1B | Original Q4 | Legacy

QUESTION FOUR

This question is about gases in the Earth's atmosphere.

In the Earth's early atmosphere	In the Earth's atmosphere today
Carbon dioxide Small amounts of: ammonia, NH_3 methane, CH_4 Water vapour	Nitrogen Oxygen Small amounts of: carbon dioxide noble gases Water vapour

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

A ammonia

B helium

C methane

D oxygen

	What we can say about the gas
1	It is a hydrocarbon.
2	It is a noble gas.
3	It is a compound of nitrogen and hydrogen.
4	It is produced in the atmosphere by the activity of plants.

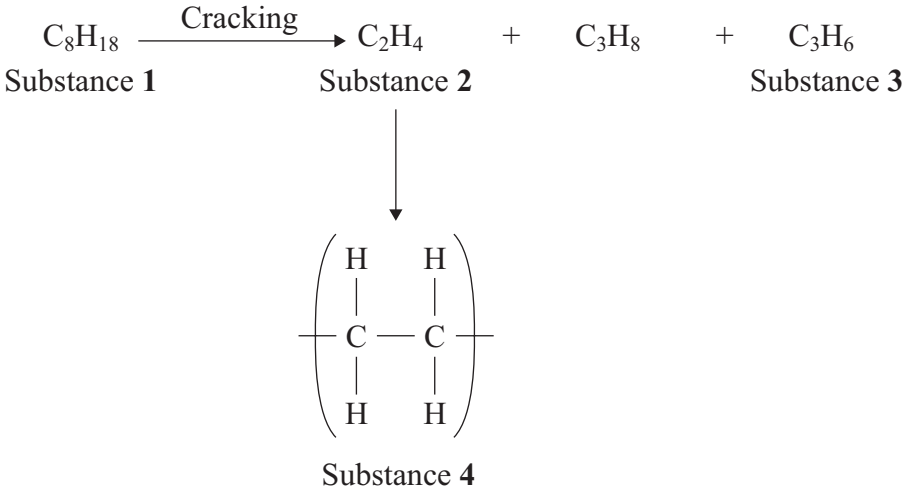
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 14

November 2007 | CHY1B | Original Q5 | Legacy

QUESTION FIVE

The flow diagram shows an example of cracking and how one of the products is used.



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

A alkene with the smallest molecules

B alkene with the largest molecules

C alkane

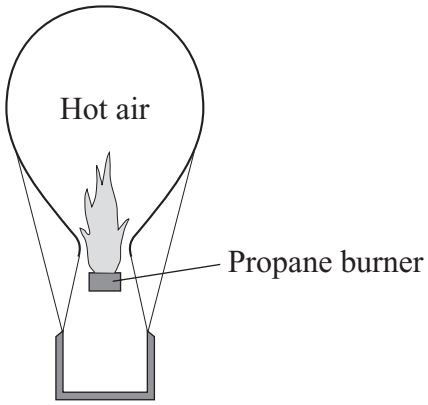
D polymer

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 15

January 2008 | CHY1F | Original Q1 | Legacy

1 Hot air balloons burn hydrocarbons to heat the air.



(a) The hot air contains these gases:

nitrogen, N_2
oxygen, O_2
argon, Ar
carbon dioxide, CO_2
water vapour, H_2O

(i) Argon is an *element*.

What is an *element*?

.....

.....

(1 mark)

(ii) Name **one** other gas in the hot air that is also an element.

.....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 15 · continued

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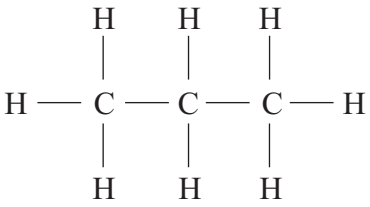
(b) Propane, C_3H_8, can be represented as:



Use the correct words from the box to complete the sentences.

bond	**carbon**	**compound**	**element**	**mixture**

(i) Propane is a ..... and is made up of atoms of hydrogen and ..... .

(2 marks)

(ii) Each line between the atoms in propane represents a chemical ..... .

(1 mark)

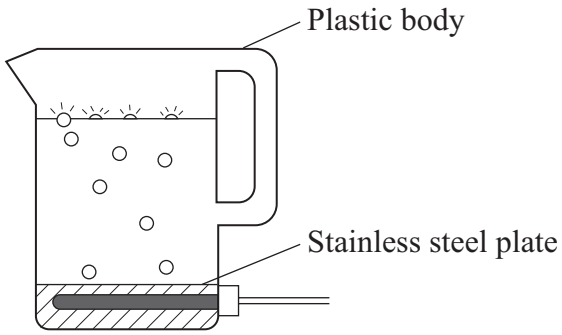
5

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 16

January 2008 | CHY1F | Original Q4 | Legacy

4 Plastics are used to make many everyday items, such as the body of the kettle.



(a) Complete the sentences by drawing a ring around the correct words.

(i) The plastic is made from many small molecules called [catalysts / monomers / polymers] .

(1 mark)

(ii) Propene is produced by cracking some of the fractions that are separated from [crude oil / limestone / metal ores] .

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 16 · continued

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(b) After a few years the kettle no longer worked.

- Some parts of the kettle are made of plastic.
- Some parts of the kettle are made of stainless steel.
- The owner of the kettle disposed of it in a landfill site.

Consider these statements.

Suggest **three** reasons why the kettle should **not** be disposed of in a landfill site.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

5

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 17

March 2008 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about crude oil.

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

A condensed

B heated

C separated

D vaporised

Crude oil can be . . . **1** . . . into a number of different fractions.

The crude oil is first . . . **2** . . . .

This causes the hydrocarbons in the crude oil to be . . . **3** . . . .

The vapours cool and are then . . . **4** . . . at different temperatures.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 18

March 2008 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

This question is about the cracking of hydrocarbons.

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

A alkanes

B alkenes

C catalysts

D polymers

Cracking hydrocarbons produces unsaturated hydrocarbons called . . . **1** . . . .

It also produces saturated hydrocarbons called . . . **2** . . . .

Molecules of unsaturated hydrocarbons can be joined together to form . . . **3** . . . .

These reactions can often be speeded up by using . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

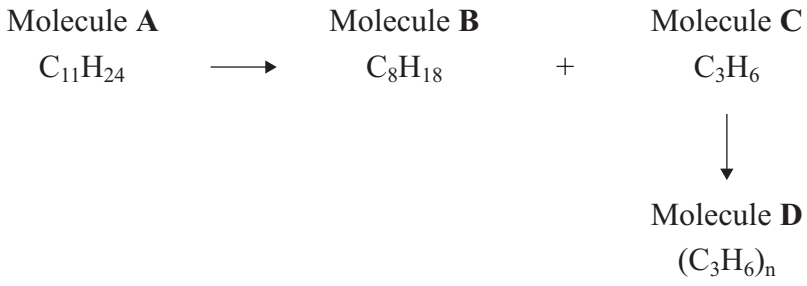
Question 19

March 2008 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

This question is about cracking.

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



Molecule . . . **1** . . . has been cracked.

Molecule . . . **2** . . . is an alkene.

Molecule . . . **3** . . . is a polymer.

Molecule . . . **4** . . . is the smallest alkane in the reaction.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 20

June 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The engine of a car is made of aluminium, to which other metals have been added to make it stronger. In the engine, petrol vapour burns as it reacts with oxygen. Petrol is made up of several alkanes.

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

A alkane

B engine

C oxygen

D petrol vapour

	Type of substance
1	mixture of metals
2	element
3	compound
4	mixture of gases

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 21

June 2008 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

This question is about hydrocarbons and fuels.

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

A C_2H_5OH

B C_3H_8

C C_2H_4

D S

1	a hydrocarbon that is **not** an alkane
2	an alkane
3	a compound that is **not** a hydrocarbon
4	an element that may be found in a fuel

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 22

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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 22 · continued

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

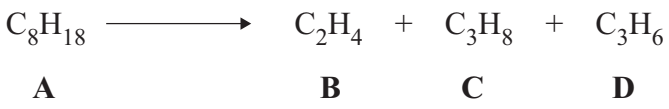
Question 23

June 2008 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.



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

1	It is the molecule which contains 11 atoms.
2	It is ethene.
3	It is the monomer from which poly(propene) can be made.
4	It is the alkane with the largest molecules.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 24

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** . . . .

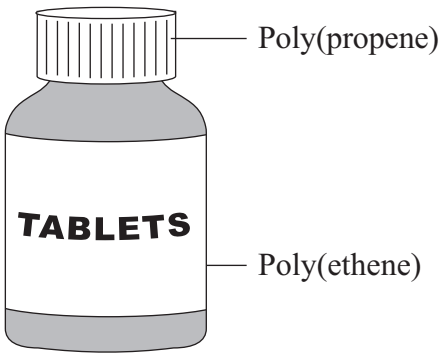
Ethene reacts with oxygen to produce carbon dioxide and water. This reaction is an example of . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 25

June 2008 | CHY1F | Original Q5 | Legacy

5 Tablet containers are often made from two different polymers.



5 (a) Ethene, C_2H_4, and propene, C_3H_6, can be made from crude oil.

5 (a) (i) Complete the following sentence.

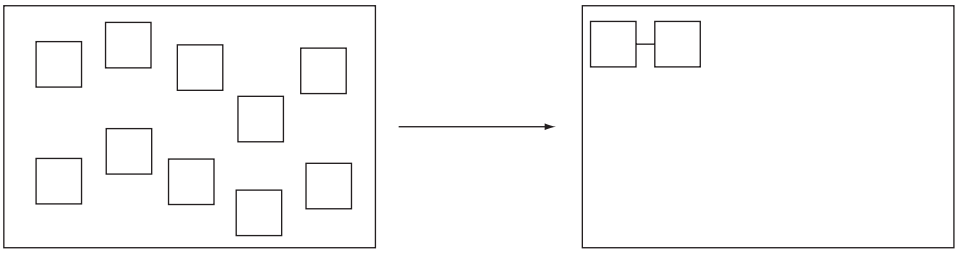
Ethene and propene are called hydrocarbons because they are made up of carbon and ..... atoms only.

(1 mark)

5 (a) (ii) Ethene molecules are used to form poly(ethene) molecules.

Complete the diagram to show the poly(ethene) molecule.

Ethene molecules **Poly(ethene) molecule**



(2 marks)

5 (b) The tablet containers could be disposed of in a landfill site or could be recycled.

5 (b) (i) Suggest **two** reasons why disposing of the tablet containers in a landfill site could cause problems.

1 .....

.....

2 .....

.....

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 25 · continued

for mark

5 (b) (ii) Suggest **one** reason why recycling the tablet containers would be difficult.

.....

.....

(1 mark)

6

Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 26

June 2008 | CHY1F | Original Q8 | Legacy

8 The hydrocarbons in crude oil can be separated into useful fractions.

Fraction	Boiling point in °C	Carbon chain length	Relative % in crude oil	Relative % demand
Naphtha	20–180	5–9	10	20
Gasoline (petrol)	20–200	5–10	10	20
Kerosene (paraffin)	180–260	10–16	15	23
Diesel	260–340	14–20	20	25
Fuel oil	370–600	20–70	45	12

8 (a) Why does gasoline (petrol) have a lower boiling point than fuel oil?

.....

.....

(1 mark)

8 (b) Suggest why gasoline (petrol) costs more than fuel oil.

.....

.....

.....

.....

(2 marks)

8 (c) Describe how fuel oil can be changed into gasoline (petrol).

.....

.....

.....

.....

(2 marks)

5

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 27

November 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about four of the gases given off when coal is heated in the absence of air.

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

A hydrogen, H_2

B ammonia, NH_3

C methane, CH_4

D carbon monoxide, CO

The gas that is an element is . . . **1** . . . .

The gas that is an alkane is . . . **2** . . . .

The gas that burns to form only carbon dioxide, CO_2, is . . . **3** . . . .

The gas that has four atoms in its formula is . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 28

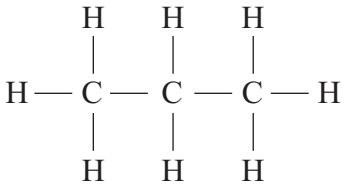
November 2008 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about four alkanes, **A**, **B**, **C** and **D**.

Alkane	Formula	Boiling point in °C
A	C_2H_6	−89
B	C_3H_8	−42
C	C_4H_{10}	0
D	C_5H_{12}	+36

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

The alkane with the structural formula  is . . . **1** . . . .

The alkane with the highest boiling point is . . . **2** . . . .

The alkane that boils at the same temperature as ice melts is . . . **3** . . . .

The alkane that is a gas at −50 °C is . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 29

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**.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 29 · 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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 30

November 2008 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about four processes.

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

A combustion

B condensation

C cracking

D hardening

1	the change from gas to liquid
2	the burning of hydrocarbons in oxygen
3	the breakdown of large hydrocarbon molecules
4	the conversion of a liquid vegetable oil to a solid fat

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 31

March 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Fuels burn in air to form oxides of the elements they contain.
When fuel molecules contain a large number of carbon atoms, combustion is not always complete.
With incomplete combustion, carbon particles may be produced.

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

A H_2

B CO

C C_4H_{10}

D $C_{14}H_{28}$

1	It will burn to form carbon dioxide only.
2	It will burn to form water only.
3	It is an alkane.
4	It will probably contribute to global dimming when burned.

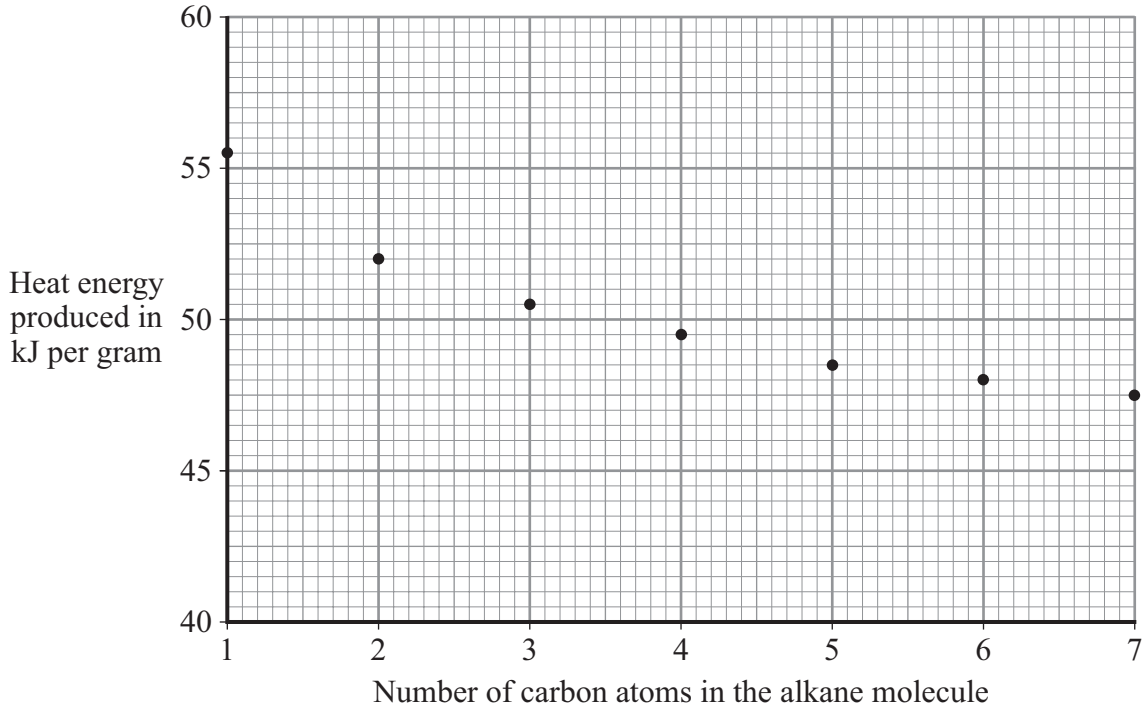
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 32

March 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

The graph shows how much heat energy is produced when one gram of each of seven alkanes is burned.



6A How much heat energy is produced by burning one gram of the alkane with two carbon atoms in its molecule?

1 51 kJ

2 52 kJ

3 53 kJ

4 54 kJ

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 32 · continued March 2009 | CHY1AP | Original Q6 | Legacy

6B The alkane that produces the most heat energy per gram, when burned, is the alkane with . . .

1 one carbon atom in its molecule.

2 three carbon atoms in its molecule.

3 five carbon atoms in its molecule.

4 seven carbon atoms in its molecule.

6C Carbon dioxide is produced when hydrocarbon fuels burn.

This is a problem because carbon dioxide . . .

1 dissolves in rainwater.

2 reacts with oxygen to form carbon monoxide.

3 may cause global warming.

4 may cause global dimming.

6D Petrol companies have reduced the amount of sulfur in petrol and diesel fuels.

The main reason is . . .

1 to reduce their production costs.

2 to reduce the amount of carbon dioxide released into the atmosphere.

3 to reduce the acidity of rain.

4 to reduce the amount of fuel used in vehicles.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 33

June 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about substances that can be burned in air.

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

A C_2H_5SH

B C_2H_6

C C_2H_2

D C

1	It would contribute to the formation of acid rain when burned.
2	It is an alkane.
3	It corresponds to the general formula C_nH_{2n-2}
4	It forms only carbon dioxide when burned in air.

4.7.1.1 Crude oil, hydrocarbons and alkanes

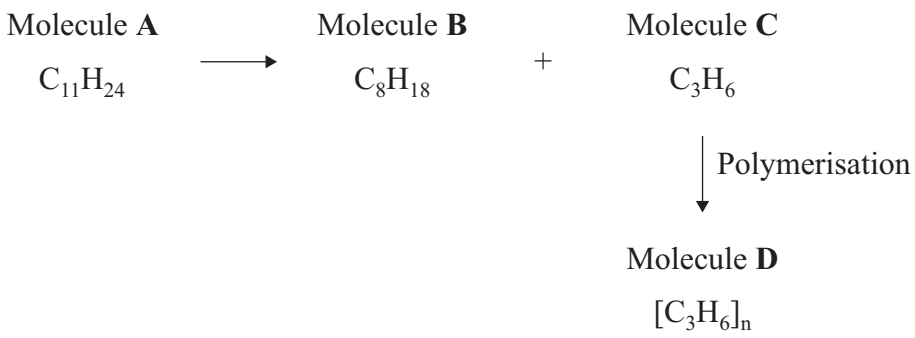
Question 34

June 2009 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about reactions of some hydrocarbon molecules.

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



The molecule that has been cracked is . . . **1** . . . .

The molecule that is an alkene is . . . **2** . . . .

The molecule that is a plastic is . . . **3** . . . .

The molecule that is the smallest alkane in these reactions is . . . **4** . . . .

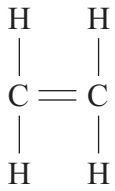
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 35

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)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 35 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 36

November 2009 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

Exhaust gases from petrol and diesel vehicles were measured under different driving conditions.

The table shows the results in parts per million (ppm).

	Driving conditions					
	Accelerating		Steady speed		Slowing down	
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel
Hydrocarbons in ppm	2000	200	1000	100	10 000	300
Carbon monoxide in ppm	25 000	1000	18 000	15	20 000	46
Nitrogen oxides in ppm	1020	856	650	240	20	30

Match the type of fuel and the driving conditions, **A**, **B**, **C** and **D**, with the exhaust gas descriptions **1–4** in the table below.

A diesel, steady speed

B diesel, slowing down

C petrol, accelerating

D petrol, slowing down

	Exhaust gas description
1	a total of 76 ppm of carbon monoxide and nitrogen oxides
2	the smallest amount of hydrocarbons
3	the highest total of carbon monoxide and nitrogen oxides
4	the most unburnt fuel

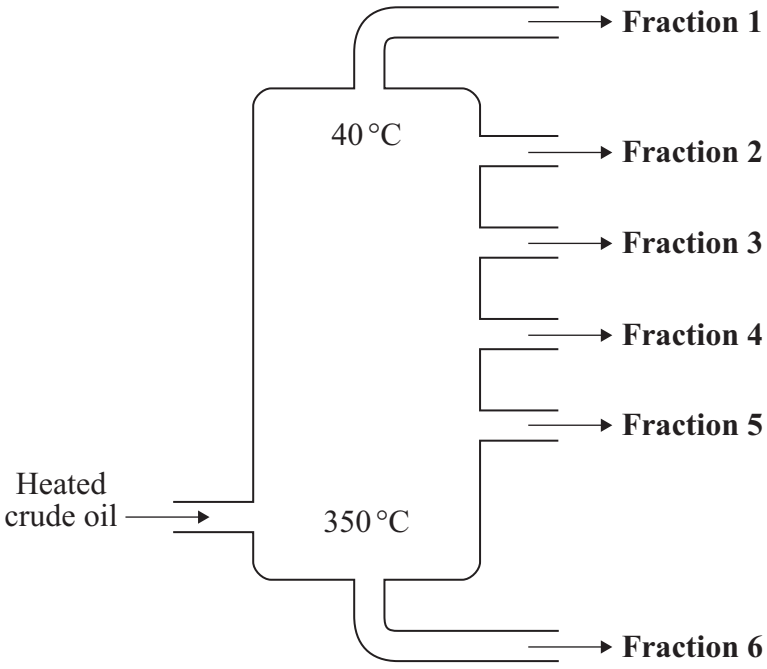
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 37

November 2009 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

In a fractionating column, crude oil is separated into a number of fractions.



8A Each fraction contains . . .

1 only alkanes that are liquids.

2 only alkanes that condense at temperatures above 40 °C.

3 alkanes with similar boiling points.

4 alkanes with the same chemical formula.

8B Which statement is true for the alkanes in **Fraction 1**?

1 They burn to produce carbon dioxide and sulfur dioxide only.

2 They have the general formula C_nH_{2n-2}

3 They are saturated compounds.

4 They are compounds of carbon, hydrogen and oxygen.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 37 · continued

8C When compared with the alkanes in **Fraction 6**, the alkanes in **Fraction 1** . . .

1 will ignite more easily.

2 will be more viscous.

3 will have higher boiling points.

4 will have larger molecules.

8D In a molecule of the alkane called propane, there are eight hydrogen atoms.

The formula for propane is . . .

1 C_2H_8

2 C_3H_8

3 C_4H_8

4 C_3H_8O

4.7.1.1 Crude oil, hydrocarbons and alkanes

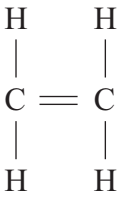
Question 38

November 2009 | CHY1BP | Original Q9 | Legacy

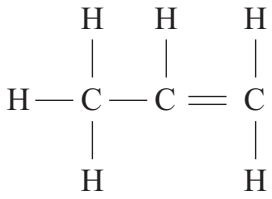
QUESTION NINE

The diagram shows three compounds.

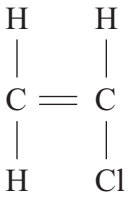
Compound W



Compound X



Compound Y



9A Which of the compounds are hydrocarbons?

1 **W** and **X**

2 **W** and **Y**

3 **X** and **Y**

4 **W**, **X** and **Y**

9B Which row in the table correctly describes the bonding in Compound **X**?

	Number of bonds to each carbon atom	Number of bonds to each hydrogen atom
1	1	1
2	1	4
3	4	1
4	4	4

9C All three compounds can form polymers because . . .

1 they have saturated molecules.

2 their molecules contain two or more carbon atoms.

3 their molecules have a double carbon carbon bond.

4 they have small molecules.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 38 · continued

9D Disposal of polymer waste can be a problem.

The main reason that it causes problems in a landfill site is that . . .

1 it is very light.

2 it is not easily broken down by microorganisms.

3 it is difficult to bury.

4 it burns easily, releasing toxic gases.

END OF TEST

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 39

January 2019 | CHY1F | Original Q4 | Legacy

4 Natural gas is mainly a hydrocarbon called methane.

4 (a) Use **one** word from the box to complete the sentence.

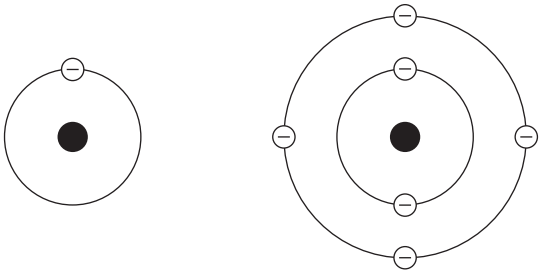
compounds	**elements**	**molecules**

Hydrocarbons contain hydrogen and carbon only.

Hydrogen and carbon are ..... .

(1 mark)

4 (b) The diagrams represent atoms of hydrogen and carbon.



Hydrogen Carbon

Draw a ring around the correct answer to complete the sentences.

4 (b) (i) The centre of each atom is called the

bond.
nucleus.
symbol.

(1 mark)

4 (b) (ii) The hydrogen atom has one electron and the carbon atom has

three
four
six

electrons.

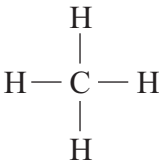
(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 39 · continued

for mark

4 (c) A molecule of methane can be represented as



Draw a ring around the correct answer to complete the sentences.

4 (c) (i) The formula of methane is

CH

CH_4

C_4H_4

(1 mark)

4 (c) (ii) The line between C—H is called a

bond.

molecule.

nucleus.

(1 mark)

4 (d) Methane burns to produce carbon dioxide (CO_2) and water (H_2O).

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

When methane burns it reacts with

carbon.

nitrogen.

oxygen.

(1 mark)

4 (d) (ii) Hydrogen (H_2) can be used as a fuel.

Suggest why burning hydrogen would be less harmful to the environment than burning methane.

.....

.....

(1 mark)

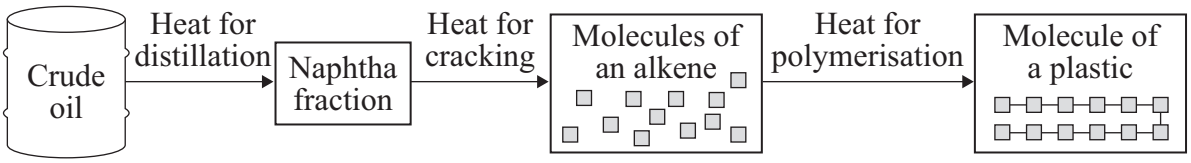
7

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 40

5 Crude oil is used to make plastics.

5 (a) To make a plastic from crude oil involves many processes.



5 (a) (i) How do alkene molecules form a molecule of a plastic?

.....

.....

(1 mark)

5 (a) (ii) Suggest **one** of the main costs of making a plastic from crude oil.

.....

.....

(1 mark)

5 (a) (iii) Suggest **two** problems caused by the disposal of plastics in landfill sites.

1 .....

.....

2 .....

.....

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 40 · continued

for mark

5 (b) Some companies are using bio-plastics made from plants such as corn.
Less fossil fuel is used to make bio-plastics than is used to make plastics from crude oil.

Plastics made from plants would be more environmentally friendly than plastics made from crude oil.

Explain why.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 41

March 2010 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Anaesthetics are used to put patients to sleep before an operation.

Many new anaesthetics are based on alkanes in which some of the hydrogen atoms are replaced by fluorine (F), chlorine (Cl) and bromine (Br).

The temperature in an operating theatre is usually above 30 °C.

	Formula of the anaesthetic	Boiling point in °C	Additional information
A	$CF_3CHClBr$	50	Unstable in light
B	$CHF_2OCHClCF_3$	49	Very few side-effects
C	$(CF_3)_2CHOCH_2F$	59	High cost
D	$CF_3CHFOCHF_2$	24	Large amount needed to put patients to sleep

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

1 It does **not** require warming in the operating theatre to turn it into a gas.

2 It has to be stored in a dark bottle.

3 It contains the most fluorine atoms in its formula.

4 It would cause least harm to patients.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 42

March 2010 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

The alkanes are a series of hydrocarbons.

9A What is the general formula for the alkane series?

1 C_nH_n

2 C_nH_{2n}

3 C_nH_{2n+2}

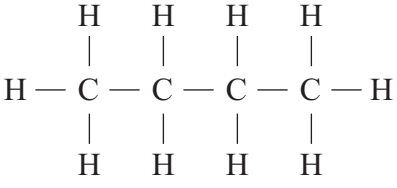
4 $C_{2n}H_{2n-2}$

The table shows information about four alkanes.

Alkane	Number of carbon atoms in each molecule
Methane	1
Butane	4
Octane	8
Dodecane	12

9B The structural formula for butane is . . .

1



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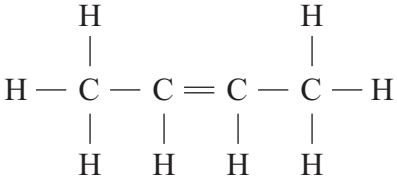

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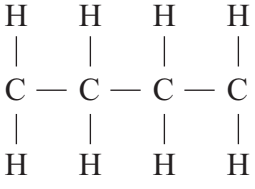

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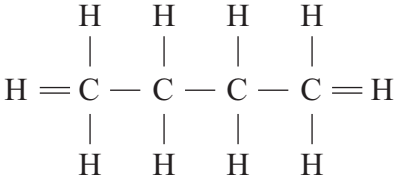


4.7.1.1 Crude oil, hydrocarbons and alkanes

9C When compared with octane, dodecane . . .

1 has a lower boiling point.

2 is easier to ignite.

3 evaporates less easily.

4 is less viscous.

9D When pure methane burns in plenty of oxygen, the only products are . . .

1 carbon dioxide and hydrogen.

2 carbon, carbon dioxide and water.

3 carbon dioxide, sulfur dioxide and water.

4 carbon dioxide and water.

END OF TEST

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 43

March 2010 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

The table below shows the masses of some gases given off when one gram of each of the polymers, **A**, **B**, **C** and **D**, are burnt in air.

		Combustion products in mg						
	Polymer name	**C_2H_4**	**CH_4**	**CO_2**	**CO***	**NO_2***	**HCN***	**NH_3***
A	Kevlar	–	–	1850	50	10	14	0.5
B	Acrylic	5	17	1300	170	45	40	3.0
C	66 Nylon	50	25	1200	250	20	30	–
D	Polyester	6	10	1000	350	–	–	–

Toxic gases are marked with *.

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

1 the polymer that produces the most HCN

2 the polymer that produces the most ethene

3 the polymer that produces no hydrocarbons

4 the polymer that produces the largest total mass of toxic gases

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 44

March 2010 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

The two equations below show reactions involving hydrocarbons.

$$C_{11}H_{24} \rightarrow C_2H_4 + C_4H_8 + C_5H_{12}$$

$$C_4H_{10} \rightarrow 2C_2H_4 + H_2$$

8A The reactions are examples of . . .

1 condensation.

2 polymerisation.

3 cracking.

4 hydrogenation.

8B The hydrocarbon C_2H_4 can be represented by . . .

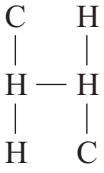
1



2



3



4



8C In the equations, the two hydrocarbons that are alkenes are . . .

1 C_2H_4 and C_4H_8

2 C_2H_4 and C_4H_{10}

3 C_2H_4 and C_5H_{12}

4 $C_{11}H_{24}$ and C_4H_{10}

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 44 · continued

8D Which of the hydrocarbons is used to make poly(ethene)?

1 C_2H_4

2 C_4H_8

3 C_4H_{10}

4 C_5H_{12}

Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 45

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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 46

June 2010 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Petrol is a hydrocarbon fuel that burns in air. Air is mainly nitrogen.

In a car engine:

- not all of the petrol burns completely
- after burning, the products pass into the exhaust pipe.

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

A nitrogen dioxide

B carbon monoxide

C carbon dioxide

D soot (carbon)

The black solid seen inside the exhaust pipe is . . . **1** . . . .

The gas in the exhaust fumes formed by the complete combustion of petrol is . . . **2** . . . .

The poisonous gas in the exhaust fumes formed by incomplete combustion of petrol is . . . **3** . . . .

The gas in the exhaust fumes formed by combining two gases from the air is . . . **4** . . . .

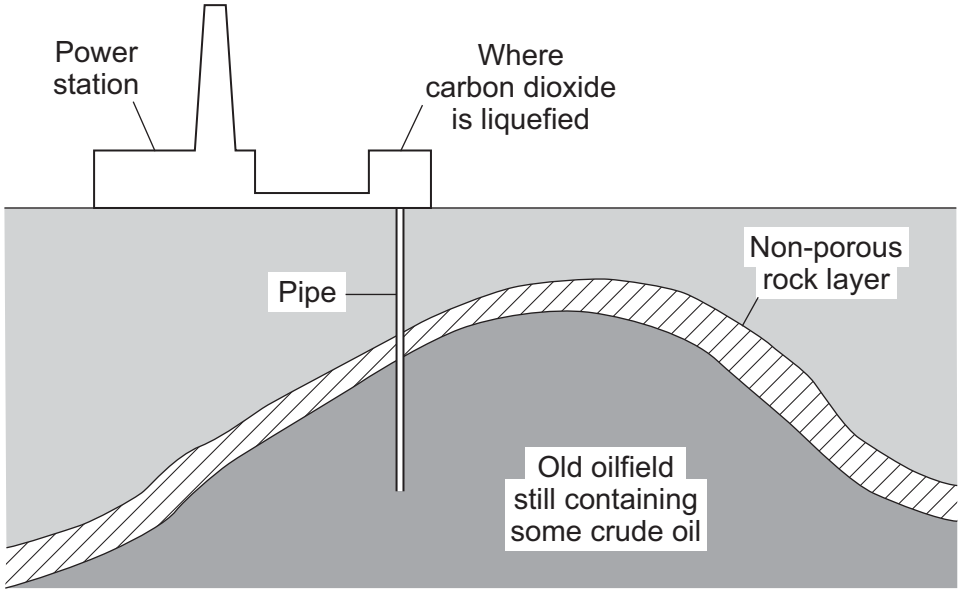
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 47

June 2010 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Carbon capture and storage (CCS) is being developed to reduce the amount of carbon dioxide released into the atmosphere by power stations. Carbon dioxide is separated from the waste gases. It is liquefied and then pumped into a storage area underground. There are many old oilfields that could be used as storage areas.



7A The main reason why CCS is being developed is . . .

1 to reduce global warming.

2 because old oilfields need filling up.

3 because carbon dioxide is toxic.

4 to store carbon dioxide for future use.

7B A possible additional benefit from CCS is that it . . .

1 stops crude oil from rising to the surface.

2 could help to extract any remaining crude oil.

3 prevents the formation of new crude oil.

4 stops the old oilfield from being used as a landfill site.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 47 · continued

7C The carbon dioxide does not re-enter the atmosphere from the old oilfield . . .

1 because of plants that grow deep underground.

2 because the pipe to the old oilfield is too narrow.

3 because of the non-porous rock layer.

4 because it turns into a fossil fuel.

7D Which of the following might be a problem for CCS?

1 The carbon dioxide is needed in the atmosphere.

2 There are no old oilfields left.

3 Nobody will be burning fossil fuels in the near future.

4 Earthquakes might occur in the old oilfields.

Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 48

June 2010 | CHY1BP | Original Q4 | Legacy

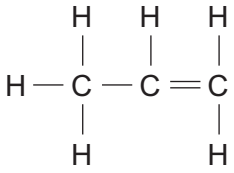
QUESTION FOUR

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.

$$\underset{\textbf{A}}{C_{10}H_{22}} \longrightarrow \underset{\textbf{B}}{C_2H_4} + \underset{\textbf{C}}{C_5H_{12}} + \underset{\textbf{D}}{C_3H_6}$$

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

1	It has molecules with 17 atoms.
2	It is ethene.
3	It can be represented by 
4	It is the alkane with the largest molecules.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 49

June 2010 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

This equation shows the thermal decomposition of a hydrocarbon.

$$C_8H_{18} \longrightarrow \text{an alkane} + \text{an alkene}$$

8A What is the name of this process?

1 polymerisation

2 cracking

3 combustion

4 hydrogenation

8B In this decomposition, . . .

1 the hydrocarbon vapour is heated with iodine.

2 the hydrocarbon is mixed with hydrogen and heated.

3 the hydrocarbon vapour is passed over a hot catalyst.

4 the hydrocarbon is liquefied, then passed over a catalyst.

8C The alkene produced . . .

1 is an unsaturated compound.

2 has molecules in which each carbon atom has two bonds.

3 is unreactive.

4 will burn to produce carbon dioxide and hydrogen.

8D Poly(ethene) is a polymer that is made from an alkene.

The polymer is . . .

1 produced by thermal decomposition.

2 a thermosoftening polymer.

3 produced by cracking.

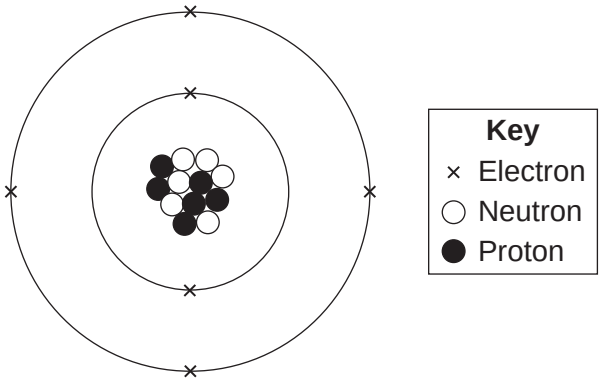
4 biodegradable.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 50

June 2010 | CHY2F | Original Q2 | Legacy

2 The diagram represents a carbon atom.



2 (a) Use words from the box to answer the questions.

electron	**neutron**	**nucleus**	**proton**

2 (a) (i) What is the name of the central part of the atom?

.....

(1 mark)

2 (a) (ii) What is the name of the particle with no charge?

.....

(1 mark)

2 (a) (iii) What is the name of the particle with a negative charge?

.....

(1 mark)

2 (b) Use the diagram above to help you to answer these questions.

2 (b) (i) Draw a ring around the atomic (proton) number of this carbon atom.

6 **12** **18**

(1 mark)

2 (b) (ii) Draw a ring around the mass number of this carbon atom.

6 **12** **18**

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 50 · continued

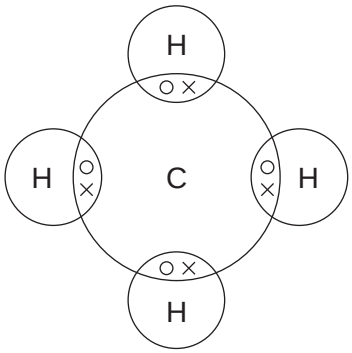
2 (c) A different carbon atom has 6 protons and 8 neutrons.

Draw a ring around the symbol that represents this atom.

$^{8}_{6}C$ $^{14}_{6}C$ $^{14}_{8}C$

(1 mark)

2 (d) The diagram shows the bonding in a methane molecule.



2 (d) (i) Draw a ring around the chemical formula of a methane molecule.

CH_4 **CH^4** **C_4H**

(1 mark)

2 (d) (ii) Draw a ring around the word that describes methane.

compound **element** **mixture**

(1 mark)

2 (d) (iii) Draw a ring around the type of bonding in a methane molecule.

covalent **ionic** **metallic**

(1 mark)

9

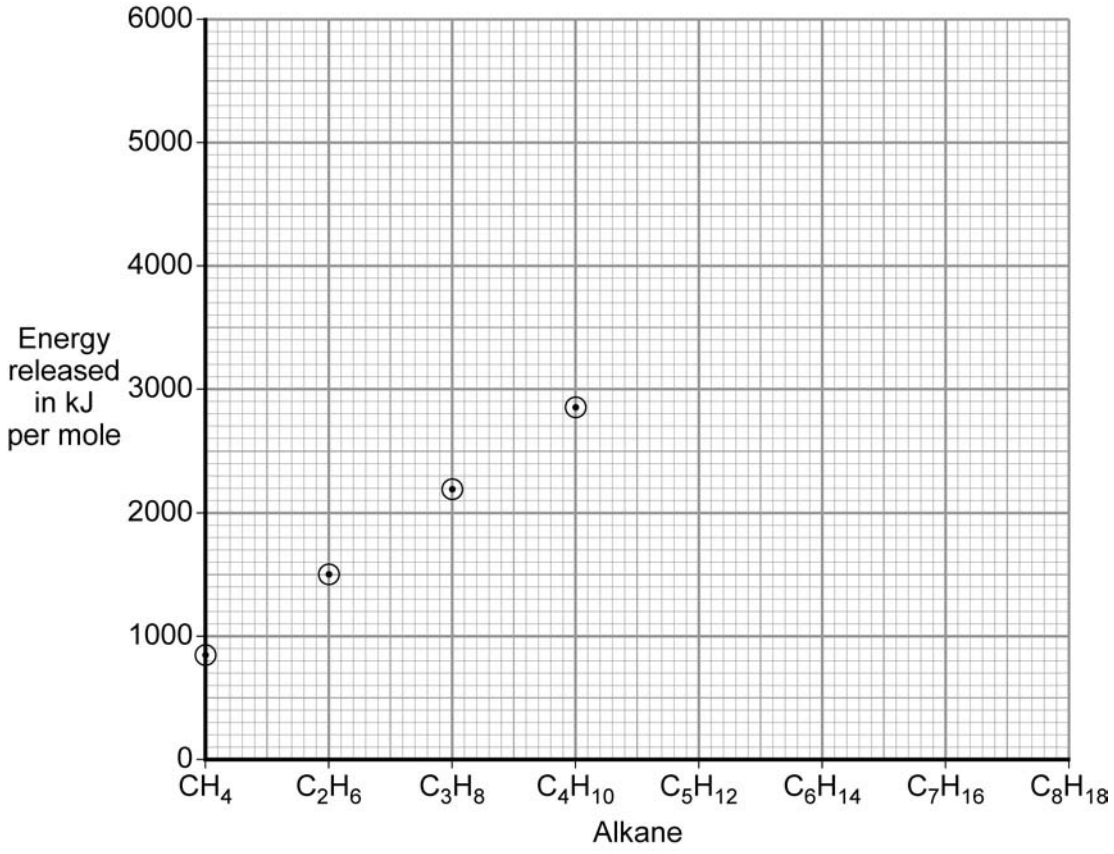
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 51

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)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 51 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 51 · continued

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

			Combustion products			
Fuel	**Type**	**Heat released in kJ per g**	**CO_2**	**SO_2**	**H_2O**	**Type of flame**
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."

.....

.....

.....

.....

(2 marks)

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

.....

.....

.....

.....

.....

.....

.....

(2 marks)

9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 52

November 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The substances that we get from the distillation of crude oil have a range of properties.

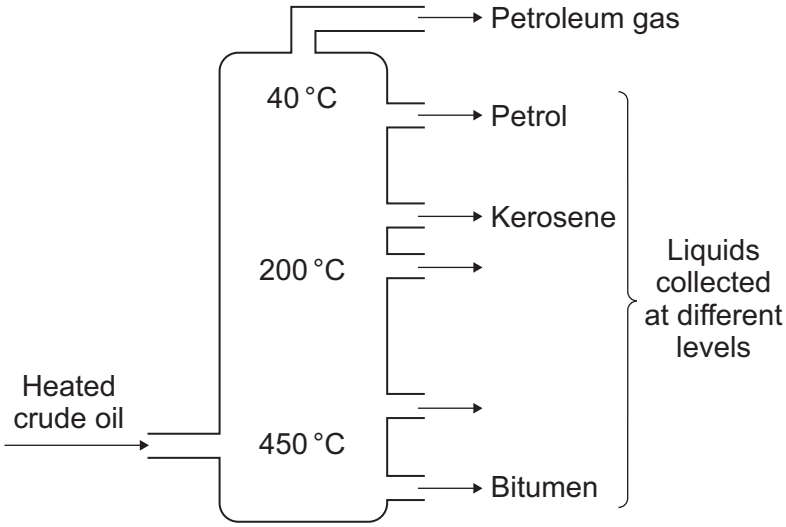
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A kerosene

B petroleum gas

C petrol

D bitumen



The substance with the lowest boiling point is . . . **1** . . . .

The substance collected at about 150 °C is . . . **2** . . . .

The most volatile liquid collected is . . . **3** . . . .

The most viscous substance collected is . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 53

November 2010 | CHY1AP | Original Q7 | Legacy

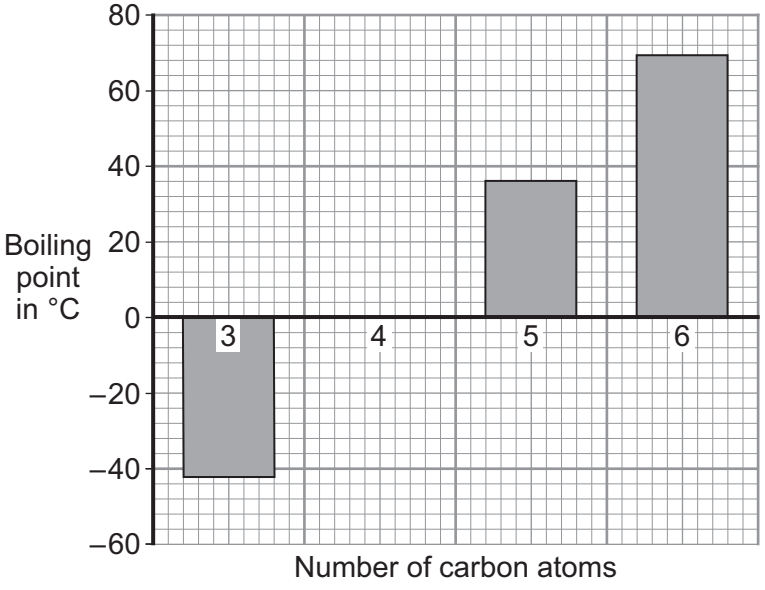
QUESTION SEVEN

This question is about alkanes with 3, 4, 5 or 6 carbon atoms in their molecules.

The table shows the boiling points of these four alkanes.

Number of carbon atoms in a molecule of the alkane	3	4	5	6
Boiling point in °C	–42	0	36	69

The data in the table can also be shown in the diagram below.



7A The diagram shows the data as a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

7B The alkane with the highest boiling point has . . .

1 3 carbon atoms.

2 4 carbon atoms.

3 5 carbon atoms.

4 6 carbon atoms.

4.7.1.1 Crude oil, hydrocarbons and alkanes

7C The alkane with 4 carbon atoms does not seem to be shown on the diagram.

This is because . . .

1 this is an anomalous result.

2 this alkane contains only hydrogen.

3 the boiling point of this alkane is 0 °C.

4 this alkane has the lowest boiling point.

7D The data shows that as the number of carbon atoms . . .

1 increases, the boiling point decreases.

2 decreases, the boiling point decreases.

3 increases, the boiling point stays the same.

4 decreases, the boiling point stays the same.

Turn over for the next question

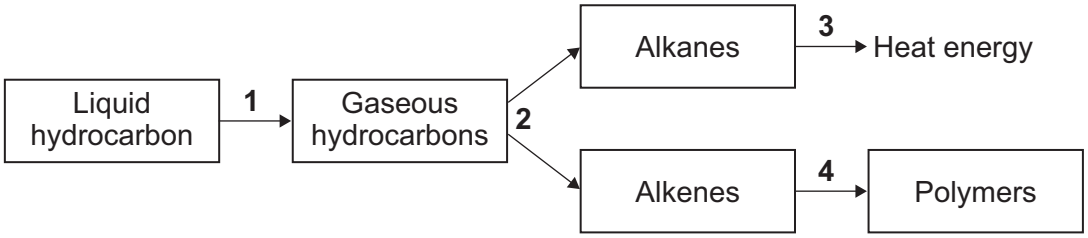
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 54

November 2010 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

The flow chart is about hydrocarbons.



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

A Crack

B Evaporate

C Polymerise

D Burn

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 55

November 2010 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

The equation shows the thermal decomposition of a hydrocarbon.

$$C_6H_{14} \longrightarrow \underset{\text{Ethene}}{C_2H_4} + \text{Substance } \mathbf{K}$$

9A What is the formula for substance **K**?

1 CH_4

2 C_2H_6

3 C_4H_{10}

4 C_8H_{18}

9B Ethene, C_2H_4 is . . .

1 an alkane.

2 an alkene.

3 a saturated hydrocarbon.

4 a polymer.

9C Ethene, C_2H_4 can form polymers because . . .

1 it contains both carbon atoms and hydrogen atoms.

2 it contains twice as many carbon atoms as hydrogen atoms.

3 the carbon atoms and hydrogen atoms are linked by single bonds.

4 there is a double bond between the carbon atoms.

9D Poly(ethene) is used to make shopping bags.

A problem with poly(ethene) is that . . .

1 it is not waterproof.

2 it cannot be coloured.

3 it is not broken down by microorganisms.

4 it is a thermosetting polymer.

END OF TEST

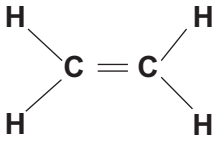
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 56

January 2011 | CHY1F | Original Q4 | Legacy

4 Supermarkets in the UK have been advised by the Government to stop giving plastic bags to customers.
Plastic bags are made from a polymer.
The polymer is made from ethene.

The structural formula of ethene is shown.



Ethene is made by cracking hydrocarbons.
These hydrocarbons come from crude oil.

4 (a) Complete these sentences about ethene.

4 (a) (i) Ethene is a hydrocarbon because it contains only ..... and

..... .

(2 marks)

4 (a) (ii) Ethene is unsaturated because it has a ..... bond.

(1 mark)

4 (b) Tick (✓) the name of the polymer formed when many ethene molecules join together.

Name of polymer	Tick (✓)
poly(chloroprene)	
poly(ethene)	
poly(propene)	

(1 mark)

4 (c) Suggest **two** reasons why supermarkets should stop giving plastic bags to customers.

1 .....

.....

2 .....

.....

(2 marks)

6

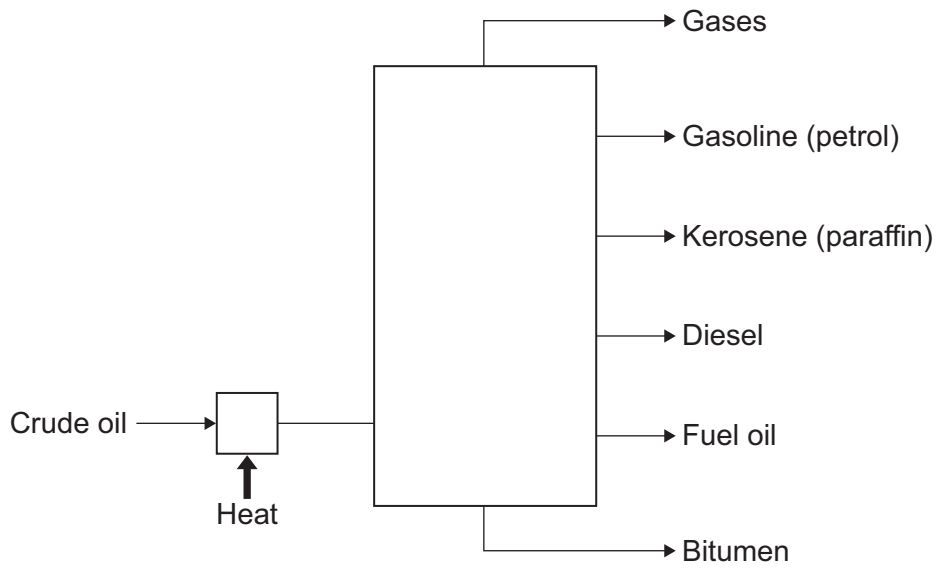
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 57

January 2011 | CHY1F | Original Q7 | Legacy

7 Crude oil is used to produce many useful materials.

7 (a) The diagram shows some of the fractions produced from crude oil by fractional distillation.



Use the diagram to help you to explain how crude oil is separated into fractions.

You should use the words evaporated and condensed in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 57 · continued

7 (b) The table shows some information about four of the fractions from crude oil that are used as fuels.

Fraction	Boiling point in °C	Number of carbon atoms found in the molecules
Gasoline (petrol)	20 – 200	5 – 10
Kerosene (paraffin)	180 – 260	10 – 16
Diesel	260 – 340	14 – 20
Fuel oil	370 – 600	20 – 70

Use the information in the table to help you to answer these questions.

7 (b) (i) How can you tell that each of the fractions is a mixture?

.....

.....

(1 mark)

7 (b) (ii) How does the number of carbon atoms in a molecule affect its boiling point?

.....

.....

(1 mark)

7 (c) Fuels are substances that release energy.

7 (c) (i) Name the reaction that releases energy from a fuel such as gasoline (petrol).

.....

(1 mark)

7 (c) (ii) Describe how fuel oil is broken down into smaller, more useful molecules such as gasoline (petrol).

.....

.....

.....

.....

(2 marks)

8

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 58

March 2011 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about four alkanes, **A**, **B**, **C** and **D**.

The general formula for the alkanes is $C_nH_{(2n+2)}$

	Name of alkane	Number of carbon atoms in each molecule	Boiling point in ºC
A	Ethane	2	−89
B	Pentane	5	+36
C	Hexane	6	+69
D	Dodecane	12	+216

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

1	It has the lowest boiling point.
2	It has the largest molecules.
3	It has 12 hydrogen atoms in each molecule.
4	It has a total of 20 atoms in each molecule.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 59

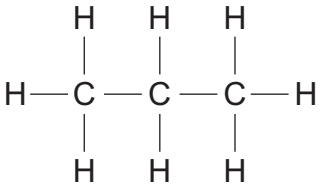
March 2011 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

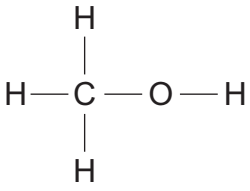
This question is about the formulae of four compounds.

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

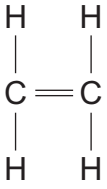
A



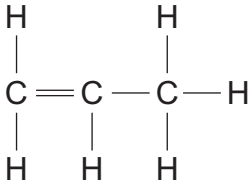
B



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.

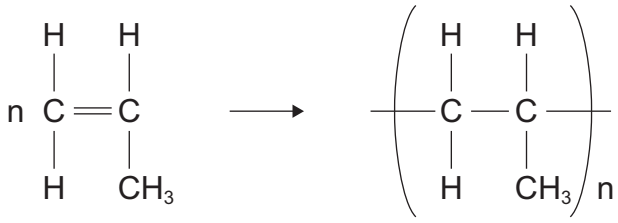
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 60

March 2011 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

The equation shows a chemical reaction.



Small molecules of hydrocarbon **X**

Large molecule of hydrocarbon **Y**

9A Hydrocarbon **X** is . . .

1 an alkane.

2 a polymer.

3 an alkene.

4 a catalyst.

9B Hydrocarbon **Y** is . . .

1 an unsaturated compound.

2 a polymer.

3 an alkene.

4 a monomer.

9C Poly(propene) is a thermosoftening polymer so it **cannot** be used to make . . .

1 buckets.

2 food containers.

3 non-stick coating for frying pans.

4 washing-up bowls.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 60 · continued

March 2011 | CHY1BP | Original Q9 | Legacy

9D Putting poly(propene) and other polymer waste into landfill creates a problem because this type of waste . . .

1 is very lightweight and blows about.

2 is not biodegradable.

3 does not dissolve in water.

4 is very dense and sinks deep underground.

END OF TEST

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 61

June 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

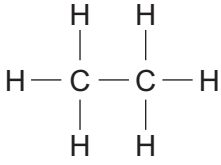
This question is about four alkanes, **A**, **B**, **C** and **D**.

	Alkane	Formula	Boiling point in °C
A	Methane	CH_4	−162
B	Ethane	C_2H_6	−89
C	Butane	C_4H_{10}	0
D	Nonane	C_9H_{20}	+150

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

The alkane with the lowest boiling point is . . . **1** . . . .

The alkane with 14 atoms in each molecule is . . . **2** . . . .

The alkane with the structural formula  is . . . **3** . . . .

The alkane which is least flammable is . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 62

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 63

June 2011 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

This question is about hydrocarbons.

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

A alkenes

B polymers

C monomers

D alkanes

Hydrocarbons are cracked to produce both saturated and unsaturated hydrocarbons.

The saturated hydrocarbons that are used as fuels are called . . . **1** . . . .

The unsaturated hydrocarbons are called . . . **2** . . . .

Compounds, such as poly(ethene) and poly(propene), that have very long chain molecules are called . . . **3** . . . .

Long chain molecules are made when many small molecules join together. These small molecules are called . . . **4** . . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 64

June 2011 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Biodiesel can be used as a fuel for vehicles. Biodiesel is made from vegetable oils. It can be used instead of diesel oil that is obtained from petroleum (crude oil).

Here is some more information about biodiesel.

- It contains much less sulfur than petroleum diesel.
- It is not hazardous to store.
- It is about the same price as petroleum diesel.
- It does not flow easily at low temperatures.
- It releases less energy than petroleum diesel when used as a fuel.
- It is difficult to ignite.

7A Biodiesel is a fuel because it . . .

1 is cheap.

2 is not hazardous when handled.

3 causes no pollution when burnt.

4 releases energy when burnt.

7B Tax is charged on petroleum diesel, but not on biodiesel.

The decision not to have tax charged on biodiesel is made by . . .

1 engine manufacturers to sell more of their engines.

2 politicians to encourage people to buy it.

3 scientists to help protect crude oil reserves.

4 petrol companies to increase sales of fuel.

7C The use of biodiesel is continuing to increase.

One reason is because . . .

1 it is easy to store.

2 it can be used at all temperatures.

3 less agricultural land is required to grow plants for food.

4 it is a sustainable fuel.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 64 · continued

7D At present, there is more petroleum diesel used than biodiesel.

This is because petroleum diesel . . .

1 can be obtained from only a few places in the world.

2 contains more sulfur.

3 is more readily available.

4 is more expensive.

Turn over for the next question

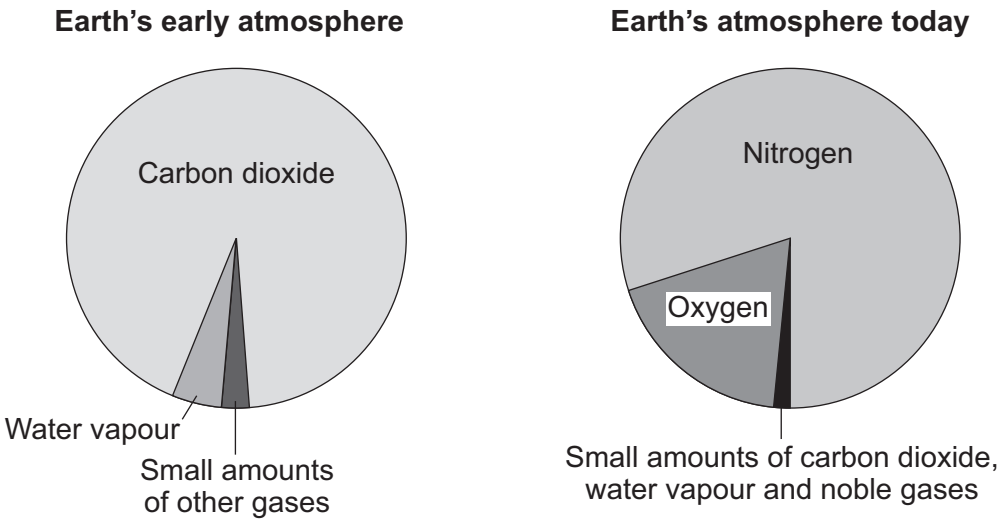
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 65

June 2011 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

The pie charts show the amounts of gases in the Earth's early atmosphere and in the Earth's atmosphere today.



8A Very small amounts of a hydrocarbon gas are thought to have been in the Earth's early atmosphere.

This gas is . . .

1 ammonia, NH_3

2 helium, He

3 methane, CH_4

4 oxygen, O_2

8B As the Earth's early atmosphere was forming, it contained water vapour.

Which row in the table shows where the water vapour came from **and** why the quantity in the atmosphere reduced?

	Water vapour came from	Water vapour reduced because
1	evaporation from the ground.	it condensed to form the oceans.
2	evaporation from the ground.	there was less rainfall.
3	volcanic activity.	it condensed to form the oceans.
4	volcanic activity.	there was less rainfall.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 65 · continued

8C Why was there no oxygen in the Earth's early atmosphere?

1 There was no carbon dioxide for the plants to use to make oxygen.

2 Living organisms had used up the oxygen.

3 There were no plants on Earth.

4 Oxygen is a very reactive gas.

8D The quantity of carbon dioxide in the Earth's atmosphere today is very different from the quantity that was in the Earth's early atmosphere.

One of the reasons why it is very different is that . . .

1 there are a lot of cars on our roads today.

2 it is locked up as carbon in fossil fuels.

3 most homes use fossil fuels for central heating.

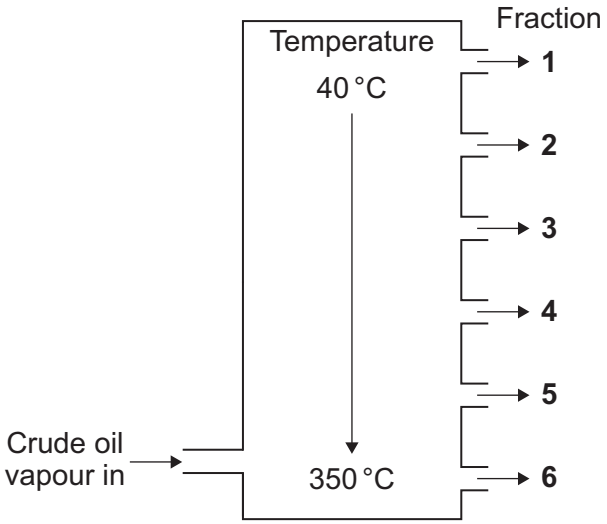
4 plants produce carbon dioxide by photosynthesis.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 66

June 2011 | CHY1F | Original Q5 | Legacy

5 Crude oil is a mixture of hydrocarbons.
Crude oil can be separated into fractions.



5 (a) (i) Complete the sentence.

The process used to separate the crude oil into fractions is called

fractional ..... .

(1 mark)

5 (a) (ii) Why do the fractions separate at different temperatures?

.....

.....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 66 · continued

5 (b) Tick (✓) **two** properties of fraction **6**.

Property	Tick (✓)
contains hydrocarbons	
has a small number of carbon atoms in each molecule	
is easy to ignite	
has a high boiling point	

(2 marks)

5 (c) Fraction **1** contains hydrocarbons called alkanes.
The general formula of an alkane is: C_nH_{2n+2}

What is the formula of the alkane that has 5 carbon atoms in each molecule?

Draw a ring around the correct answer.

C_5H_9 **C_5H_{10}** **C_5H_{11}** **C_5H_{12}**

(1 mark)

5

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 67

June 2011 | CHY1F | Original Q7 | Legacy

7 The raw materials used to make the polymer polyvinyl chloride (PVC) are crude oil and sea salt (sodium chloride).

7 (a) There are three main stages in the production of PVC.

7 (a) (i) **Stage 1** Cracking of hydrocarbons from crude oil produces ethene, C_2H_4

$$C_{10}H_{22} \longrightarrow C_8H_{18} + C_2H_4$$

How are hydrocarbons cracked?

.....

.....

.....

.....

(2 marks)

7 (a) (ii) **Stage 2** Electrolysis of sodium chloride solution produces chlorine.
Ethene from **Stage 1** is then reacted with this chlorine.
One of the hydrogen atoms in each ethene molecule is replaced by a chlorine atom to produce vinyl chloride.

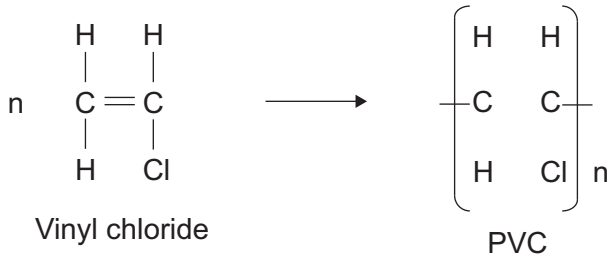
Complete the chemical equation by writing in the formula of the product vinyl chloride.

$$C_2H_4 + Cl_2 \longrightarrow \text{.....} + HCl$$

(1 mark)

7 (a) (iii) **Stage 3** Polymerisation of vinyl chloride produces polyvinyl chloride (PVC).

Complete the chemical equation by drawing in the missing bonds of the product, PVC.



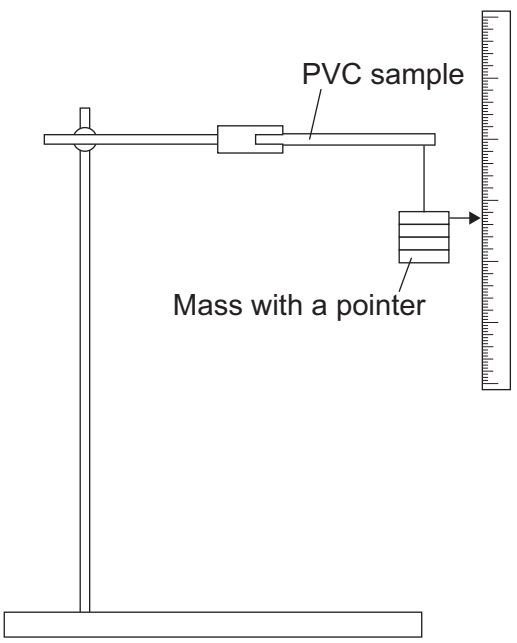
(1 mark)

Question 7 continues on the next page

Question 67 · continued

7 (b) Unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.
PVC with a plasticiser added is used to make cling film for wrapping food.
A plasticiser is a chemical compound.

A student investigated how the percentage of plasticiser added to PVC affected its flexibility.
The student measured the bending of PVC samples when a mass was added.



The student's results are shown in the table.

Sample of PVC	Percentage (%) of plasticiser added	Bending of PVC sample in mm				
		Test 1	Test 2	Test 3	Test 4	Mean
A	**0**	2	3	3	4	3
B	**5**	22	15	23	24	
C	**10**	27	27	29	29	28
D	**15**	34	35	35	36	35

7 (b) (i) Each PVC sample should be the same size to make it a fair test.
Explain why.

.....

.....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 67 · continued

7 (b) (ii) The student repeated the test four times for each sample.
Explain why.

.....

.....

(1 mark)

7 (b) (iii) Calculate the mean value for sample **B**.

.....

.....

.....

.....

(2 marks)

7 (b) (iv) Each of the samples bent the most in test **4**.
Suggest a possible reason for this.

.....

.....

(1 mark)

7 (c) Suggest why unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.

.....

.....

(1 mark)

10

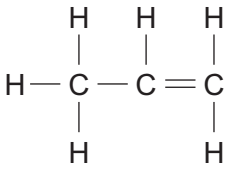
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 68

June 2011 | CHY3F | Original Q4 | Legacy

4 Propene (C_3H_6) is an *unsaturated* hydrocarbon used to make polymers.

The structure of a propene molecule is shown below.



Bromine water can be used to show that propene is *unsaturated*.

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

4 (a) (i) Bromine water is

blue.

green.

orange.

(1 mark)

4 (a) (ii) Bromine water reacts with propene and turns

colourless.

purple.

red.

(1 mark)

4 (a) (iii) Propene is *unsaturated* because it contains

a carbon carbon double bond.

a carbon carbon single bond.

carbon hydrogen single bonds.

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 68 · continued

4 (b) Hydrocarbons are often used as fuels.

Some information about three fuels is given in the table.

Fuel	Mass of fuel burned in g	Heat released in kJ	Price of fuel in pence per g	Combustion products	
				CO_2	H_2O
A	1	30	3p	Yes	Yes
B	1	20	1p	Yes	Yes
C	1	40	5p	No	Yes

4 (b) (i) Which fuel, **A**, **B** or **C**, releases the most heat per gram? ☐

(1 mark)

4 (b) (ii) Which fuel, **A**, **B** or **C**, releases the most heat per penny? ☐

(1 mark)

4 (b) (iii) Suggest why fuel **C** is the most environmentally friendly.

.....

.....

(1 mark)

6

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 69

November 2011 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

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

	Name of alkane	Formula of alkane	Melting point in °C	Boiling point in °C	Amount of oxygen, in cm^3, needed to completely burn 100 cm^3 of the alkane
A	Methane	CH_4	–182	–164	200
B	Ethane	C_2H_6	–183	–89	350
C	Propane	C_3H_8	–190	–42	500
D	Butane	C_4H_{10}	–138	–1	650

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

1	This alkane has the lowest melting point.
2	This alkane has the smallest molecules.
3	The boiling point of this alkane is similar to the melting point of ice.
4	10 cm^3 of this alkane requires 35 cm^3 of oxygen to burn completely.

4.7.1.1 Crude oil, hydrocarbons and alkanes

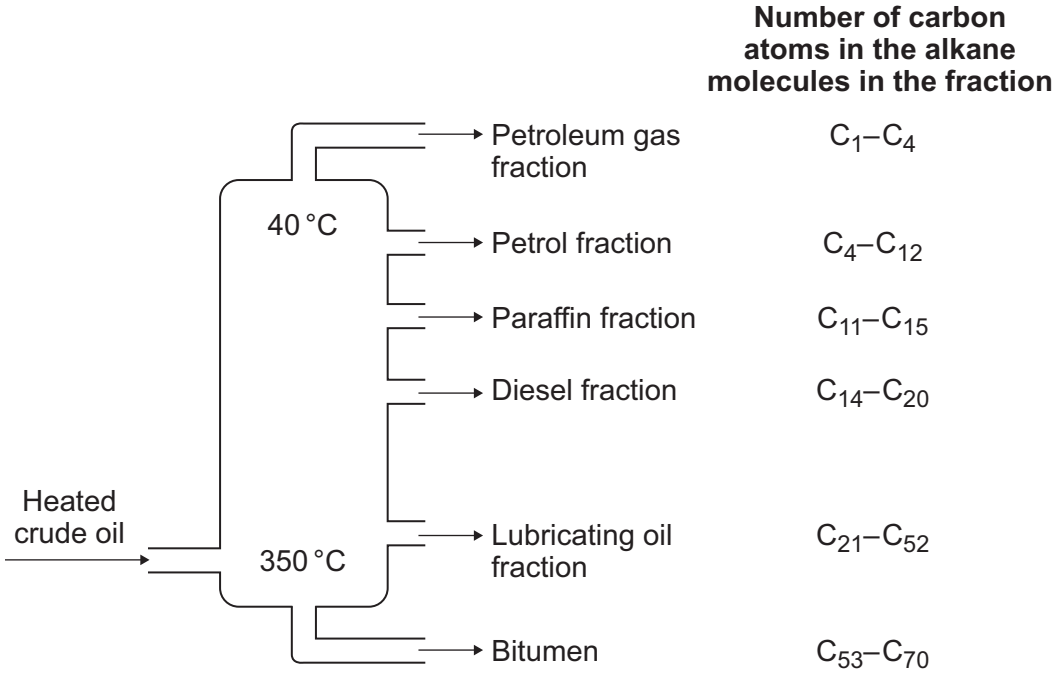
Question 70

November 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

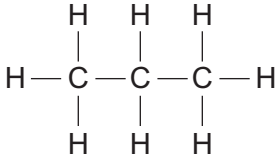
Crude oil can be separated into fractions.

Each fraction contains several alkanes.



8A One of the alkanes in the petrol fraction can be represented by . . .

1



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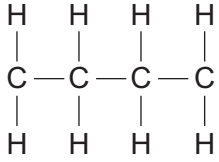

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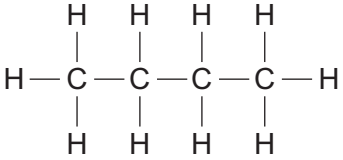

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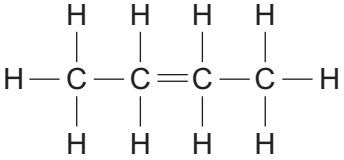


4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 70 · continued

8B When compared with the alkanes in the petrol fraction, the alkanes in the lubricating oil fraction . . .

1 will be more difficult to ignite.

2 will burn with a cleaner flame.

3 will have lower boiling points.

4 will have smaller molecules.

8C The alkane called nonane has 20 hydrogen atoms in each molecule.

In which fraction will it be mainly collected?

1 Petroleum gas fraction

2 Petrol fraction

3 Diesel fraction

4 Lubricating oil fraction

8D Which of these gases **cannot** be produced when a pure alkane burns?

1 carbon monoxide

2 carbon dioxide

3 sulfur dioxide

4 water vapour

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 71

November 2011 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

Large hydrocarbon molecules can be broken down to produce smaller molecules.

An example is shown below.

Hydrocarbon **K** (large molecule) $\rightarrow$ C_6H_{12} + C_3H_6 + C_3H_8

9A What are the conditions needed for this reaction to take place most successfully?

1 heat hydrocarbon **K** vapour over a hot catalyst

2 heat hydrocarbon **K** vapour with hydrogen

3 heat hydrocarbon **K** with a dilute acid

4 heat hydrocarbon **K** at 40 °C

9B The formula for hydrocarbon **K** is . . .

1 C_9H_{18}

2 $C_{12}H_{24}$

3 $C_{12}H_{26}$

4 $C_{26}H_{12}$

9C Which row in the table shows the products that react with bromine water and the colour change seen when they react?

	Product(s)	Colour change
1	C_6H_{12} and C_3H_6	from yellow-brown to colourless
2	C_3H_6 and C_3H_8	from yellow-brown to colourless
3	C_6H_{12} and C_3H_6	from colourless to yellow-brown
4	C_3H_8 only	from yellow-brown to colourless

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 71 · continued

9D Two of the products can form polymers because . . .

1 they are obtained from crude oil by fractional distillation.

2 they are saturated compounds.

3 their molecules have a double carbon carbon bond.

4 they vaporise at temperatures below 20 °C.

END OF TEST

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 72

January 2012 | CH1FP | Original Q3 | Legacy

3 (a) Crude oil is a mixture of compounds.
These compounds are made up of hydrogen and carbon atoms only.

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

Compounds made up of carbon and hydrogen atoms only are called

alcohols.

hydrocarbons.

vegetable oils.

(1 mark)

3 (a) (ii) The table shows five of these compounds.

Compound	State at room temperature (20 °C)	Boiling point in °C
ethane, C_2H_6	gas	−89
butane, C_4H_{10}	gas	0
hexane, C_6H_{14}	liquid	+69
pentadecane, $C_{15}H_{32}$	liquid	+270
heptadecane, $C_{17}H_{36}$	solid	+302

Tick (✓) **two** correct statements about the five compounds.

Statement	Tick (✓)
ethane has the smallest molecules	
hexane and pentadecane are liquid at 100 °C	
heptadecane has the highest boiling point	
butane boils at 100 °C	

(2 marks)

3 (a) (iii) Draw a ring around the correct answer to complete each sentence.

Fractional distillation is used to separate the compounds in crude oil.

The first step in fractional distillation is

cracking

displacing

evaporating

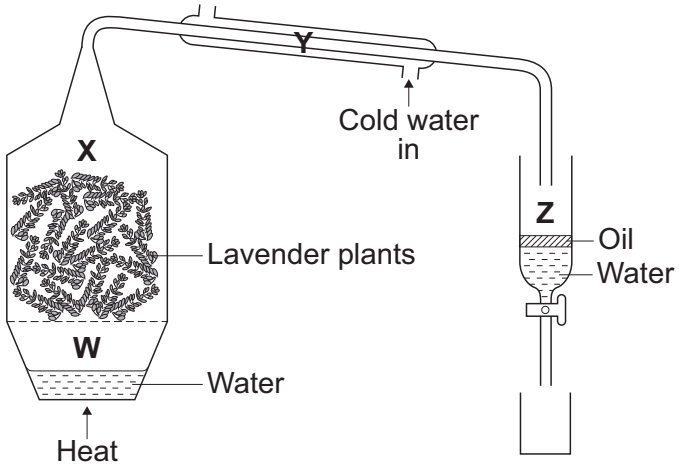
the crude oil.

Question 72 · continued

During fractional distillation the compounds [burn / condense / decompose] at different temperatures.

(2 marks)

3 (b) Steam distillation is used to separate oils from plants.
The diagram shows some apparatus that can be used to separate oil from lavender plants. Four parts of the apparatus are labelled **W**, **X**, **Y** and **Z**.



3 (b) (i) In which part, **W**, **X**, **Y** or **Z**, of the apparatus:

is steam produced ☐

are steam and oil condensed? ☐

(2 marks)

3 (b) (ii) Use the correct word from the box to complete the sentence.

dissolves	floats	sinks

When the oil separates from the water, the oil ..... .

(1 mark)

3 (b) (iii) Describe how part **Z** of the apparatus can be used to remove the water from the oil.

.....

.....

.....

.....

(2 marks)

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

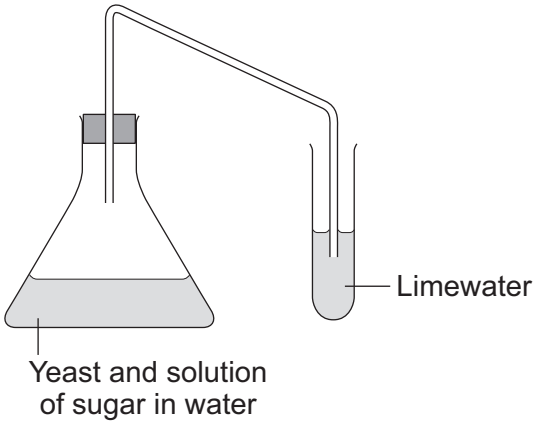
Question 73

January 2012 | CH1FP | Original Q4 | Legacy

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)

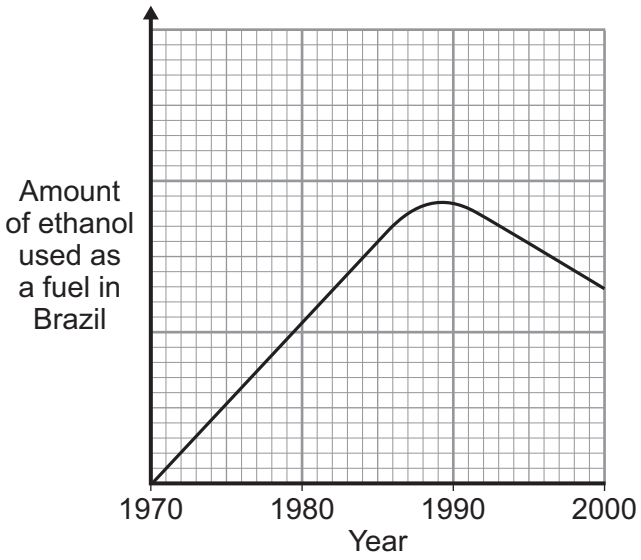
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 73 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 74

January 2012 | CH1FP | Original Q6 | Legacy

6 A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

6 (a) Use the information above to answer these questions.

6 (a) (i) Give the formula for heptane.

.....

(1 mark)

6 (a) (ii) Complete the general formula of alkanes.
n = number of carbon atoms

$$C_nH$$

(1 mark)

6 (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1**.

6 (b) (i) Name the carbon compound produced in **Reaction 2**.

.....

(1 mark)

6 (b) (ii) Give a reason why the carbon compounds produced are different.

.....

.....

(1 mark)

Question 6 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 74 · continued

6 (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

6 (c) (i) What is the percentage of the other gases in the table?

.....

(1 mark)

6 (c) (ii) What is the name of the compound that makes up most of the other gases?

.....

(1 mark)

6 (c) (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

.....

.....

(1 mark)

6 (c) (iv) State how nitrogen oxides are produced in a petrol engine.

.....

.....

.....

.....

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 74 · continued

6 (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

.....

.....

.....

.....

(2 marks)

11

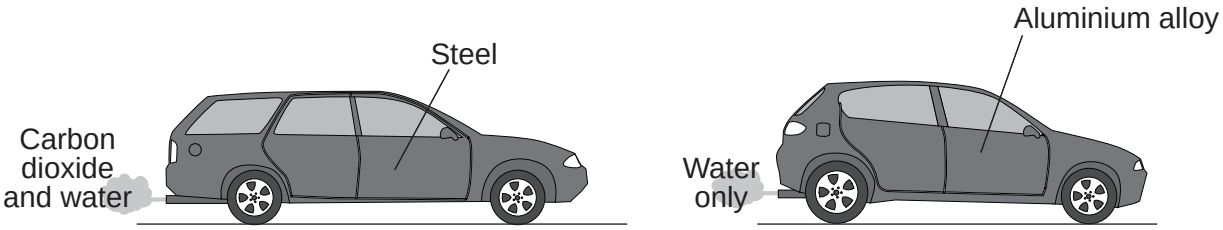
Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 75

June 2012 | CH1FP | Original Q3 | Legacy

3 The picture shows two different cars.



3 (a) Some properties of aluminium are given below.

Tick (✓) **two** reasons why aluminium is better than steel for car bodies.

Reason	Tick (✓)
Aluminium is not a transition metal.	
Aluminium has a low density.	
Aluminium is expensive to extract.	
Aluminium is resistant to corrosion.	

(2 marks)

3 (b) Each car body is made from an *alloy*.

3 (b) (i) What is an *alloy*?

.....

.....

(1 mark)

3 (b) (ii) An alloy is used to make a car body. A pure metal is **not** used to make a car body.

Suggest why.

.....

.....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 75 · continued

3 (c) The car with a steel body uses petrol for fuel.

Draw a ring around the correct answer to complete each sentence.

3 (c) (i) Petrol is made from

air.
crude oil.
metal ores.

(1 mark)

3 (c) (ii) Petrol is a mixture of

carbonates
hydrocarbons
polymers

including C_8H_{18}

(1 mark)

3 (c) (iii) In the car engine petrol reacts with

argon
nitrogen
oxygen

to produce carbon dioxide and water.

(1 mark)

3 (d) Look at the substances coming out of each car's exhaust.

3 (d) (i) Suggest the name of the fuel used in the car with the aluminium alloy body.

Name of fuel .....

(1 mark)

3 (d) (ii) Why is the fuel burned in the car with the aluminium alloy body better for the environment than petrol?

.....

.....

(1 mark)

9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 76

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).

.....

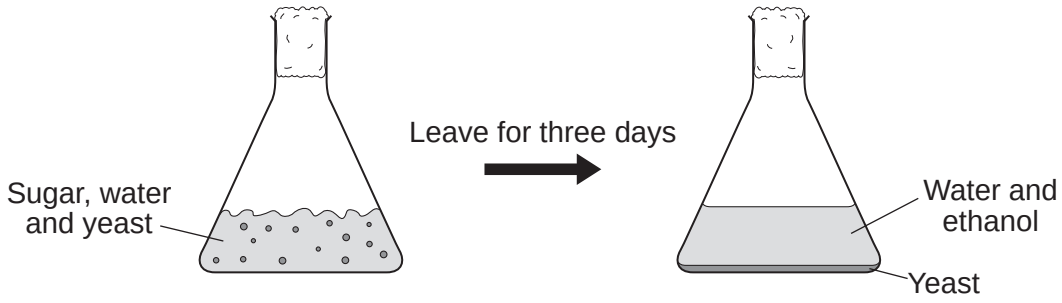
(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 76 · 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

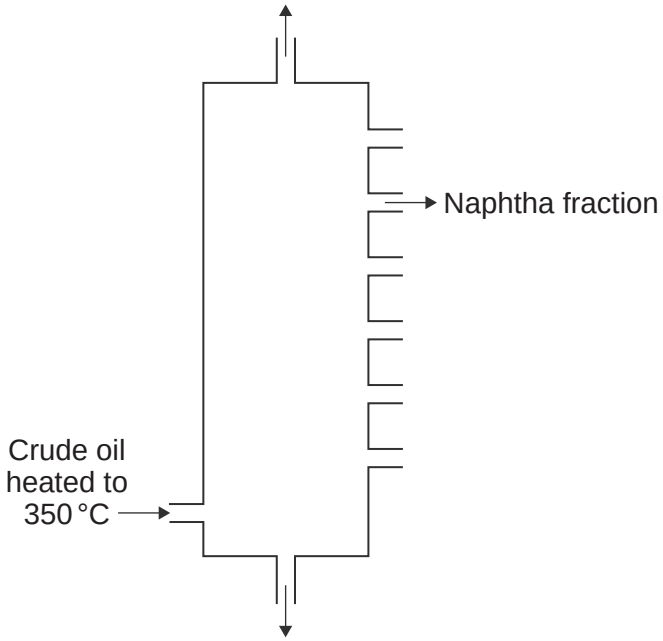
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 77

June 2012 | CH1FP | Original Q8 | Legacy

8 Crude oil is used to produce poly(ethene).

8 (a) Fractional distillation is used to separate crude oil into fractions.



8 (a) (i) Write a number, **2**, **3**, **4** or **5**, next to each stage so that the description of fractional distillation is in the correct order. Numbers **1** and **6** have been done for you.

Number	Stage
1	The crude oil is heated to 350 °C.
	When a fraction in the vapours cools to its boiling point, the fraction condenses.
	Any liquids flow down to the bottom of the column and the hot vapours rise up the column.
6	The condensed fraction is separated and flows out through a pipe.
	When the hot vapours rise up the column, the vapours cool.
	Most of the compounds in the crude oil evaporate.

(2 marks)

8 (a) (ii) The naphtha fraction is cracked to produce ethene (C_2H_4).
Ethene is used to make the polymer called poly(ethene).

Name **two** substances produced when poly(ethene) burns in air.

1 .....

2 .....

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 77 · continued

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

Each year in the UK, billions of plastic bags are given free to shoppers. These bags are made from poly(ethene) and are often used only once.
After being used many of these plastic bags are either thrown away as litter or buried in landfill sites.

In 2006 over 10 billion of these plastic bags were given free to shoppers.
In 2009 the number of plastic bags given to shoppers had decreased to 6.1 billion.
One reason for the decrease was because some supermarkets made people pay for their plastic bags.

From 2011 a new type of plastic shopping bag made mainly from poly(ethene) had a use-by date of only one year printed on the bag.

Use the information above and your knowledge and understanding to describe advantages and disadvantages of using plastic shopping bags made from poly(ethene).

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(6 marks)

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 78

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 → ..... + ...

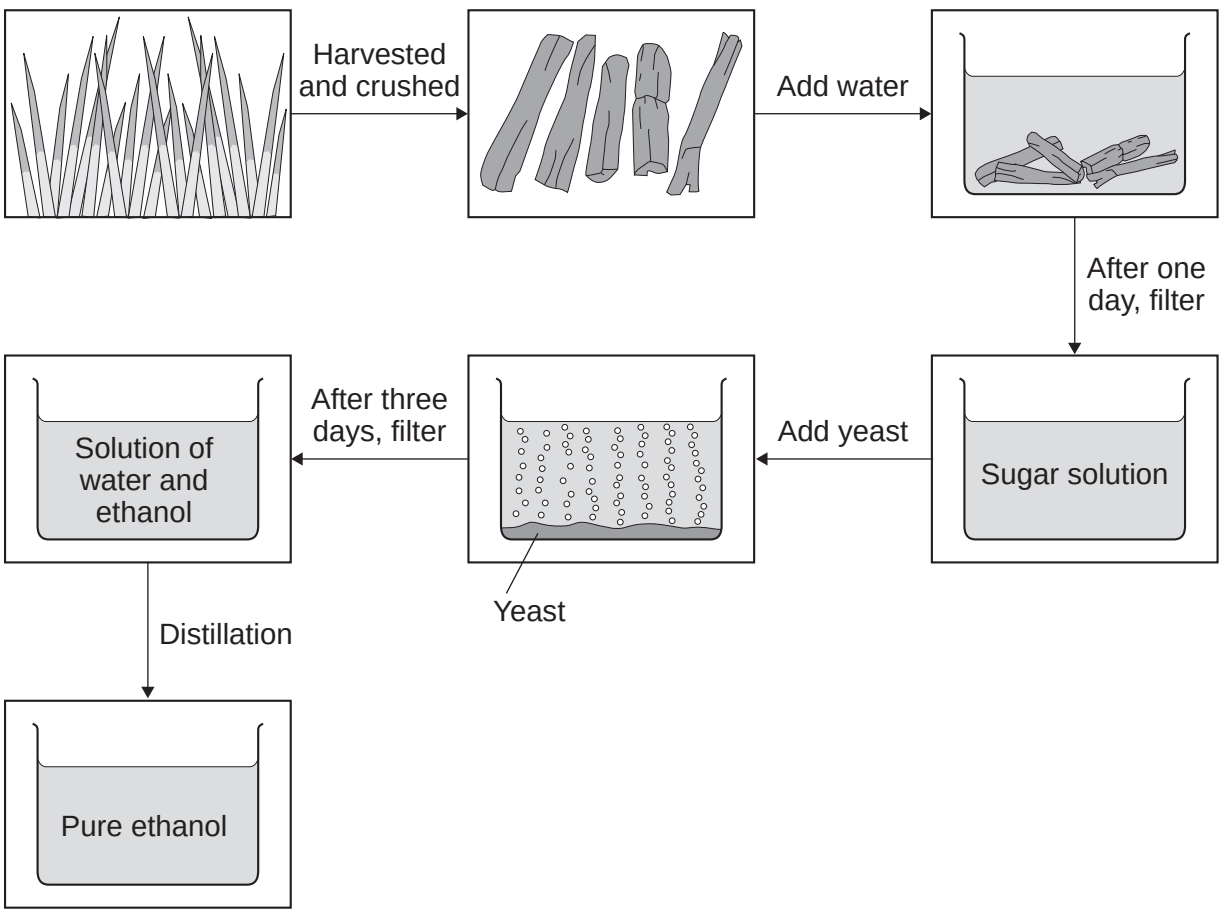
(2 marks)

Question 5 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 78 · 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)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 78 · 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 .....

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2 .....

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(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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 79

January 2013 | CH1FP | Original Q7 | Legacy

7 This question is about oil reserves.

7 (a) Diesel is separated from crude oil by fractional distillation.

Describe the steps involved in the fractional distillation of crude oil.

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(3 marks)

7 (b) Diesel is a mixture of lots of different *alkanes.*

What are *alkanes*?

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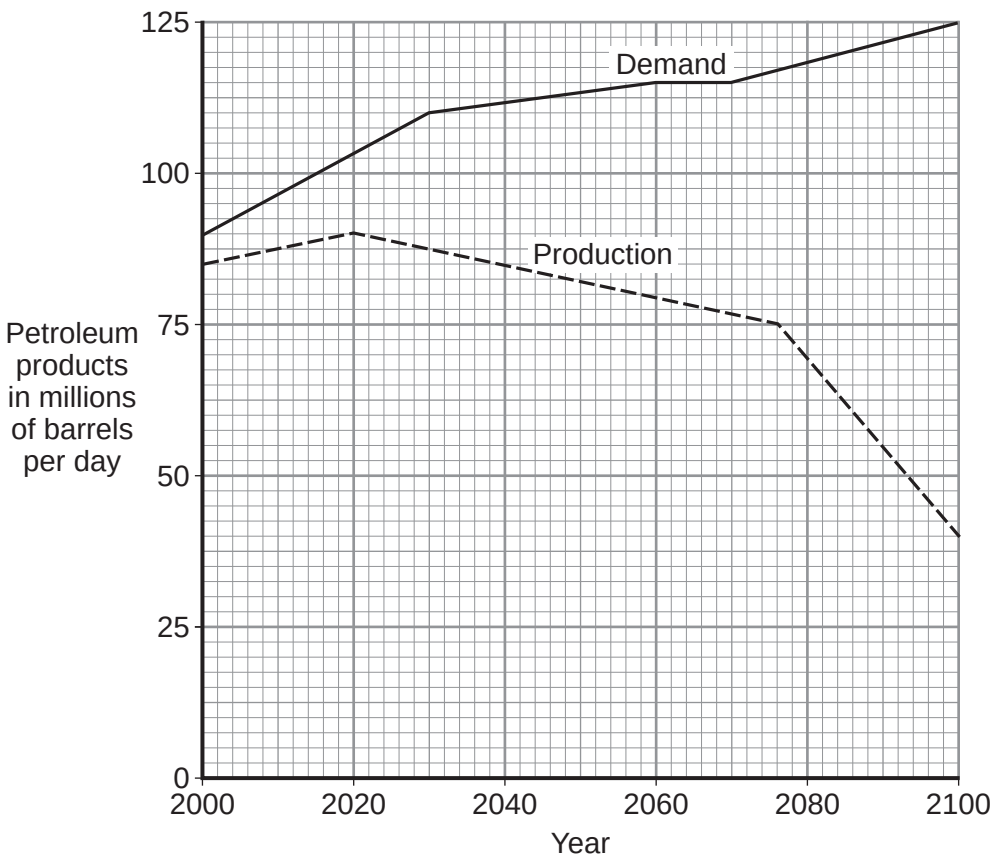
(2 marks)

Question 7 continues on the next page

Question 79 · continued

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

Petroleum products, such as petrol, are produced from crude oil.
The graph shows the possible future production of petroleum products from crude oil and the expected demand for petroleum products.



Canada's oil sands hold about 20% of the world's known crude oil reserves.

The oil sands contain between 10 to 15% of crude oil. This crude oil is mainly bitumen.

In Canada the oil sands are found in the ground underneath a very large area of forest. The trees are removed. Then large diggers and trucks remove 30 metres depth of soil and rock to reach the oil sands. The oil sands are quarried. Boiling water is mixed with the quarried oil sands to separate the bitumen from the sand. Methane (natural gas) is burned to heat the water.

The mixture can be separated because bitumen floats on water and the sand sinks to the bottom of the water. The bitumen is cracked and the products are separated by fractional distillation.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 79 · continued

Use the information on page 18 and your knowledge and understanding to suggest the advantages and disadvantages of extracting petroleum products from oil sands.

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(6 marks)

11

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 80

June 2013 | CH1FP | Original Q2 | Legacy

2 Barbecues are heated by burning charcoal or burning hydrocarbons.



2 (a) Use the Chemistry Data Sheet to help you to answer this question.

The chemical equation for charcoal burning is:

$$C + O_2 \longrightarrow CO_2$$

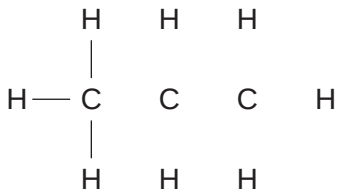
Complete the word equation for this reaction.

carbon + ... ⟶ carbon dioxide

(1 mark)

2 (b) Propane is a hydrocarbon.

2 (b) (i) Complete the displayed structure of propane. Draw in the missing bonds.



(1 mark)

2 (b) (ii) Write the chemical formula of propane. .....

(1 mark)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 80 · continued

2 (b) (iii) Draw a ring around the correct answer to complete the sentence.

Propane burns in air to produce carbon dioxide and

hydrogen.

hydroxide.

water.

(1 mark)

2 (c) The table shows information about six hydrocarbons.

Hydrocarbon	State at room temperature (20 °C)	Boiling point in °C
Ethane (C_2H_6)	gas	–89
Ethene (C_2H_4)	gas	–104
Butane (C_4H_{10})	gas	–1
Butene (C_4H_8)	gas	–6
Hexane (C_6H_{14})	liquid	+69
Hexene (C_6H_{12})	liquid	+64

Tick (✓) **two** correct statements about the six hydrocarbons.

Statement	Tick (✓)
Ethane and butane boil at temperatures less than 20 °C.	
Hexene and butene are alkanes.	
Butane and hexane are liquid at 0°C.	
Ethene and hexene each have a carbon-carbon double bond.	

(2 marks)

6

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 81

June 2013 | CH1FP | Original Q8 | Legacy

8 Crude oil is a mixture of many different chemical compounds.

8 (a) Fuels, such as petrol (gasoline), can be produced from crude oil.

8 (a) (i) Fuels react with oxygen to release energy.

Name the type of reaction that releases energy from a fuel.

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(1 mark)

8 (a) (ii) Fuels react with oxygen to produce carbon dioxide.
The reaction of a fuel with oxygen can produce a different oxide of carbon.

Name this different oxide of carbon and explain why it is produced.

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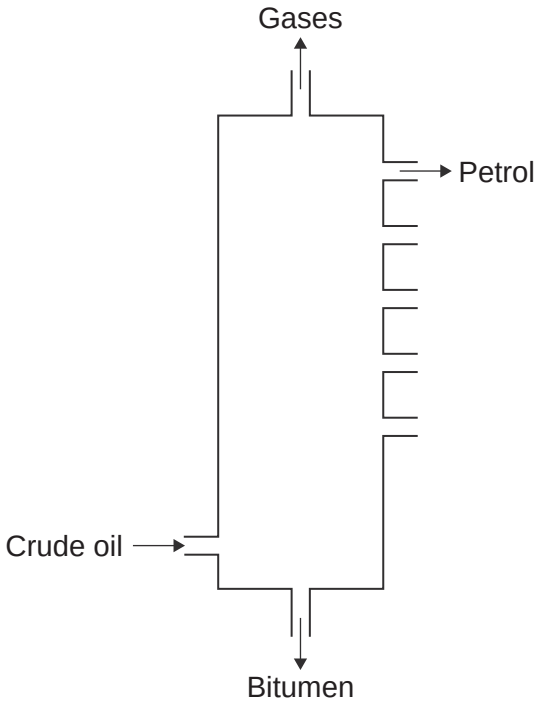
(2 marks)

8 (b) Most of the compounds in crude oil are hydrocarbons.
Hydrocarbons with the smallest molecules are very volatile.



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 81 · continued

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

Describe and explain how **petrol** is separated from the mixture of hydrocarbons in crude oil.

Use the diagram and your knowledge to answer this question.

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(6 marks)

9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 82

June 2013 | CH2FP | Original Q3 | Legacy

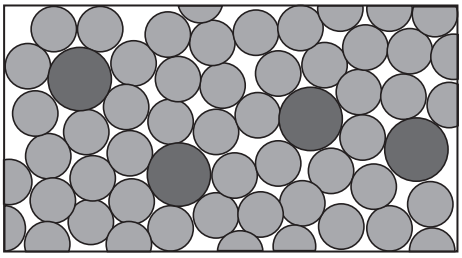
3 Oil rigs are used to drill for crude oil.



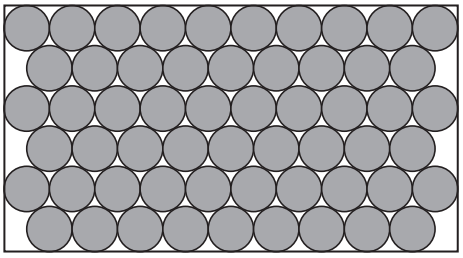
3 (a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.

Alloy



Pure iron



Use the diagrams to explain why the alloy is harder than pure iron.

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(2 marks)

3 (b) Drill heads contain diamonds.

Tick (✓) **two** reasons why diamonds are hard.

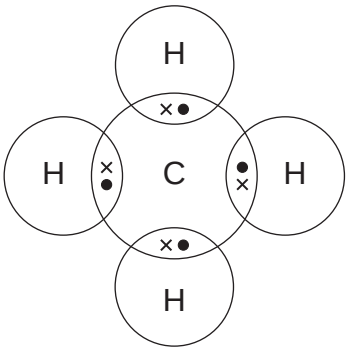
Reason	Tick (✓)
Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 82 · continued

3 (c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



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

Methane is

a compound.

an element.

a mixture.

(1 mark)

3 (c) (ii) Draw a ring around the correct answer to complete the sentence.

The formula of methane is

C_4H_4

C_4H

CH_4

(1 mark)

3 (c) (iii) Name the type of bond between the carbon and hydrogen atoms in methane.

.....

(1 mark)

3 (d) Explain why methane is a gas at 20 °C.

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(2 marks)

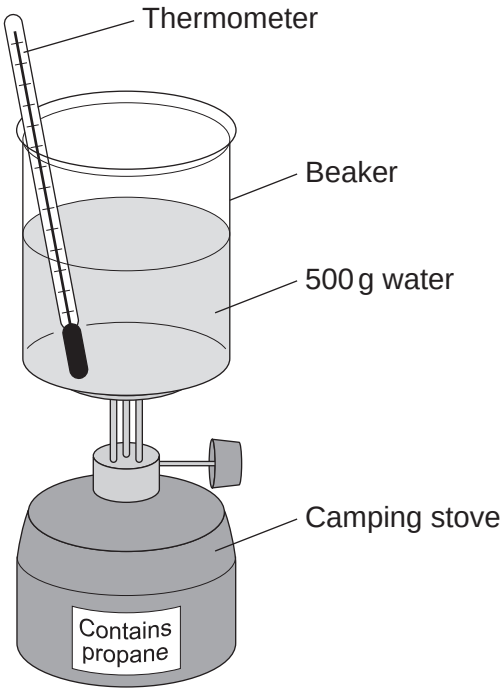
9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 83

June 2013 | CH3FP | Original Q4 | Legacy

4 A camping stove uses propane gas.



4 (a) A student did an experiment to find the energy released when propane is burned.

The student:

- put 500 g water into a beaker
- measured the temperature of the water
- heated the water by burning propane for 1 minute
- measured the temperature of the water again.

The student found the temperature change was 20 °C.

The student can calculate the energy released, in joules (J), using the equation:

energy released (J) = mass of water (g) × 4.2 × temperature change (°C)

4 (a) (i) Use the student's result to calculate the energy released in joules (J).

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Energy released = ... J

(2 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 83 · continued

4 (a) (ii) State **two** safety precautions that the student should take during the experiment.

1 .....

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2 .....

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(2 marks)

4 (a) (iii) Tick (✓) **two** boxes which describe how the student could make his result more accurate.

	Tick (✓)
Stir the water before measuring the temperature.	
Heat the water until it boils.	
Place a lid on the beaker.	
Use a larger beaker for the water.	

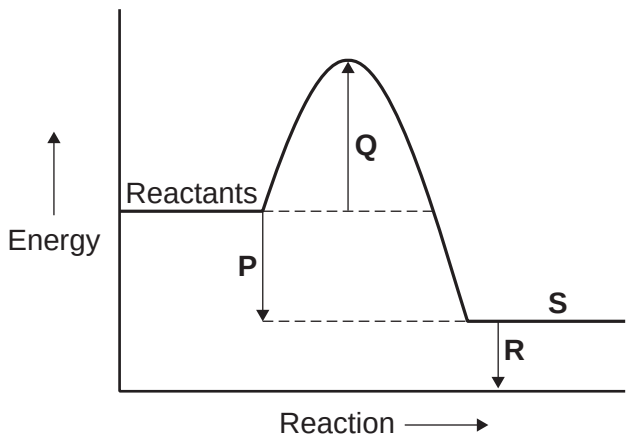
(2 marks)

Question 4 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 83 · continued

4 (b) The change in energy when propane is burned can be shown in an energy level diagram.



Draw **one** line from each description to the correct letter.

Description	Letter
products	P
activation energy	Q
energy released by the reaction	R
	S

(3 marks)

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 83 · continued

4 (c) Propane and hydrogen are both used as fuels.

Some information about propane and hydrogen is given in the table.

Fuel	Resource	Products formed when fuel burned
propane	crude oil	carbon dioxide and water
hydrogen	water	water

Use the information in the table to suggest **two** disadvantages that propane has as a fuel compared to hydrogen.

1 .....

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2 .....

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(2 marks)

11

4.7.1.1 Crude oil, hydrocarbons and alkanes

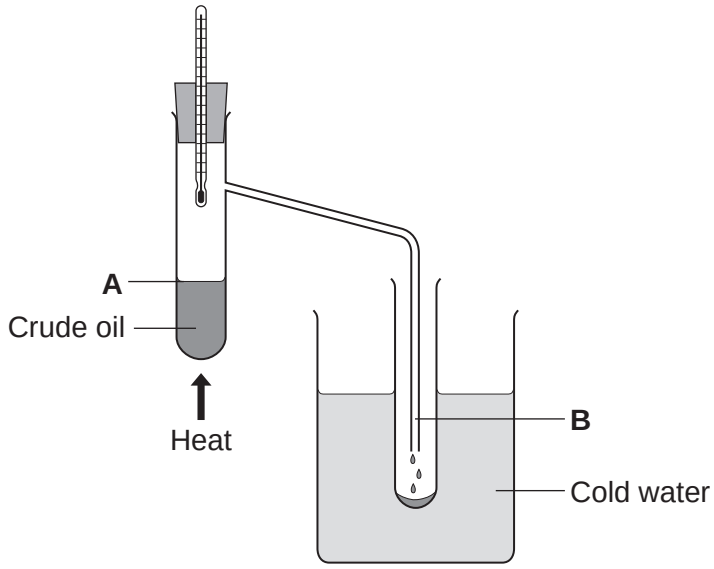
Question 84

June 2014 | CH1FP | Original Q4 | Legacy

4 Crude oil is a mixture of a very large number of compounds.

Figure 4 shows a laboratory experiment to separate crude oil.

Figure 4



4 (a) Complete the sentence.

[1 mark]

The name for compounds that contain only hydrogen and carbon is ..... .

4 (b) Use the correct word from the box to complete each sentence.

condensation	**decomposition**	**distillation**
evaporation	**reduction**	

4 (b) (i) The process of separating crude oil is fractional ..... .

[1 mark]

4 (b) (ii) The process taking place at **A** is ..... .

[1 mark]

4 (b) (iii) The process taking place at **B** is ..... .

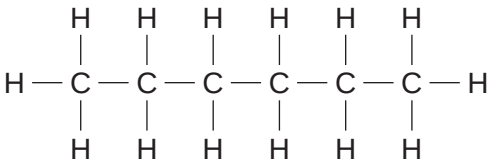
[1 mark]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 84 · continued

4 (c) One of the compounds in crude oil is hexane. The displayed structure of hexane is shown in **Figure 5**.

Figure 5



Complete the sentences.

4 (c) (i) Each line between the atoms in hexane represents a covalent ..... .

[1 mark]

4 (c) (ii) Complete the chemical formula for hexane.

[1 mark]

C_6H.....

4 (c) (iii) Hexane can be broken down into smaller molecules by a process called ..... .

[1 mark]

4 (d) Small molecules, called alkenes, are used to make polymers.

4 (d) (i) Name the polymer made from butene.

[1 mark]

.....

4 (d) (ii) Incinerators are used to burn waste polymers, such as plastic bags.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of burning plastic bags.

[2 marks]

	Advantage Tick (✓)	Disadvantage Tick (✓)
Energy is released.		
More recycling is needed.		
Carbon dioxide is produced.		

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 85

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]

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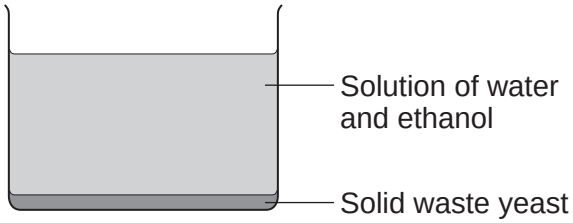
.....

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]

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4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 85 · 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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4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 86

June 2015 | CH1FP | Original Q3 | Legacy

3 Crude oil is a fossil fuel.

3 (a) To make crude oil more useful it is separated into fractions.

Use the correct word from the box to complete each sentence.

boiling	**compound**	**decomposition**	**distillation**
filtration	**mixture**	**molecule**	

3 (a) (i) Crude oil is a ..... of different substances.

[1 mark]

3 (a) (ii) The substances in crude oil have different ..... points.

[1 mark]

3 (a) (iii) Crude oil is separated by fractional ..... .

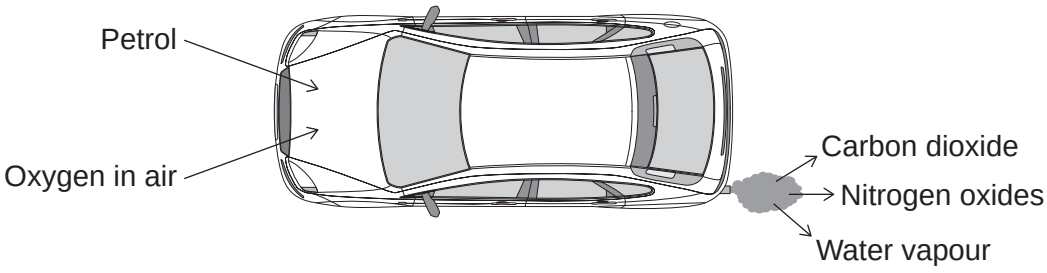
[1 mark]

3 (b) Petrol is one of the fractions produced from crude oil.

Car engines use a mixture of petrol and air.

Figure 5 shows some of the gases produced.

Figure 5



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 86 · continued

3 (b) (i) What type of reaction happens to petrol in a car engine?

[1 mark]

Tick (✓) **one** box.

combustion ☐

decomposition ☐

neutralisation ☐

3 (b) (ii) Petrol contains octane (C_8H_{18}).

Complete the word equation for the reaction of octane with oxygen.

[2 marks]

octane + ... ⟶ ..... + ...

3 (b) (iii) Cars use sulfur-free petrol as a fuel.

Describe why sulfur should be removed from petrol.

[2 marks]

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Question 3 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 86 · continued

3 (c) Some fractions from crude oil contain large hydrocarbon molecules.

These molecules can be cracked to produce smaller, more useful molecules.

An equation for cracking decane is:

$$\underset{\text{decane}}{C_{10}H_{22}} \longrightarrow \underset{\text{propane}}{C_3H_8} + \underset{\text{ethene}}{C_2H_4} + \underset{\text{pentene}}{C_5H_{10}}$$

3 (c) (i) Why is propane useful?

[1 mark]

Tick (✓) **one** box.

Propane is a polymer. ☐

Propane is an alloy. ☐

Propane is a fuel. ☐

3 (c) (ii) Draw bonds to complete the displayed structure of ethene.

[1 mark]



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 86 · continued

3 (c) (iii) What is the colour change when bromine water reacts with ethene?

[1 mark]

Tick (✓) **one** box.

Orange to colourless ☐

Orange to green ☐

Orange to red ☐

3 (c) (iv) Complete the sentence.

[1 mark]

Pentene is useful because many pentene molecules can join together to form ..... .

12

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 87

June 2015 | CH1FP | Original Q4 | Legacy

4 Polymers and fuels can be produced from crude oil and from plants.

4 (a) There are many types of polymer. Each polymer has different properties.

4 (a) (i) Poly(chloroethene) is a polymer produced from crude oil.

Why is poly(chloroethene) used for water pipes?

[2 marks]

Tick (✓) **two** boxes.

- The polymer is not biodegradable. ☐
- The polymer is made from crude oil. ☐
- The polymer decomposes when heated. ☐
- The polymer is waterproof. ☐
- The polymer does not conduct electricity. ☐

4 (a) (ii) Some shopping bags are made from a biopolymer.

Biopolymers are produced from plants.

Suggest **one** advantage of using a biopolymer.

[1 mark]

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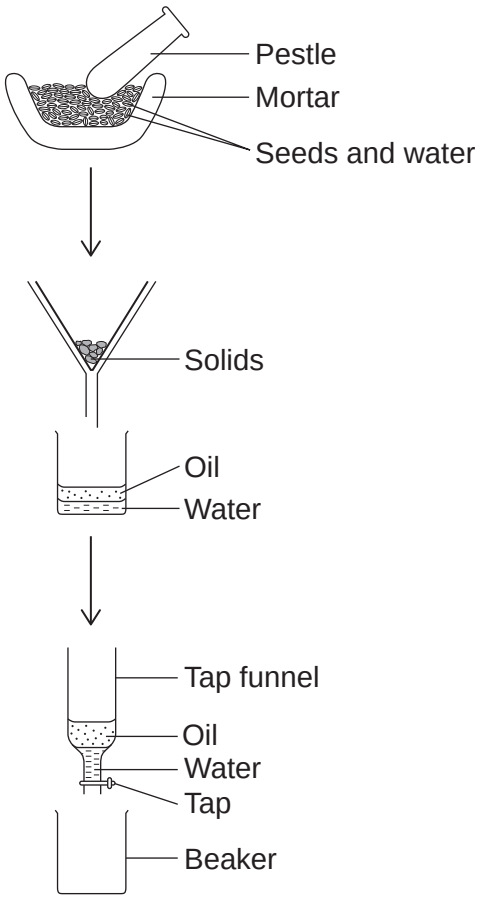
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 87 · continued

4 (b) Some plants have seeds that contain vegetable oils.
The flow diagram in **Figure 6** shows how the oil can be extracted.

Figure 6



4 (b) (i) Use the correct word from the box to complete each sentence.

[2 marks]

burning	**crushing**	**distilling**	**filtering**

Oil is released from the seeds by..... .

Solids are removed from the oil and water by ..... .

4 (b) (ii) Describe how the tap funnel can be used to separate the oil from the water.

[2 marks]

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4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 87 · continued

4 (c) Vegetable oils are used as foods and fuels.

4 (c) (i) Why are vegetable oils important foods and fuels?

[1 mark]

Tick (✓) **one** box.

They are used as emulsifiers. ☐

They have high boiling points. ☐

They provide a lot of energy. ☐

4 (c) (ii) Burning fossil fuels made from crude oil increases the overall percentage of carbon dioxide in the atmosphere.

Burning biofuels made from vegetable oil does **not** increase the overall percentage of carbon dioxide in the atmosphere.

Explain why.

[2 marks]

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4.7.1.1 Crude oil, hydrocarbons and alkanes

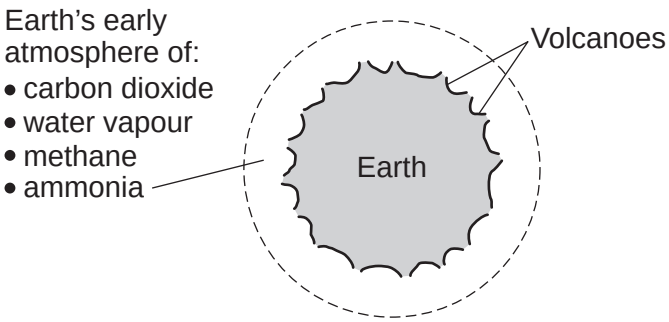
Question 88

June 2016 | CH1FP | Original Q2 | Legacy

2 This question is about the Earth and its atmosphere.

2 (a) **Figure 4** shows the Earth and its atmosphere billions of years ago.

Figure 4



2 (a) (i) The boiling point of water is 100 °C.

Suggest **one** reason why there was no liquid water on the Earth's surface billions of years ago.

[1 mark]

_____

_____

2 (a) (ii) Complete the sentence.

[1 mark]

On the Earth today, volcanic eruptions happen at the boundaries between

tectonic _____ .

Question 2 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 88 · continued

2 (b) The Earth's atmosphere today contains nitrogen, oxygen, argon, carbon dioxide and other gases.

2 (b) (i) Draw **one** line from each substance to a description of the substance.

[3 marks]

Substance	Description of the substance
air	compound
carbon dioxide	element
argon	hydrocarbon
	metal
	mixture

2 (b) (ii) Which gas in the Earth's atmosphere is used when hydrocarbons burn?

[1 mark]

Tick (✓) **one** box.

- carbon dioxide ☐
- nitrogen ☐
- oxygen ☐

2 (b) (iii) What percentage of the Earth's atmosphere is nitrogen?

[1 mark]

Tick (✓) **one** box.

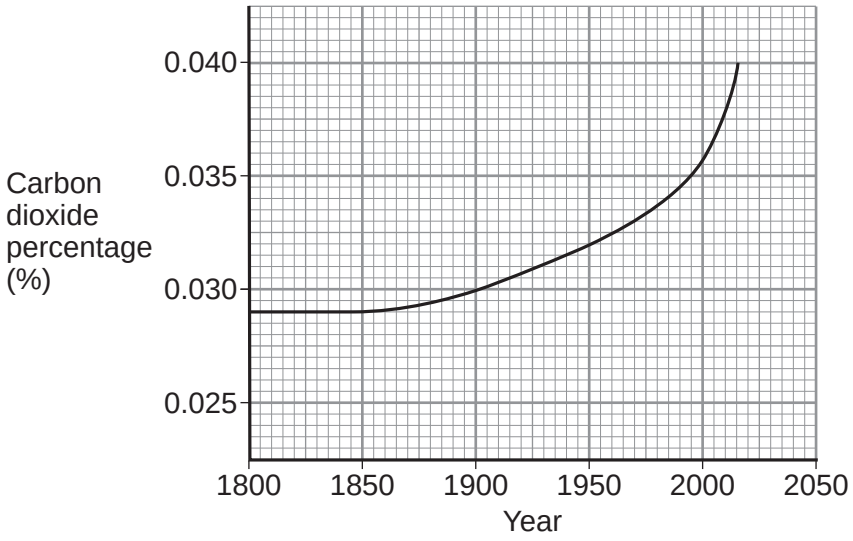
- about 40% ☐
- about 60% ☐
- about 80% ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 88 · continued

2 (c) **Figure 5** shows the carbon dioxide percentage (%) in the Earth's atmosphere since the year 1800.

Figure 5



2 (c) (i) What was the carbon dioxide percentage in 1900?

[1 mark]

_____ %

2 (c) (ii) Describe, in detail, how the carbon dioxide percentage changed from 1900 to 2015.

[2 marks]

_____

_____

_____

_____

2 (c) (iii) Suggest **two** reasons for the change in the carbon dioxide percentage from 1900 to 2015.

[2 marks]

1 _____

_____

2 _____

_____

12

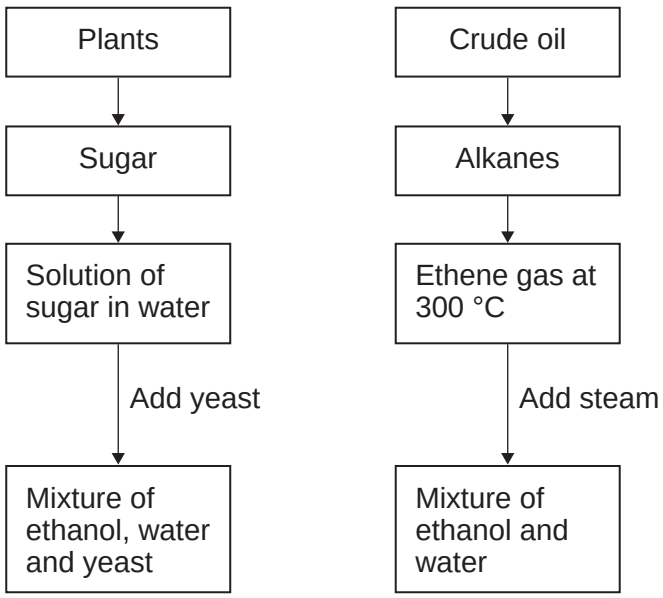
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 89

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 ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 89 · 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

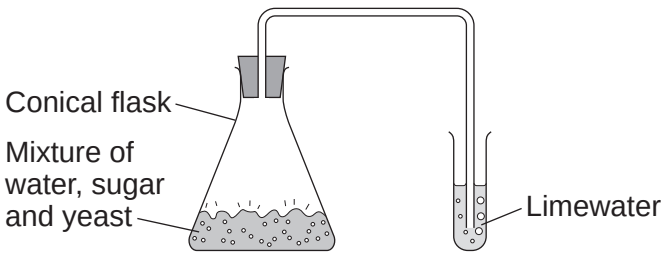
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 89 · 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?

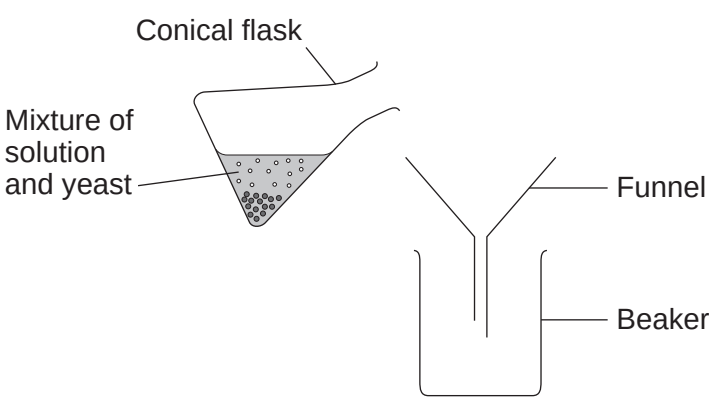
Give a reason for your answer.

[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]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 89 · 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. ☐

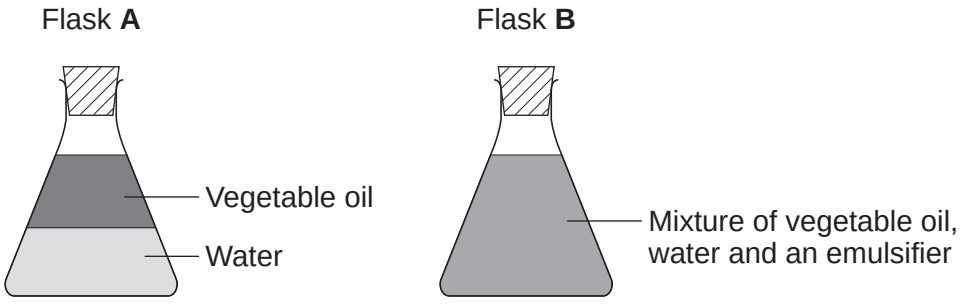
Vegetable oils cook foods at higher temperatures than boiling water. ☐

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 90

June 2016 | CH1FP | Original Q5 | Legacy

5 This question is about hydrocarbons.

5 (a) Most of the hydrocarbons in crude oil are alkanes.

5 (a) (i) Large alkane molecules can be cracked to produce more useful molecules.

The equation shows the cracking of dodecane.

$$\underset{\text{dodecane}}{C_{12}H_{26}} \longrightarrow \underset{\text{butane}}{C_4H_{10}} + \underset{\text{hexene}}{C_6H_{12}} + \underset{\text{ethene}}{C_2H_4}$$

Give **two** conditions used to crack large alkane molecules.

[2 marks]

1 _____

2 _____

5 (a) (ii) The products hexene and ethene are alkenes.

Complete the sentence.

[1 mark]

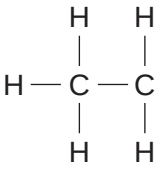
When alkenes react with bromine water the colour changes

from orange to _____ .

5 (a) (iii) Butane (C_4H_{10}) is an alkane.

Complete the displayed structure of butane.

[1 mark]



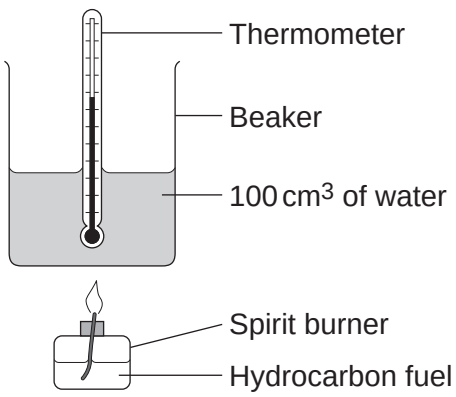
Question 5 continues on the next page

Question 90 · continued

5 (b) A group of students investigated the energy released by the combustion of four hydrocarbon fuels.

Figure 12 shows the apparatus used.

Figure 12



Each hydrocarbon fuel was burned for two minutes.

Table 2 shows the students' results.

Table 2

	After two minutes				
Name and formula of hydrocarbon fuel	**Mass of fuel used in g**	**Temperature increase of water in °C**	**Energy released by fuel in kJ**	**Energy released by 1.0 g of fuel in kJ**	**Relative amount of smoke in the flame**
Hexane, C_6H_{14}	0.81	40	16.80	20.74	very little smoke
Octane, C_8H_{18}	1.10	54	22.68	20.62	some smoke
Decane, $C_{10}H_{22}$	1.20	58	24.36		smoky
Dodecane, $C_{12}H_{26}$	1.41	67	28.14	19.96	very smoky

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 90 · continued

5 (b) (i) Calculate the energy released by 1.0 g of decane in kJ.

[2 marks]

Energy released = _____ kJ

5 (b) (ii) Suggest **one** improvement to the apparatus, or the use of the apparatus, that would make the temperature increase of the water for each fuel more accurate.

Give a reason why this is an improvement.

[2 marks]

5 (b) (iii) The students noticed that the bottom of the beaker became covered in a black substance when burning these fuels.

Name this black substance.

Suggest why it is produced.

[2 marks]

5 (b) (iv) A student concluded that hexane is the best of the four fuels.

Give **two** reasons why the results in **Table 2** support this conclusion.

[2 marks]

1 _____

2 _____

Question 5 continues on the next page

Question 90 · continued

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

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

Table 3 shows information about petrol and hydrogen.

Table 3

	Petrol	**Hydrogen**
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen ⟶ carbon dioxide + water	hydrogen + oxygen ⟶ water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

[6 marks]

4.7.1.1 Crude oil, hydrocarbons and alkanes

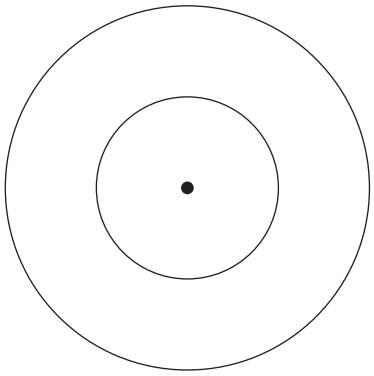
Question 91

June 2017 | CH1FP | Original Q6 | Legacy

6 This question is about compounds of carbon.

6 (a) **Figure 7** shows an atom with two energy levels (shells).

Figure 7



6 (a) (i) A carbon atom has six electrons.

Complete **Figure 7** to show the electronic structure of a carbon atom.

Use **x** to represent an electron.

[1 mark]

6 (a) (ii) Complete the following description about the central part of this carbon atom.

[3 marks]

The central part is made up of six neutrons that have no electrical charge and _____

_____

_____

_____

_____

6 (b) Crude oil is a mixture of compounds. These compounds are mainly hydrocarbons.

What does the term hydrocarbon mean?

[1 mark]

_____

_____

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 91 · continued

6 (c) Alkanes and alkenes are hydrocarbons.

Table 2 shows the boiling points of some alkanes and alkenes.

Table 2

Alkanes

Name	Formula	Boiling point in °C
Ethane	C_2H_6	−88
Propane	C_3H_8	−42
Butane	C_4H_{10}	0
Pentane	C_5H_{12}	+36
Hexane	C_6H_{14}	+69

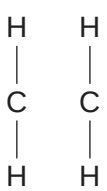
Alkenes

Name	Formula	Boiling point in °C
Ethene	C_2H_4	−104
Propene	C_3H_6	−48
Butene	C_4H_8	−6
Pentene	C_5H_{10}	+30
Hexene	C_6H_{12}	+64

6 (c) (i) Complete the displayed structure of ethane and the displayed structure of ethene.

[2 marks]

Ethane



Ethene



6 (c) (ii) Describe the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule.

[1 mark]

4.7.1.1 Crude oil, hydrocarbons and alkanes

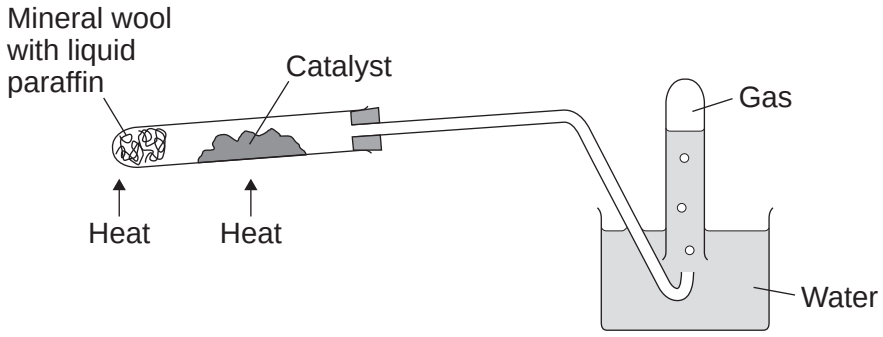
Question 91 · continued

6 (c) (iii) Use the information in **Table 2** to compare the boiling points of alkanes with the boiling points of alkenes.

[2 marks]

6 (d) A student used the apparatus in **Figure 8** to investigate what happens when liquid paraffin is heated to a high temperature.

Figure 8



Liquid paraffin contains alkanes.

Describe what happens to the alkane molecules in this investigation.

[3 marks]

13

4.7.1.1 Crude oil, hydrocarbons and alkanes

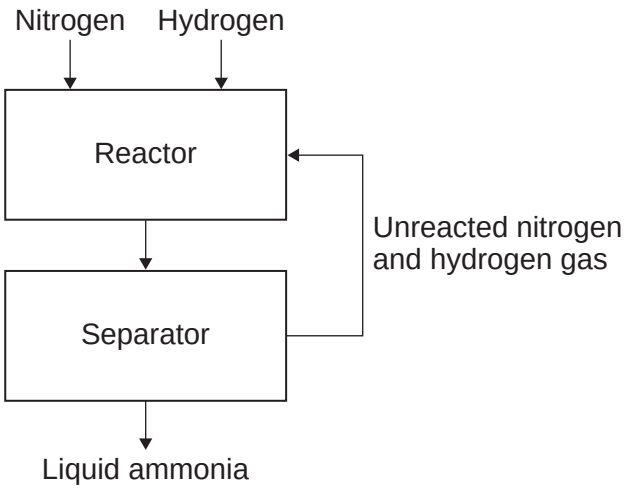
Question 92

June 2017 | CH3FP | Original Q3 | Legacy

3 This question is about the Haber process.

Figure 3 shows a flow diagram of the Haber process.

Figure 3



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

[1 mark]

air	crude oil	natural gas	water

Nitrogen for the Haber process is obtained from _____ .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 92 · continued

3 (a) (ii) Iron is used as a catalyst in the reactor.

How does a catalyst speed up a reaction?

[1 mark]

Tick (✓) **one** box.

Changes the pressure in the reactor ☐

Lowers the activation energy ☐

Makes the particles move faster ☐

3 (a) (iii) Describe how the ammonia is separated from the other gases.

[2 marks]

_____

_____

_____

_____

3 (b) Complete the word equation for the reaction in the Haber process.

[1 mark]

nitrogen + _____ ⇌ _____

Question 3 continues on the next page

Question 92 · continued

3 (c) **Figure 4** shows how, in the Haber process, the rate of reaction changes as the temperature and pressure increase.

Figure 4

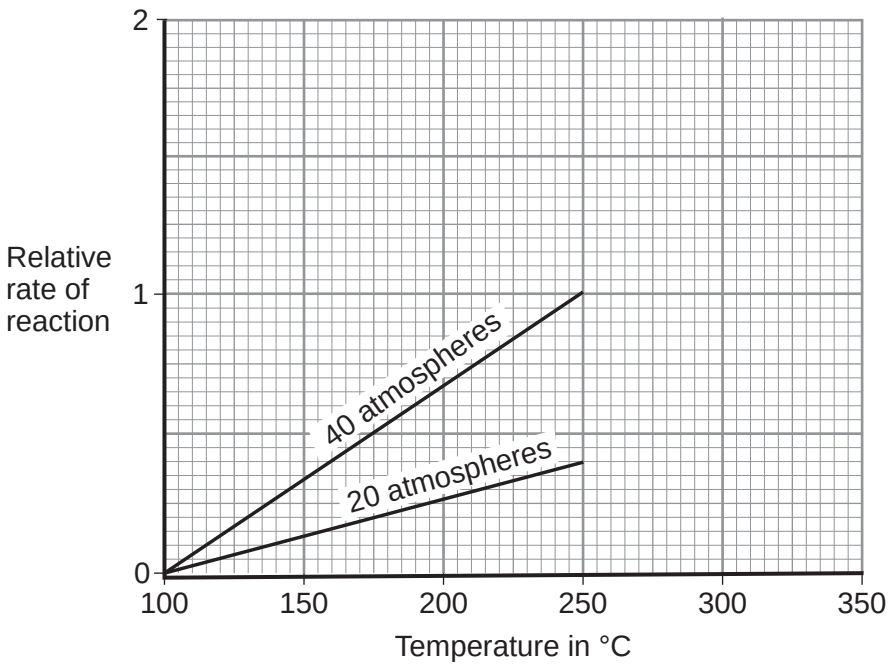


Table 1 shows the relative rate of reaction at 80 atmospheres at different temperatures.

Table 1

Temperature in °C	Relative rate of reaction
100	0.0
150	0.5
200	1.0
250	1.7
300	2.0

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 92 · continued

3 (c) (i) Plot the data in **Table 1** on the graph in **Figure 4**.

[2 marks]

3 (c) (ii) Draw a straight line of best fit for the points you have plotted.

[1 mark]

3 (c) (iii) What is the relative rate of reaction at 20 atmospheres and 300 °C?

Show your working on **Figure 4**.

[2 marks]

Relative rate of reaction = _____

3 (c) (iv) Describe how the rate of reaction changes as the pressure increases.

[1 mark]

_____

_____

11

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 93

June 2018 | 8462/2F | Original Q2

0 2 This question is about fuels.

Octane (C_8H_{18}) is a hydrocarbon in petrol.

0 2 . 1 Cracking breaks down large hydrocarbon molecules into smaller hydrocarbon molecules.

Which hydrocarbon molecule can be cracked to produce octane, C_8H_{18} ?

[1 mark]

Tick **one** box.

- C_4H_8 ☐
- C_4H_{10} ☐
- C_8H_{16} ☐
- $C_{12}H_{26}$ ☐

0 2 . 2 What type of carbon compound is octane, C_8H_{18} ?

[1 mark]

Tick **one** box.

- Alcohol ☐
- Alkane ☐
- Carboxylic acid ☐
- Ester ☐

Question 2 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 93 · continued

0 2 . 3 Oxygen is needed to burn fuels.

Name the source of the oxygen needed to burn fuels.

[1 mark]

0 2 . 4 Particulates and sulfur dioxide are pollutants produced when some fuels burn.

Draw **one** line from each pollutant to the polluting effect.

[2 marks]

Pollutant	Polluting effect
	Acid rain
Particulates	Global dimming
	Global warming
Sulfur dioxide	Landfill
	Sewage sludge

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 93 · continued

0 2 . 5 Which **two** gases are produced when fuels burn in car engines?

[2 marks]

Tick **two** boxes.

- Ammonia ☐
- Carbon dioxide ☐
- Carbon monoxide ☐
- Nitrogen ☐
- Oxygen ☐

0 2 . 6 Vehicles produce most of the atmospheric pollution in cities.

How could the atmospheric pollution in cities be reduced?

[2 marks]

Tick **two** boxes.

- Build more roads in cities ☐
- Build new car factories ☐
- Develop fuel efficient engines ☐
- Make car tax cheaper ☐
- Use electric cars ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

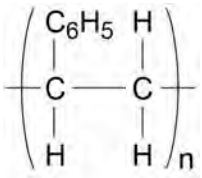
Question 94

June 2018 | 8462/2F | Original Q6

0 6 Disposable cups are made from coated paper or poly(styrene).

Figure 4 represents the structure of poly(styrene).

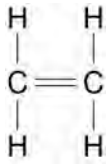
Figure 4



0 6 . 1 Which small molecule is used to produce poly(styrene)?

[1 mark]

Tick **one** box.



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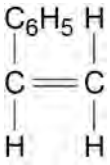

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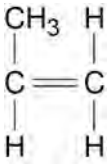

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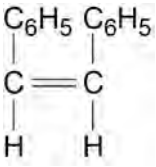


☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 94 · continued

June 2018 | 8462/2F | Original Q6

0 6 . 2 Which process is used to make poly(styrene) from small molecules?

[1 mark]

Tick **one** box.

Cracking ☐

Distillation ☐

Fermentation ☐

Polymerisation ☐

0 6 . 3 Complete the sentences.

Choose answers from the box.

[3 marks]

ceramics	**composites**	**four**	**many**
monomers	**polymers**	**two**	

Poly(styrene) is produced from small molecules called _____.

When poly(styrene) is made, _____ styrene molecules join to form large molecules.

These large molecules are called _____.

Question 6 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 94 · continued

0 6 . 4 **Table 4** gives some information about disposable cups.

Table 4

	Coated paper cups	Poly(styrene) cups
Source of raw materials	Wood	Crude oil
Energy to make 1 cup in arbitrary units	550	200
Biodegradable	Yes	No
Recyclable	No	Yes

Compare the advantages and disadvantages of using coated paper and poly(styrene) to make disposable cups.

Use **Table 4** and your knowledge and understanding of life cycle assessments (LCAs).

[4 marks]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 95

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 _____

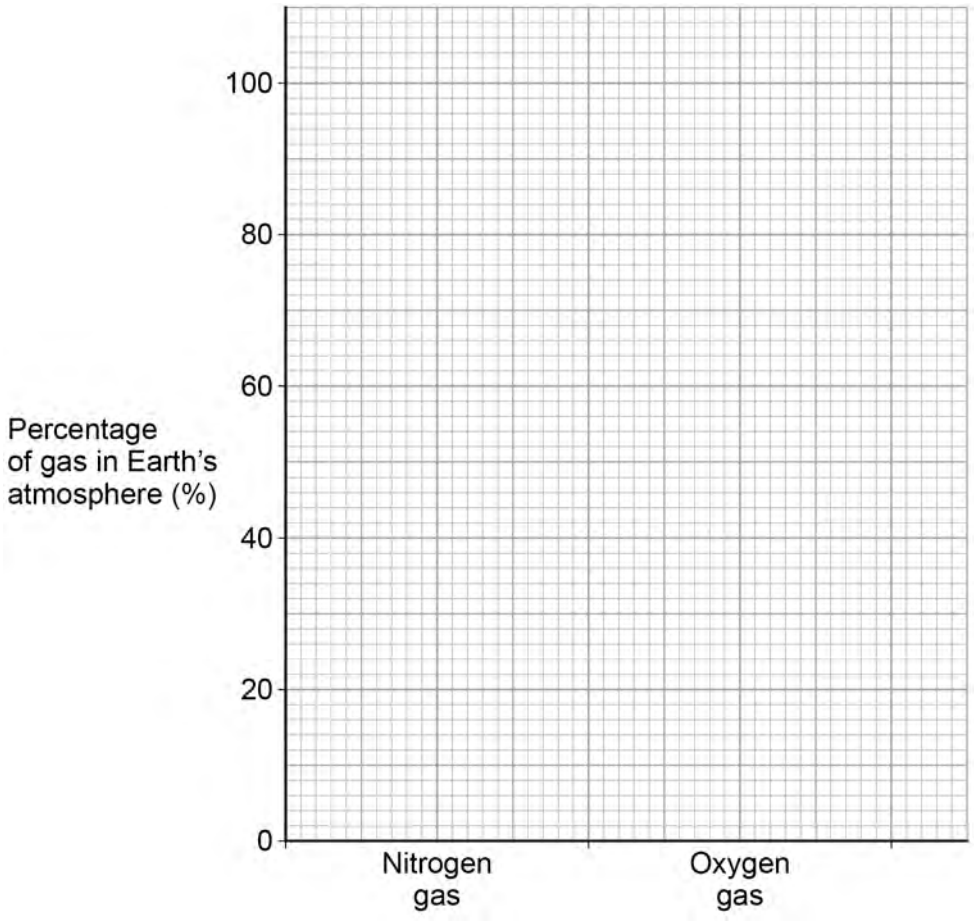
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 95 · 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 95 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 95 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 96

June 2019 | 8462/2F | Original Q8

0 8 This question is about crude oil and hydrocarbons.

Figure 6 shows a fractionating column used to separate crude oil into fractions.

Figure 6

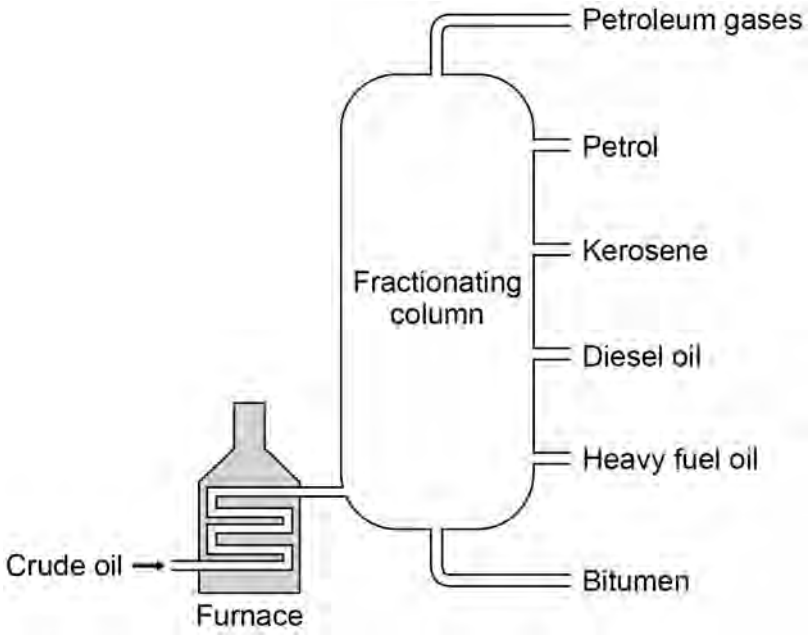


Table 5 gives information about some of the fractions.

Table 5

Fraction	Boiling point range in °C
Petroleum gases	Below 30
Petrol	40–110
Kerosene	180–260
Diesel oil	260–320
Heavy fuel oil	320–400
Bitumen	400–450

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 96 · continued

0 8 . 1 Suggest a suitable temperature for the furnace in **Figure 6**.

[1 mark]

_____ °C

0 8 . 2 Explain why diesel oil collects above heavy fuel oil but below kerosene in the fractionating column.

Use **Table 5**.

[2 marks]

_____

_____

_____

_____

0 8 . 3 Suggest **two** reasons why bitumen is **not** used as a fuel.

[2 marks]

1 _____

_____

2 _____

_____

Question 8 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 96 · continued

0 8 . 4 Petrol contains mainly alkanes.

Which of the following compounds is an alkane?

[1 mark]

Tick (✓) **one** box.

C_2H_4 ☐

C_4H_8 ☐

C_6H_{14} ☐

C_8H_{16} ☐

Large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

0 8 . 5 Describe the conditions needed to crack hydrocarbon molecules from the diesel oil fraction.

[2 marks]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 96 · continued

0 8 . 6 Explain why large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

[2 marks]

0 8 . 7 Complete the equation for the cracking of $C_{15}H_{32}$

[1 mark]

$$C_{15}H_{32} \rightarrow C_{12}H_{26} + _____$$

11

Turn over for the next question

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 97

November 2020 | 8462/2F | Original Q6

0 6 This question is about materials used to make plates.

Plates are made from ceramics, paper or poly(propene).

0 6 . 1 Paper plates are biodegradable and recyclable.

Which stage of a life cycle assessment (LCA) would contain this information?

[1 mark]

Tick (✓) **one** box.

- Disposal at the end of useful life ☐
- Extracting and processing raw materials ☐
- Manufacturing and packaging ☐
- Use and operation during lifetime ☐

0 6 . 2 Which **two** processes are used to make ceramic plates?

[2 marks]

Tick (✓) **two** boxes.

- Forming a composite ☐
- Galvanising with zinc ☐
- Heating in a furnace ☐
- Melting sand and boron trioxide ☐
- Shaping wet clay ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 97 · continued

Poly(propene) is produced from an alkene.

0 6 . 3 Complete the sentences.

[2 marks]

The name for very large molecules such as poly(propene) is _____.

The name of the alkene used to produce poly(propene) is _____.

0 6 . 4 The alkene needed to make poly(propene) is produced from crude oil.

Which **two** processes are used to produce this alkene from crude oil?

[2 marks]

Tick (✓) **two** boxes.

- Chromatography ☐
- Cracking ☐
- Fermentation ☐
- Fractional distillation ☐
- Quarrying ☐

0 6 . 5 What type of bond joins the atoms in a molecule of poly(propene)?

[1 mark]

Tick (✓) **one** box.

- Covalent ☐
- Ionic ☐
- Metallic ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 97 · continued

Table 4 shows information about two polymers used to make plates.

Table 4

Polymer	Effect of heating the polymer
A	does not melt
B	melts at 50 °C

0 6 . 6 What type of polymer is polymer **A**?

Use **Table 4**.

[1 mark]

0 6 . 7 Why does polymer **A** behave differently to polymer **B** when heated?

You should refer to crosslinks in your answer.

[1 mark]

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 98

November 2020 | 8462/2F | Original Q10

10 This question is about hydrocarbons.

Hexane and hexene are hydrocarbons containing six carbon atoms in each molecule.

Hexane is an alkane and hexene is an alkene.

10.1 Draw **one** line from each hydrocarbon to the formula of that hydrocarbon.

[2 marks]

Hydrocarbon	Formula
	C_6H_8
Hexane	C_6H_{10}
	C_6H_{12}
Hexene	C_6H_{14}
	C_6H_{16}

10.2 Bromine water is added to hexane and to hexene.

What would be observed when bromine water is added to hexane and to hexene?

[2 marks]

Hexane _____

_____

Hexene _____

_____

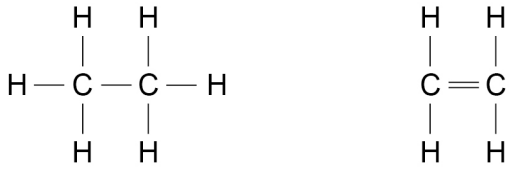
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 98 · continued

1 0 . 3 Ethane is an alkane and ethene is an alkene.

Figure 8 shows the displayed structural formulae of ethane and of ethene.

Figure 8



Ethane **Ethene**

Compare ethane with ethene.

You should refer to:

- their structure and bonding
- their reactions.

[6 marks]

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

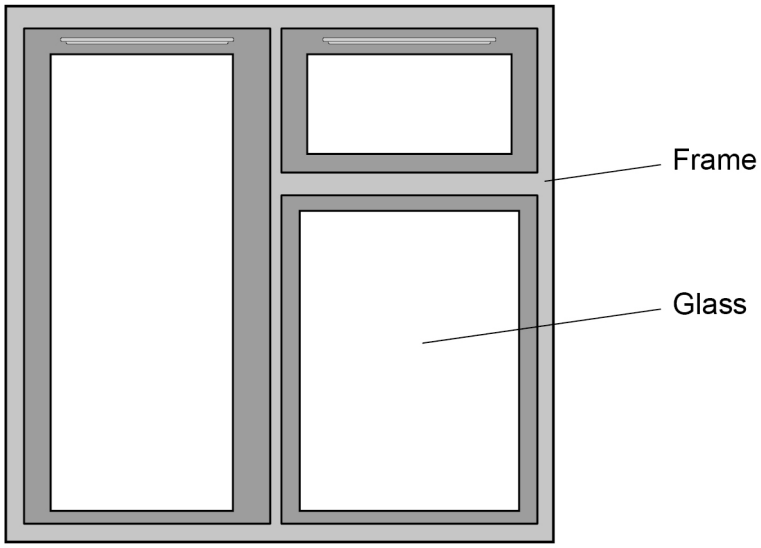
Question 99

November 2021 | 8462/2F | Original Q3

0 3 This question is about substances used to make windows and window frames.

Figure 2 shows a window.

Figure 2



0 3 . 1 Glass is made by heating sand with **two** other materials.

Which **two** other materials are used to make glass?

[2 marks]

Tick (✓) **two** boxes.

- Clay ☐
- Graphite ☐
- Limestone ☐
- Sodium carbonate ☐
- Sodium hydroxide ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 99 · continued

Window frames need to be:

- easy to install
- resistant to damage.

The polymers poly(chloroethene) and HDPE are used to make window frames.

Table 3 shows information about poly(chloroethene) and HDPE.

Table 3

Property	Poly(chloroethene)	HDPE
Density in g/cm^3	1.4	0.92
Relative strength	72	25

0 3 . 2 Suggest **one** advantage of using poly(chloroethene) compared with HDPE to make window frames.

Give **one** reason for your answer.

Use **Table 3**.

[2 marks]

Advantage _____

_____

Reason _____

_____

0 3 . 3 Suggest **one** advantage of using HDPE compared with poly(chloroethene) to make window frames.

Give **one** reason for your answer.

Use **Table 3**.

[2 marks]

Advantage _____

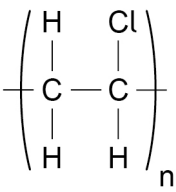
_____

Reason _____

_____

0 3 . 4 **Figure 3** shows the displayed structural formula of poly(chloroethene).

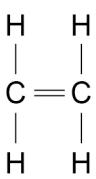
Figure 3

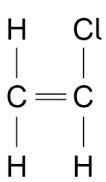


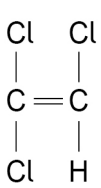
Which monomer is used to make poly(chloroethene)?

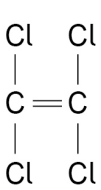
[1 mark]

Tick (✓) **one** box.

 ☐

 ☐

 ☐

 ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 99 · continued

0 3 . 5 Chlorine gas is used to produce poly(chloroethene).

Describe a test to identify chlorine gas.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

0 3 . 6 Wood can be used instead of polymers to make window frames.

- Polymers are unreactive.
- Polymers are produced from crude oil.
- Wood breaks down in wet conditions.
- Wood is produced from trees.

Suggest **one** advantage of using polymers and **one** advantage of using wood to make window frames.

[2 marks]

Advantage of polymers _____

_____

Advantage of wood _____

_____

Question 3 continues on the next page

Question 99 · continued

Window frames can also be made from an alloy of aluminium.

0 3 . 7 6.00 kg of the alloy is used to make a window frame.

Table 4 shows the mass of each element in 6.00 kg of the alloy.

Table 4

Element	Mass in kg
Aluminium	5.94
Magnesium	0.04
Silicon	0.02

Calculate the percentage of aluminium in 6.00 kg of the alloy.

[2 marks]

Percentage of aluminium = _____ %

0 3 . 8 Why is an alloy used instead of pure aluminium to make window frames?

[1 mark]

14

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 100

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 ☐

Question 100 · 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. ☐

Question 100 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 101

November 2021 | 8462/2F | Original Q9

0 9 This question is about alkanes.

Table 6 shows information about some alkanes.

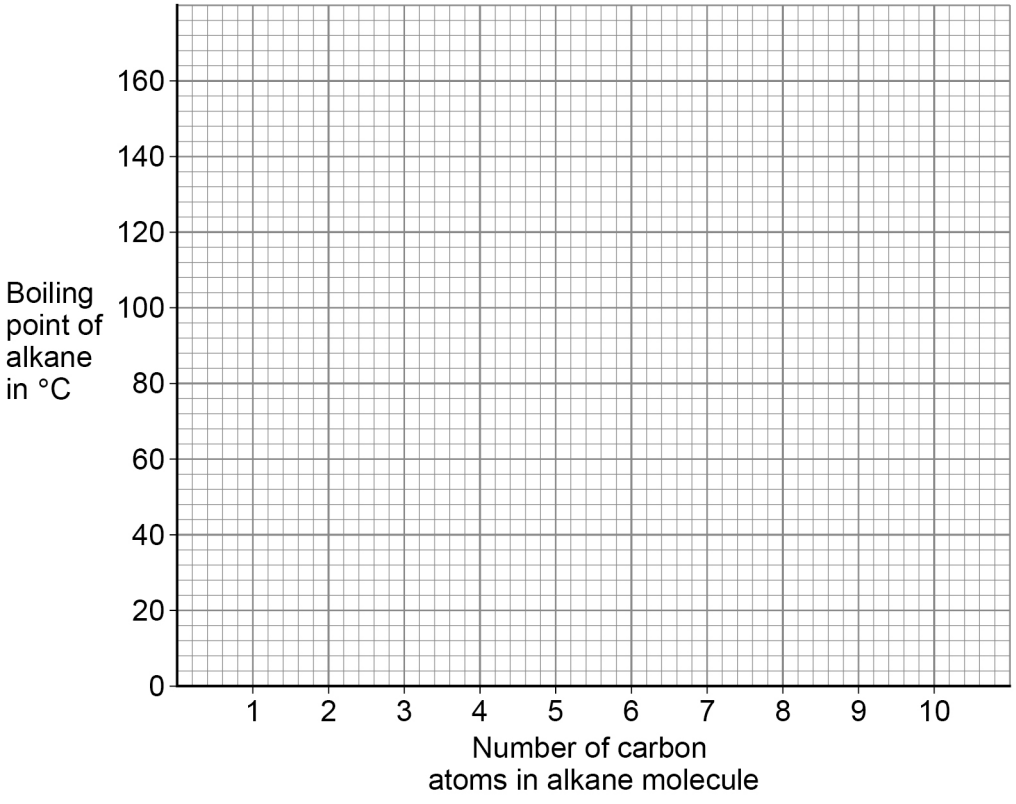
Table 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	**X**
8	126
9	151

0 9 . 1 Plot the data from **Table 6** on **Figure 7**.

[2 marks]

Figure 7



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 101 · continued

0 9 . 2 Predict the boiling point **X** of the alkane with seven carbon atoms in a molecule.

Use **Table 6** and **Figure 7**.

[1 mark]

X = _____ °C

0 9 . 3 **Figure 7** is **not** suitable to show the boiling point of the alkane with three carbon atoms in a molecule.

Suggest **one** reason why.

[1 mark]

_____

_____

0 9 . 4 What is the state at 20 °C of the alkane with four carbon atoms in a molecule?

Use **Table 6**.

[1 mark]

_____

Question 9 continues on the next page

Question 101 · continued

Table 6 is repeated below.

Table 6

Number of carbon atoms in alkane molecule	Boiling point of alkane in °C
4	0
5	36
6	69
7	**X**
8	126
9	151

The alkane with nine carbon atoms in a molecule is called nonane.

0 9 . 5 Complete the formula of nonane.

[1 mark]

C_9H____

0 9 . 6 Nonane will condense lower in a fractionating column during fractional distillation than the other alkanes in **Table 6**.

Explain why.

You should refer to the temperature gradient in the fractionating column.

[2 marks]

8

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 102

June 2022 | 8462/2F | Original Q2

0 2 This question is about hydrocarbons in crude oil.

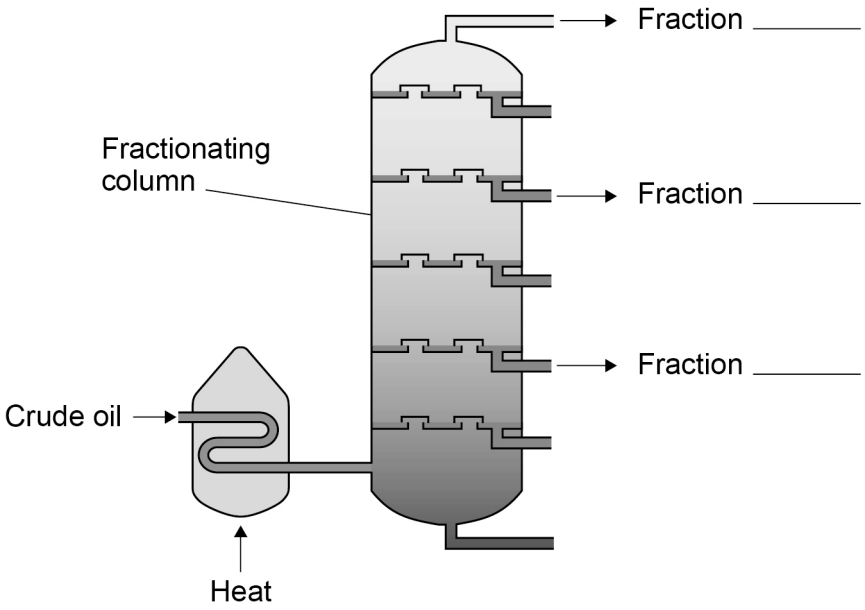
0 2 . 1 **Table 2** shows information about three fractions obtained from crude oil.

Table 2

Fraction	Boiling point range in °C
A	200–300
B	100–150
C	Below 30

Figure 1 shows the fractionating column used to separate fractions **A**, **B** and **C**.

Figure 1



The temperature of the fractionating column is:

- 30 °C at the top
- 400 °C at the bottom.

Complete **Figure 1** to show where fractions **A**, **B** and **C** are collected.

[1 mark]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 102 · continued

0 2 . 2 **Table 3** shows information about three fractions obtained from crude oil.

Table 3

Fraction	Range of number of carbon atoms in each molecule
Petrol	5–12
Diesel oil	15–19
Heavy fuel oil	20–40

Complete the sentences.

Choose answers from the box.

[2 marks]

lower	the same	higher

Compared to petrol, the viscosity of heavy fuel oil is _____.

Compared to petrol, the flammability of diesel oil is _____.

Question 2 continues on the next page

Question 102 · continued

Table 4 shows the percentage of two fractions obtained from two different sources of crude oil.

Table 4

Source	Percentage (%) of fraction	
	Kerosene	Heavy fuel oil
J	13	30
K	4	44

0 2 . 3 Complete **Figure 2**.

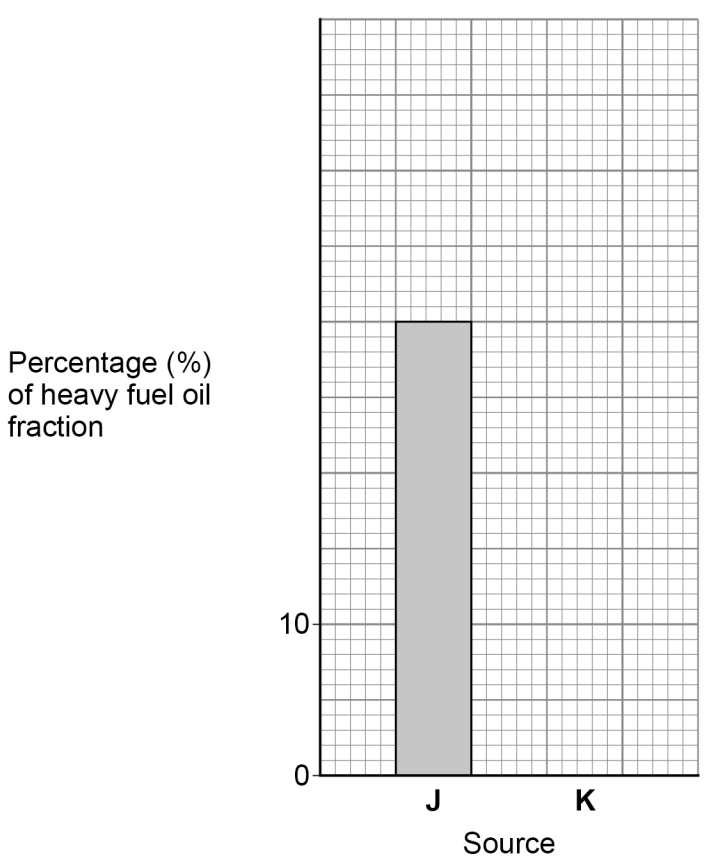
You should:

- complete the *y*-axis scale
- plot the percentage of the heavy fuel oil fraction obtained from source **K**.

Use **Table 4**.

[2 marks]

Figure 2



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 102 · continued

0 2 . 4 Kerosene is in higher demand than heavy fuel oil.

Suggest why crude oil from source **J** is in higher demand than crude oil from source **K**.

Use **Table 4**.

[1 mark]

Large hydrocarbon molecules can be cracked to produce smaller hydrocarbon molecules including alkanes.

0 2 . 5 Which **two** of the following can be used to crack large hydrocarbon molecules?

[2 marks]

Tick (✓) **two** boxes.

- A catalyst ☐
- A fertiliser ☐
- Air ☐
- Ozone ☐
- Steam ☐

0 2 . 6 Alkanes have the general formula C_nH_{2n+2}

Complete the formula of the alkane molecule containing 11 carbon atoms.

[1 mark]

$C_{11}H$___

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 102 · continued

0 2 . 7 C_2H_6 is an alkane.

Which type of bond is found in a C_2H_6 molecule?

[1 mark]

Tick (✓) **one** box.

- A double bond between two carbon atoms. ☐
- A double bond between two hydrogen atoms. ☐
- A single bond between two carbon atoms. ☐
- A single bond between two hydrogen atoms. ☐

0 2 . 8 Which **two** substances are produced when alkanes completely combust?

[2 marks]

Tick (✓) **two** boxes.

- Carbon ☐
- Carbon dioxide ☐
- Carbon monoxide ☐
- Hydrogen ☐
- Water ☐

12

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 103

June 2022 | 8462/2F | Original Q3

0 3 This question is about the Earth's atmosphere.

Table 5 shows:

- the estimated percentages of gases in the Earth's early atmosphere
- the percentages of gases in the Earth's atmosphere today.

Table 5

Gas	Estimated percentage (%) in the Earth's early atmosphere	Percentage (%) in the Earth's atmosphere today
Nitrogen	1.8	**X**
Oxygen	0.2	20.95
Carbon dioxide	96.0	0.04
Other gases	2.0	0.92

0 3 . 1 Calculate value **X** in **Table 5**.

[1 mark]

X = _____ %

0 3 . 2 Which **two** other gases may have been in the Earth's early atmosphere?

[2 marks]

Tick (✓) **two** boxes.

- Ammonia ☐
- Coal ☐
- Limestone ☐
- Methane ☐
- Poly(ethene) ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 103 · continued

Algae and plants increased the percentage of oxygen in the Earth's atmosphere.

The same process in algae and plants decreased the percentage of carbon dioxide in the Earth's atmosphere.

0 3 . 3 Which process in algae and plants increased the percentage of oxygen in the Earth's atmosphere?

[1 mark]

Tick (✓) **one** box.

- Fermentation ☐
- Photosynthesis ☐
- Rusting ☐
- Sedimentation ☐

0 3 . 4 Which **two** other processes decreased the percentage of carbon dioxide in the Earth's atmosphere?

[2 marks]

Tick (✓) **two** boxes.

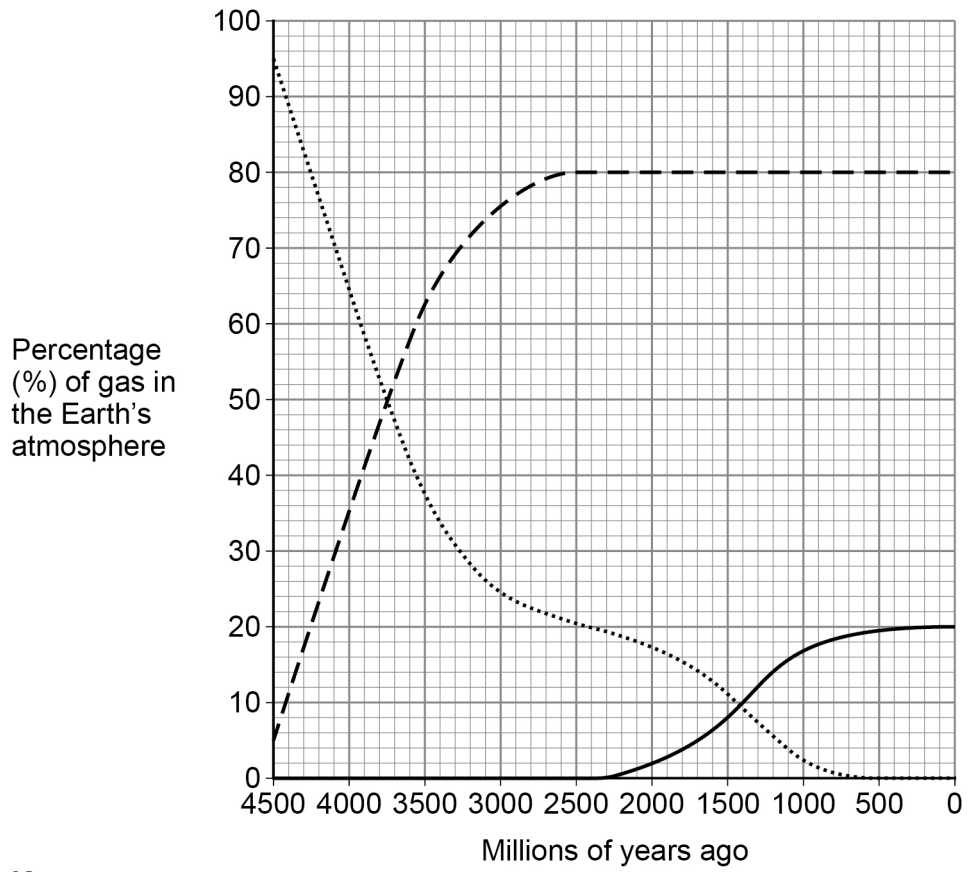
- Burning fossil fuels ☐
- Dissolving carbon dioxide in oceans ☐
- Eruption of volcanoes ☐
- Evolution of animals ☐
- Formation of sedimentary rocks ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 103 · continued

Figure 3 shows how the percentages of gases in the Earth's atmosphere may have changed since the atmosphere was formed.

Figure 3



0 3 . 5 When was the percentage of oxygen in the Earth's atmosphere 8%?

Use **Figure 3**.

[1 mark]

_____ millions of years ago

0 3 . 6 When did the percentage of nitrogen in the Earth's atmosphere become constant?

Use **Figure 3**.

[1 mark]

_____ millions of years ago

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 103 · continued

June 2022 | 8462/2F | Original Q3

0 3 . 7 Crude oil was formed from an ancient biomass as the Earth's atmosphere evolved.

What did this ancient biomass mainly consist of?

[1 mark]

Tick (✓) **one** box.

- Limestone ☐
- Plankton ☐
- Sand ☐

0 3 . 8 Most of the percentages of the gases in **Figure 3** are estimated values.

Why have scientists used estimated values for the percentages of the gases in **Figure 3**?

[1 mark]

_____

_____

10

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 104

June 2022 | 8462/2F | Original Q10

1 0 This question is about life cycle assessments (LCAs).

1 0 . 1 Milk bottles can be made from glass or from a polymer.

Table 10 shows information about milk bottles of equal volume.

Table 10

	Glass	Polymer
Raw materials	Limestone Sand Sodium carbonate	Crude oil
Energy needed to process raw materials in kilojoules	6750	1710
Energy needed to manufacture bottle in kilojoules	750	90
Mass of bottle in grams	200	20
Mean number of times used during lifetime of bottle	25	1
One disposal method at end of useful life	Recycled to make different glass products	Recycled to make different polymer products

Evaluate the use of glass for milk bottles compared with the use of a polymer for milk bottles.

Use features of life cycle assessments (LCAs) in your answer.

Use **Table 10**.

[6 marks]

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 104 · continued

10.2 Milk is also sold in cardboard cartons.

A carton is made using 40 cm^3 of cardboard.

The density of the cardboard is 0.40 g/cm^3.

Calculate the mass of the carton.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

[3 marks]

Mass = _____ g

9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 105

June 2023 | 8462/2F | Original Q2

0 2 This question is about glass and polymers.

Beakers can be made from borosilicate glass or poly(propene).

Table 1 shows information about materials used to make beakers.

Table 1

	Material used to make beakers	
	borosilicate glass	**poly(propene)**
Temperature at which melting begins in °C	850	160
Flammability	does not burn	burns
Resistance to impact	shatters	tough
Cost of 100 cm^3 beaker in £	1.50	2.00

0 2 . 1 Suggest **two** reasons why a Bunsen burner should **not** be used to heat a liquid in a poly(propene) beaker.

Use **Table 1**.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 2 Poly(propene) beakers are more expensive than borosilicate glass beakers.

Suggest **one** reason why using poly(propene) beakers instead of borosilicate glass beakers could save money.

Use **Table 1**.

[1 mark]

_____

_____

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 105 · continued

0 2 . 3 Which is a raw material used to make borosilicate glass?

[1 mark]

Tick (✓) **one** box.

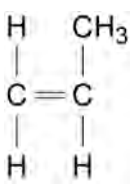
Boron trioxide ☐

Clay ☐

Limestone ☐

Poly(propene) is produced from propene.

The displayed structural formula of propene is:



0 2 . 4 **Table 2** shows some information about the elements in one molecule of propene.

Table 2

Symbol for element	Name of element	Number of atoms of element in one molecule of propene
C		
H		

Complete **Table 2**.

[2 marks]

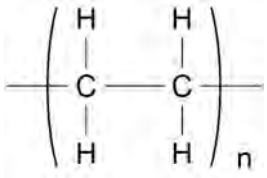
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 105 · continued

0 2 . 5 Which structure is the repeating unit of poly(propene)?

[1 mark]

Tick (✓) **one** box.



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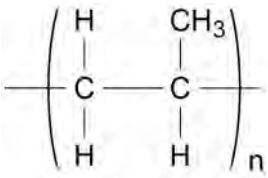

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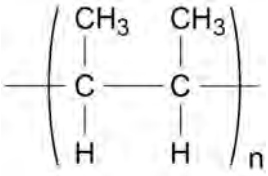

☐

0 2 . 6 Poly(propene) is produced in three stages:

- **Stage 1:** separating large alkane molecules from crude oil
- **Stage 2:** producing propene molecules from large alkane molecules
- **Stage 3:** joining many propene molecules together.

Name **Stage 1**, **Stage 2** and **Stage 3**.

Choose answers from the box.

[3 marks]

cracking	**fermentation**	**fractional distillation**
polymerisation	**reverse osmosis**	

Stage 1 is _____.

Stage 2 is _____.

Stage 3 is _____.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 105 · continued

0 2 . 7 A molecule of hexene contains a double carbon–carbon bond.

Many hexene molecules join together to form poly(hexene).

Which **two** words describe a hexene molecule in this process?

[2 marks]

Tick (✓) **two** boxes.

- Alkene ☐
- Catalyst ☐
- Composite ☐
- Element ☐
- Monomer ☐

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4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 106

June 2024 | 8462/2F | Original Q1

0 1 This question is about hydrocarbons.

A hydrocarbon has the formula C_6H_{14}

0 1 . 1 Name the **two** elements in a hydrocarbon.

[2 marks]

1 _____

2 _____

0 1 . 2 How many atoms are there in one molecule of C_6H_{14}?

[1 mark]

Tick (✓) **one** box.

2 ☐

6 ☐

14 ☐

20 ☐

C_6H_{14} is a member of a homologous series.

0 1 . 3 What is the general formula for the homologous series that contains C_6H_{14}?

[1 mark]

Tick (✓) **one** box.

C_nH_{2n-2} ☐

C_nH_{2n} ☐

C_nH_{2n+2} ☐

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 106 · continued

0 1 . 4 Which homologous series has C_6H_{14} as a member?

[1 mark]

Tick (✓) **one** box.

Alcohols ☐

Alkanes ☐

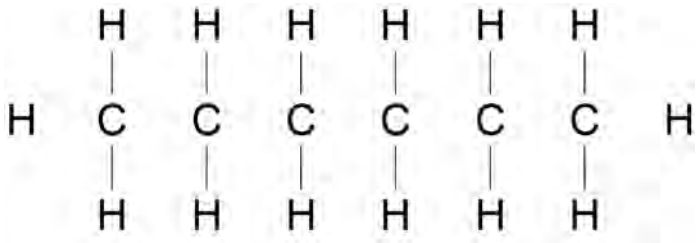
Alkenes ☐

Carboxylic acids ☐

0 1 . 5 Complete **Figure 1** to show the displayed structural formula of C_6H_{14}

[1 mark]

Figure 1



0 1 . 6 Petrol contains C_6H_{14}

Petrol is burned in car engines.

What general name is used to describe petrol when petrol is burned to release energy?

[1 mark]

Question 1 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 106 · continued

0 1 . 7 Atmospheric pollutants are formed when C_6H_{14} undergoes incomplete combustion.

Complete the sentences.

Choose answers from the box.

[2 marks]

ammonia	**carbon monoxide**	**coal**
soot	**sulfur**	**sulfur dioxide**

The solid atmospheric pollutant formed during incomplete combustion of C_6H_{14} is

_____ .

The gaseous atmospheric pollutant formed during incomplete combustion of C_6H_{14} is

_____ .

0 1 . 8 A different organic compound ($C_{12}H_{26}$) can be broken down to produce C_6H_{14} and one other compound.

Complete the equation for the reaction.

[1 mark]

$$C_{12}H_{26} \rightarrow C_6H_{14} + C__ H__$$

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 106 · continued

0 1 . 9 The percentage by mass of each element in C_6H_{14} is:

- 84% C
- 16% H

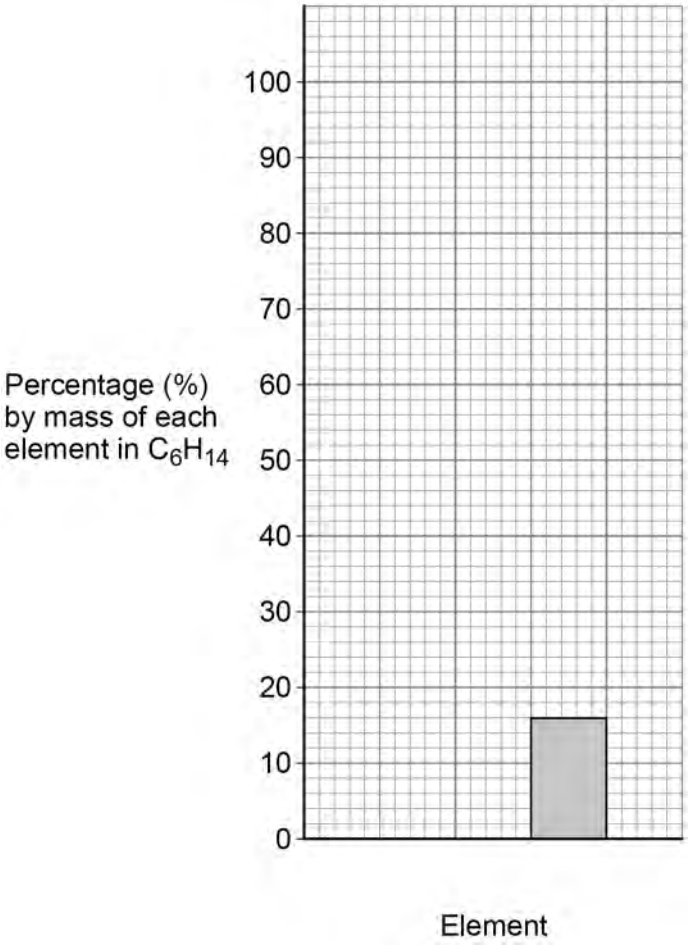
Complete **Figure 2**.

You should:

- label each element on the x-axis
- plot the percentage by mass of C in C_6H_{14}

[2 marks]

Figure 2



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4.7.1.1 Crude oil, hydrocarbons and alkanes

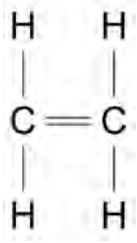
Question 107

June 2024 | 8462/2F | Original Q6

0 6 This question is about addition reactions.

Figure 7 shows the displayed structural formula of ethene.

Figure 7



0 6 . 1 Complete the sentence.

[1 mark]

When bromine water is added to ethene, the bromine water changes from orange to

_____ .

Question 107 · continued

Chlorine reacts with ethene.

0 6 . 2 What is used to identify chlorine?

[1 mark]

Tick (✓) **one** box.

A lighted splint ☐

Damp litmus paper ☐

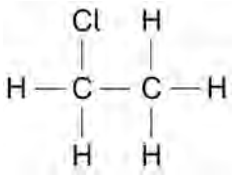
Limewater ☐

0 6 . 3 Which of the following shows the displayed structural formula of the compound produced when chlorine reacts with ethene?

Use **Figure 7**.

[1 mark]

Tick (✓) **one** box.



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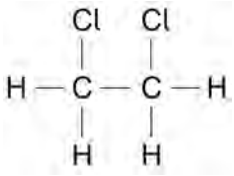

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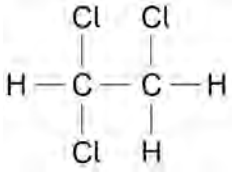

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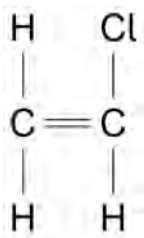
Question 6 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 107 · continued

0 6 . 4 Chloroethene can be used to produce a polymer called poly(chloroethene).

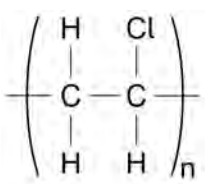
The displayed structural formula of chloroethene is



Which represents the structure of poly(chloroethene)?

[1 mark]

Tick (✓) **one** box.



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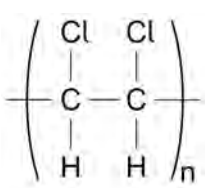

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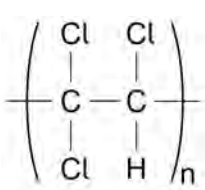

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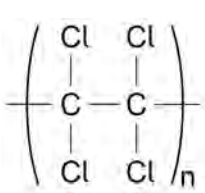


☐

Question 107 · continued

Ethene can be used to produce another polymer called poly(ethene).

Table 3 shows information about poly(chloroethene) and poly(ethene).

Table 3

	Poly(chloroethene)	Poly(ethene)
Density in g/cm^3	1.5	0.9
Temperature at which polymer completely melts in °C	260	120

0 6 . 5 Determine the simplest whole number ratio of the density of poly(chloroethene) : density of poly(ethene).

[3 marks]

Simplest whole number ratio = _____ : _____

0 6 . 6 Poly(ethene) **and** poly(chloroethene) can both be used to make pipes.

Suggest why neither polymer is suitable for pipes carrying steam at a temperature of 300 °C.

Use **Table 3**.

[1 mark]

0 6 . 7 Poly(ethene) and paper can both be used to make shopping bags.

Poly(ethene) is produced from crude oil. Paper is produced from trees.

Suggest **one** reason why paper is more sustainable than poly(ethene) for making shopping bags.

[1 mark]

9

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 108

June 2025 | 8462/2F | Original Q2

0 2 Alkanes and alkenes are hydrocarbons.

Hydrocarbon molecules are made up of hydrogen and carbon atoms only.

An alkene has the formula C_3H_6

0 2 . 1 Which alkene has the formula C_3H_6?

[1 mark]

Tick (✓) **one** box.

Butene ☐

Ethene ☐

Propene ☐

0 2 . 2 How many atoms are there in a molecule of C_3H_6?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 6 ☐ 9 ☐

0 2 . 3 Which is a use of C_3H_6?

[1 mark]

Tick (✓) **one** box.

Making a polymer ☐

Making ammonia ☐

Making glass ☐

0 2 . 4 The percentage (%) by mass of each element in a molecule of C_3H_6 is:

- hydrogen 14%
- carbon 86%.

Figure 1 shows the percentage by mass of hydrogen in a molecule of C_3H_6

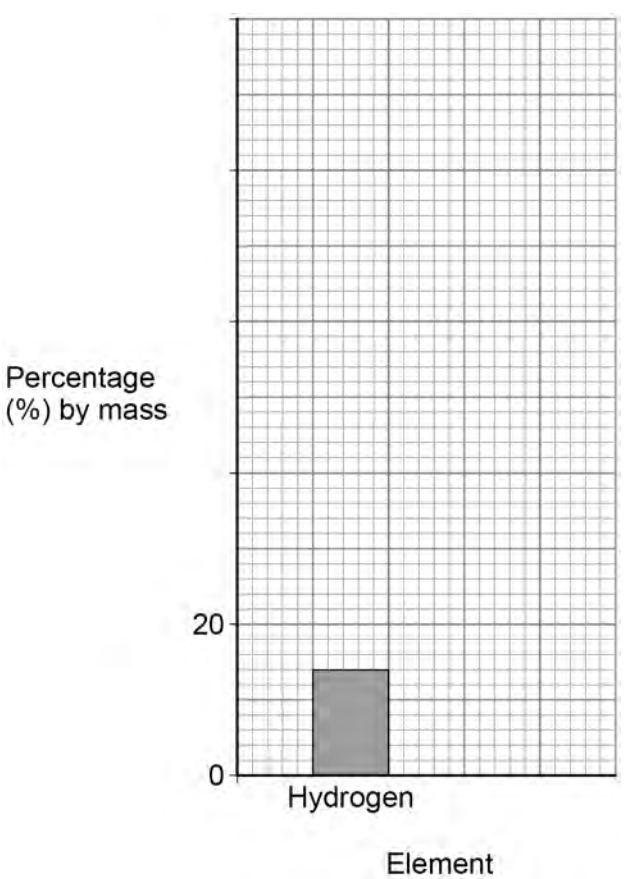
Complete **Figure 1**.

You should:

- complete the *y*-axis scale
- plot the percentage by mass of carbon as a bar
- label the bar plotted for carbon.

[3 marks]

Figure 1



4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 108 · continued

Alkanes can be cracked to produce alkenes and smaller alkane molecules.

0 2 . 5 Describe a test for alkenes.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

0 2 . 6 $C_{10}H_{22}$ can be cracked to produce C_3H_6 and an alkane.

Complete the equation for the reaction.

[1 mark]

$$C_{10}H_{22} \longrightarrow C_3H_6 + C ___ H_{16}$$

0 2 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

ceramics	**fertilisers**	**fuels**

Smaller alkanes from cracking are useful as _____.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 108 · continued

High temperatures between 450 °C and 750 °C are used in cracking reactions.

0 2 . 8 Which statement describes the molecules at 750 °C compared with the molecules at 450 °C?

[1 mark]

Tick (✓) **one** box.

- The molecules collide more frequently at 750 °C. ☐
- The molecules have less energy at 750 °C. ☐
- The molecules move more slowly at 750 °C. ☐

0 2 . 9 How does the rate of reaction at 750 °C compare with the rate of reaction at 450 °C?

[1 mark]

_____

_____

12

4.7.1.1 Crude oil, hydrocarbons and alkanes

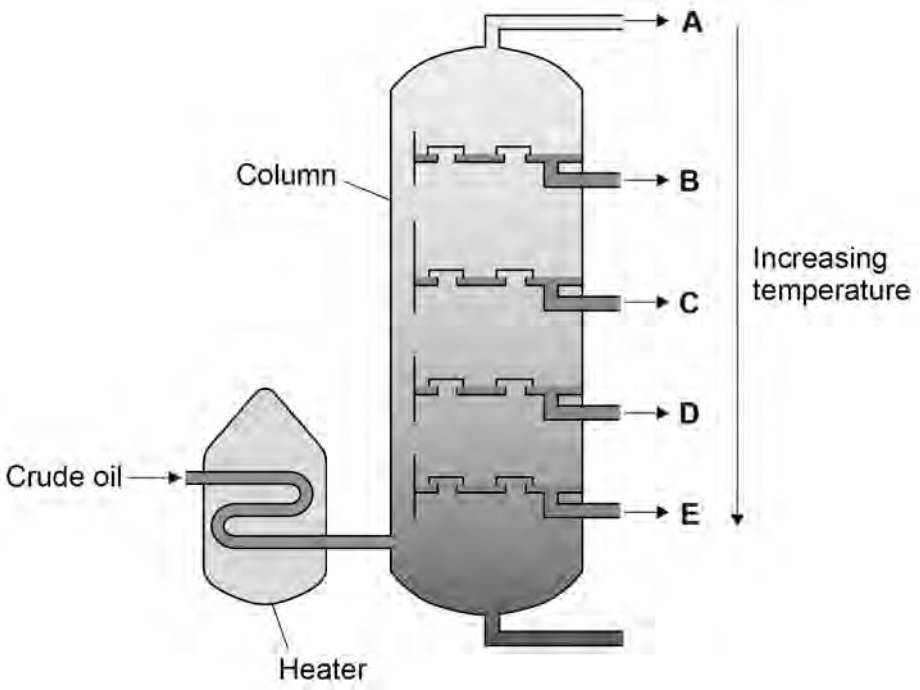
Question 109

June 2025 | 8462/2F | Original Q9

0 9 This question is about hydrocarbon fuels.

Figure 7 represents the process used to separate hydrocarbon fuels from crude oil.

Figure 7



0 9 . 1 Name the process represented by **Figure 7**.

[1 mark]

0 9 . 2 Changes of state take place during the process in **Figure 7**.

Name the change of state taking place in:

- the heater
- the column.

[2 marks]

Heater _____

Column _____

Question 109 · continued

June 2025 | 8462/2F | Original Q9

Different fuels are obtained from crude oil at the points on **Figure 7** labelled **A** to **E**.

Table 4 shows the boiling point ranges of different fuels obtained from the process in **Figure 7**.

Table 4

Fuel	Boiling point range in °C
Diesel oil	260 – 320
Heavy fuel oil	320 – 400
Kerosene	180 – 260
Petrol	40 – 110
Petroleum gases	Below 30

0 9 . 3 Which fuel is obtained at **B** in the column?

Use **Figure 7** and **Table 4**.

[1 mark]

0 9 . 4 Fuels with higher boiling point ranges contain larger molecules.

What is the order of increasing flammability of the fuels?

Use **Table 4**.

[1 mark]

Tick (✓) **one** box.

Heavy fuel oil ⟶ diesel oil ⟶ kerosene ☐

Heavy fuel oil ⟶ kerosene ⟶ diesel oil ☐

Kerosene ⟶ diesel oil ⟶ heavy fuel oil ☐

Kerosene ⟶ heavy fuel oil ⟶ diesel oil ☐

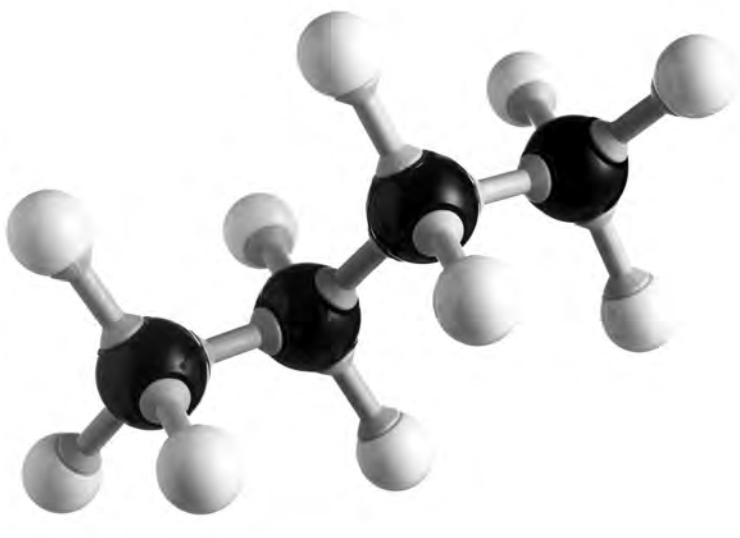
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 109 · continued

Liquified petroleum gases are a mixture of several different hydrocarbons.

Figure 8 shows a model of one of these hydrocarbons.

Figure 8



0 9 . 5 Write the molecular formula of the hydrocarbon represented by the model in **Figure 8**.

[1 mark]

0 9 . 6 Name the hydrocarbon represented by the model in **Figure 8**.

[1 mark]

0 9 . 7 Petroleum gases also contain a hydrocarbon with the formula C_3H_8

Balance the equation for the complete combustion of C_3H_8

[2 marks]

$$C_3H_8 + 5\ O_2 \rightarrow ___\ CO_2 + ___\ H_2O$$

9