AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.1.3

Properties of hydrocarbons

Past-paper questions

Tier	**Foundation**
Question groups	**55**
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.

4.7.1.3 Properties of hydrocarbons

Question 01

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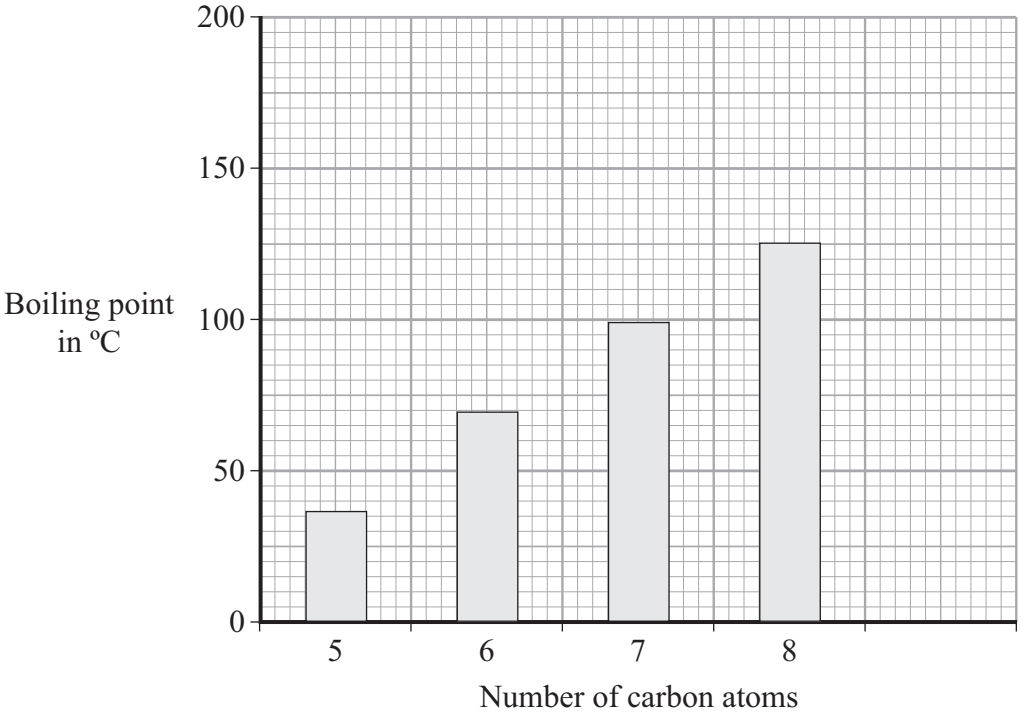
(b) The hydrocarbons used to make ethene come from crude oil.
The properties of hydrocarbons are linked to the number of carbon atoms in their molecules.

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)

4.7.1.3 Properties of hydrocarbons

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

4.7.1.3 Properties of hydrocarbons

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** . . . .

4.7.1.3 Properties of hydrocarbons

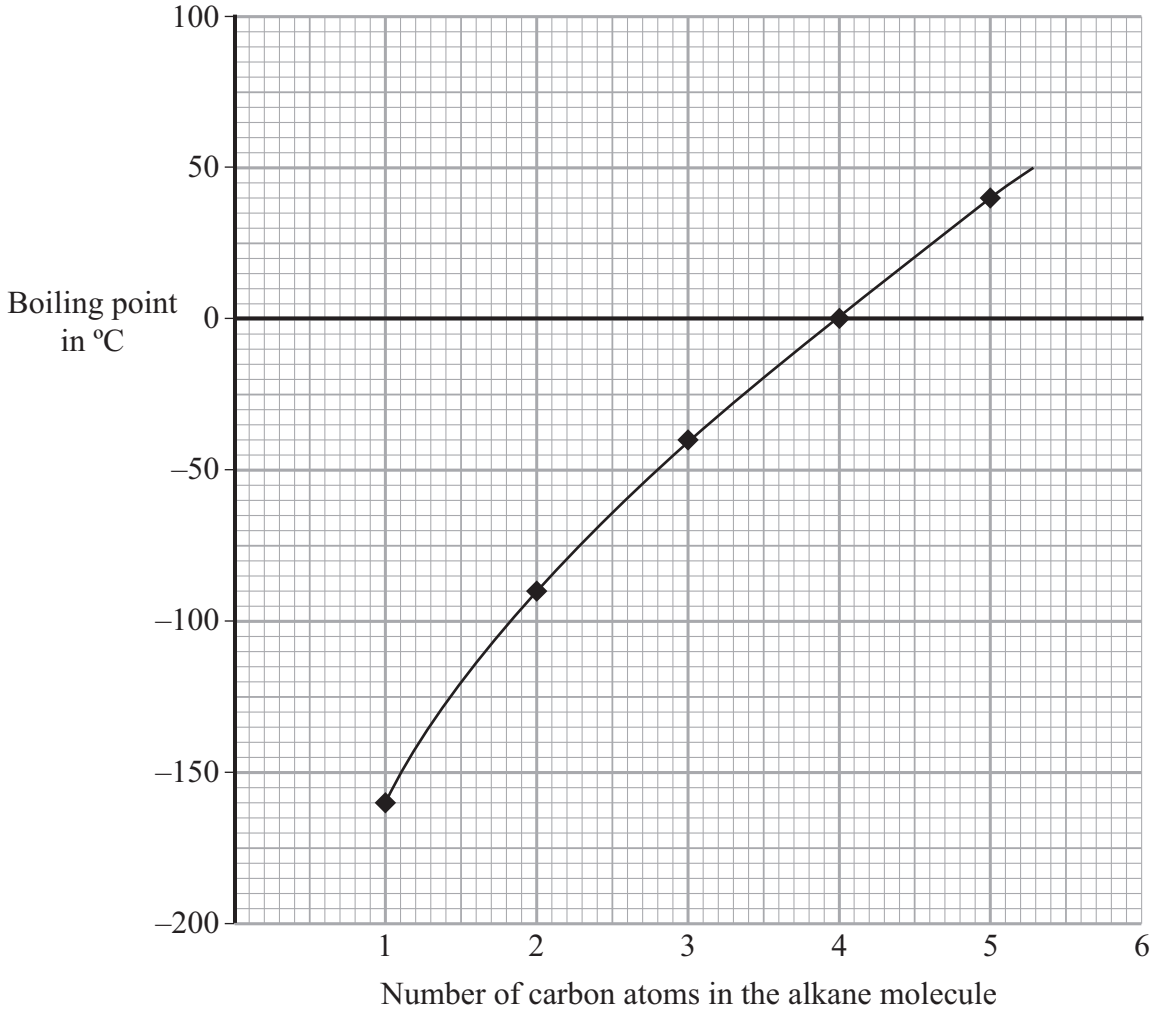
Question 03

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.

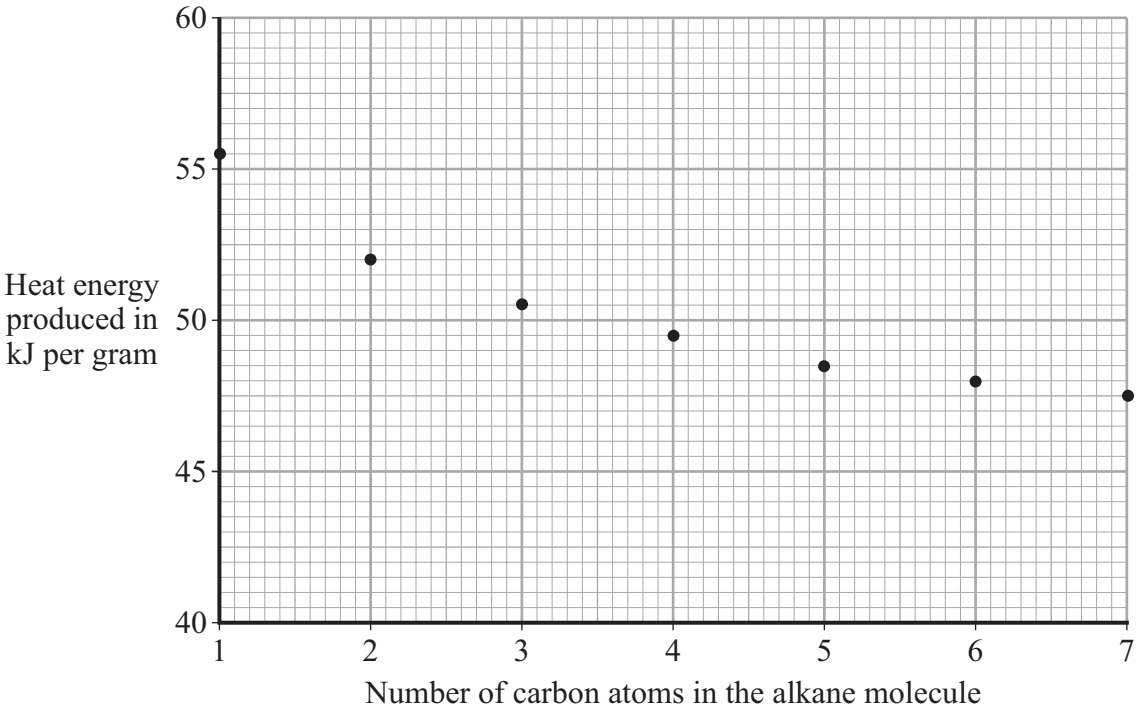
4.7.1.3 Properties of hydrocarbons

Question 04

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.

4.7.1.3 Properties of hydrocarbons

Question 05

June 2007 | CHY1F | Original Q3 | Legacy

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

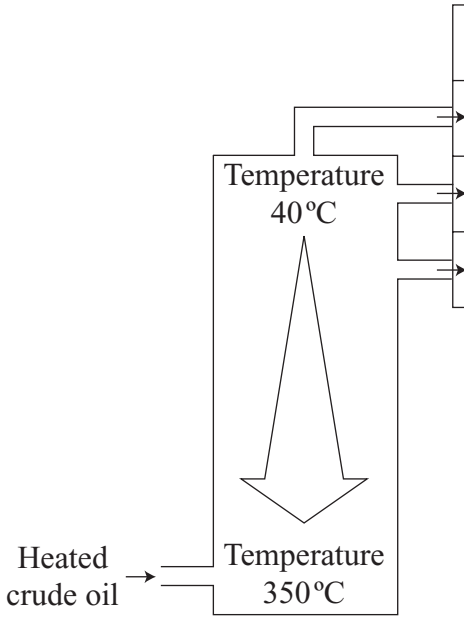
(a) Crude oil is a mixture of hydrocarbons.

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)

4.7.1.3 Properties of hydrocarbons

Question 05 · continued

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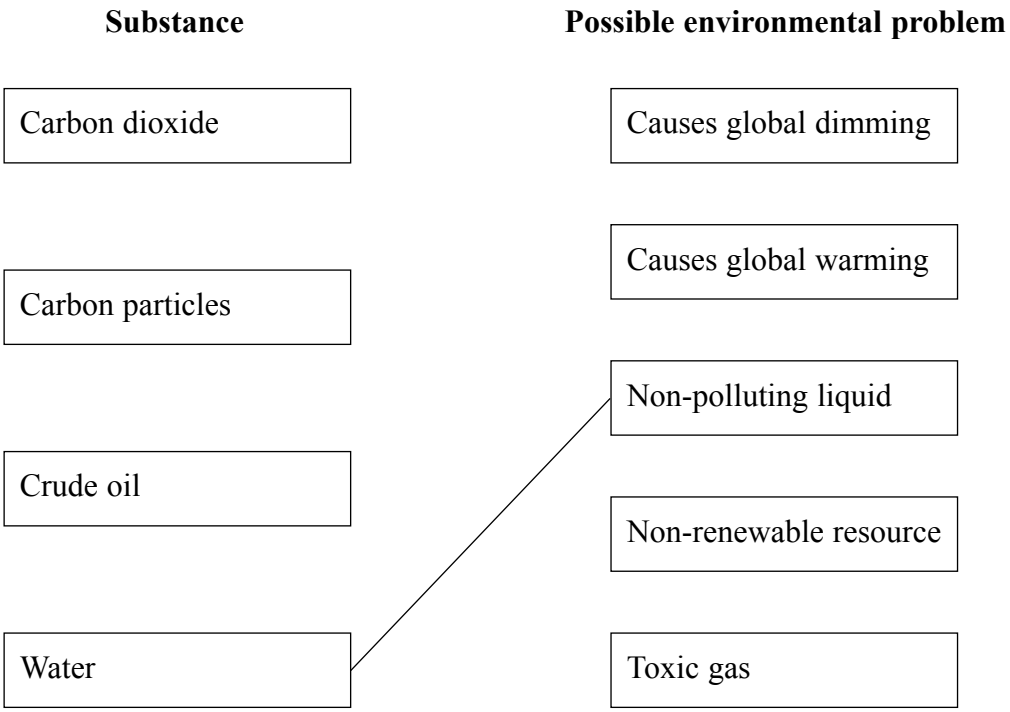
(c) Fuels from crude oil burn to provide heat energy.

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

4.7.1.3 Properties of hydrocarbons

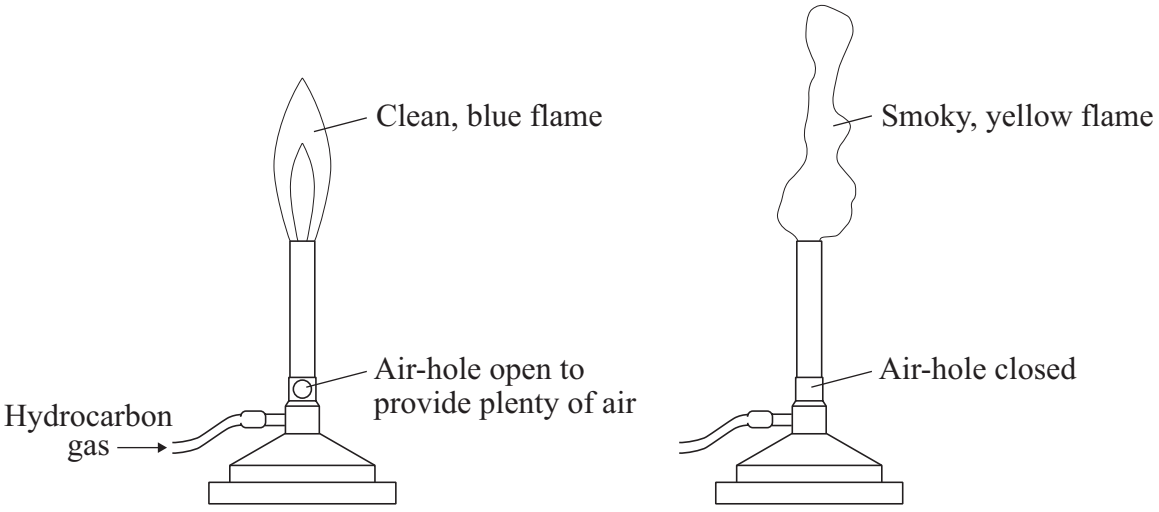
Question 06

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** . . . .

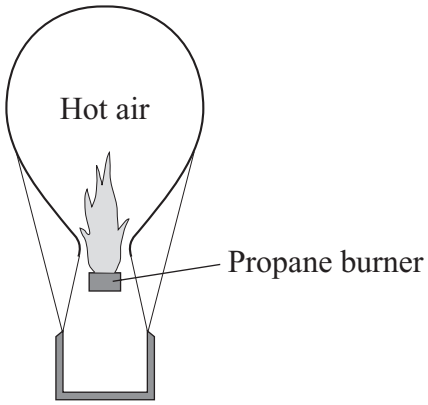
The yellow flame contains black specks of . . . **4** . . . .

4.7.1.3 Properties of hydrocarbons

Question 07

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)

4.7.1.3 Properties of hydrocarbons

Question 07 · continued

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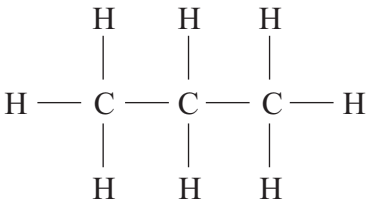
(b) Propane, C_3H_8, can be represented as:



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

4.7.1.3 Properties of hydrocarbons

Question 08

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

4.7.1.3 Properties of hydrocarbons

Question 09

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.

4.7.1.3 Properties of hydrocarbons

Question 09 · continued June 2008 | CHY1AP | Original Q9 | Legacy

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

4.7.1.3 Properties of hydrocarbons

Question 10

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** . . . .

4.7.1.3 Properties of hydrocarbons

Question 11

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

4.7.1.3 Properties of hydrocarbons

Question 12

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** . . . .

4.7.1.3 Properties of hydrocarbons

Question 13

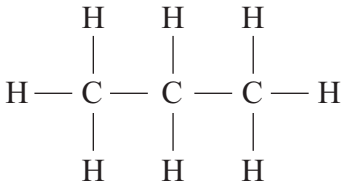
November 2008 | CHY1AP | Original Q5 | Legacy

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** . . . .

4.7.1.3 Properties of hydrocarbons

Question 14

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**.

4.7.1.3 Properties of hydrocarbons

Question 14 · 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.

4.7.1.3 Properties of hydrocarbons

Question 15

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

4.7.1.3 Properties of hydrocarbons

Question 16

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.

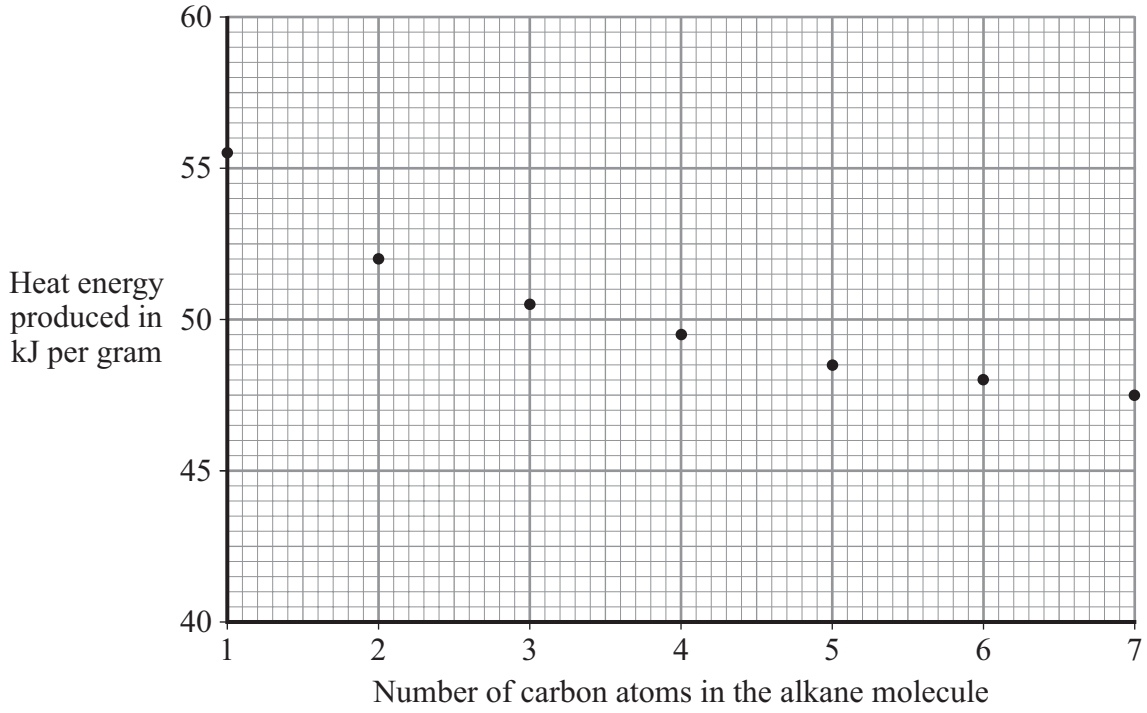
4.7.1.3 Properties of hydrocarbons

Question 17

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

4.7.1.3 Properties of hydrocarbons

Question 17 · 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.

4.7.1.3 Properties of hydrocarbons

Question 18

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.

4.7.1.3 Properties of hydrocarbons

Question 19

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

4.7.1.3 Properties of hydrocarbons

Question 20

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.

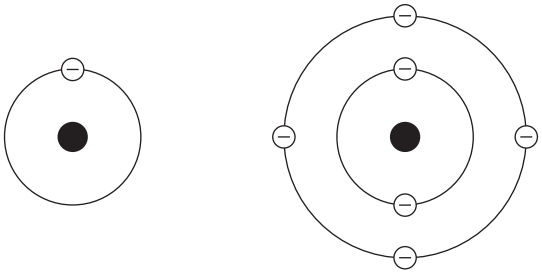
compounds	**elements**	**molecules**

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.

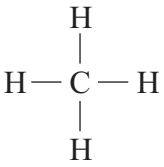
(1 mark)

4.7.1.3 Properties of hydrocarbons

Question 20 · 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

4.7.1.3 Properties of hydrocarbons

Question 21

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.

4.7.1.3 Properties of hydrocarbons

Question 22

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}

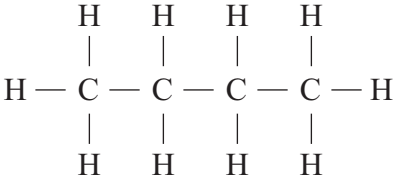
4 $C_{2n}H_{2n-2}$

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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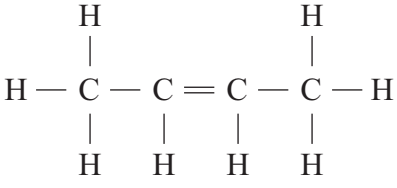

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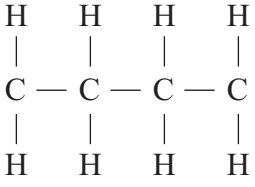

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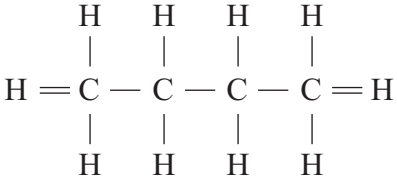


4.7.1.3 Properties of hydrocarbons

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

4.7.1.3 Properties of hydrocarbons

Question 23

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

4.7.1.3 Properties of hydrocarbons

Question 24

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.

4.7.1.3 Properties of hydrocarbons

Question 25

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** . . . .

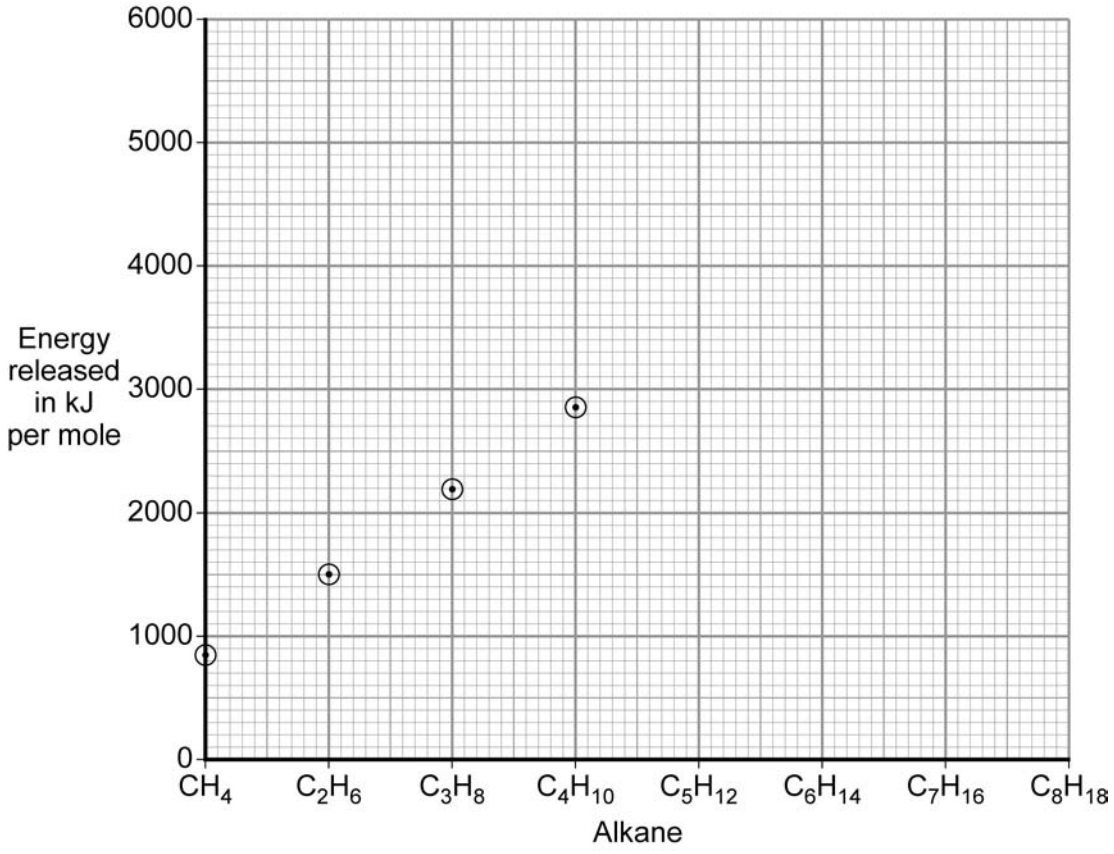
4.7.1.3 Properties of hydrocarbons

Question 26

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)

4.7.1.3 Properties of hydrocarbons

Question 26 · 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

4.7.1.3 Properties of hydrocarbons

Question 26 · 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

4.7.1.3 Properties of hydrocarbons

Question 27

November 2010 | CHY1AP | Original Q7 | Legacy

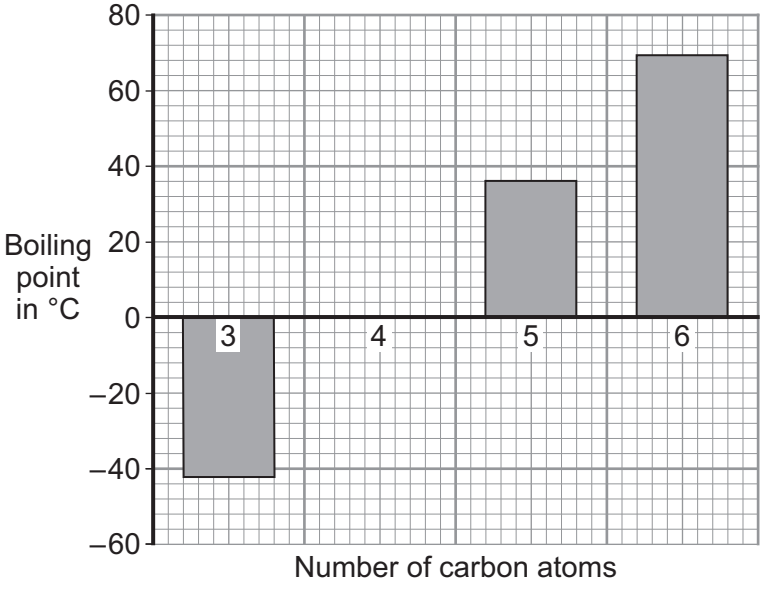
QUESTION SEVEN

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.

4.7.1.3 Properties of hydrocarbons

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

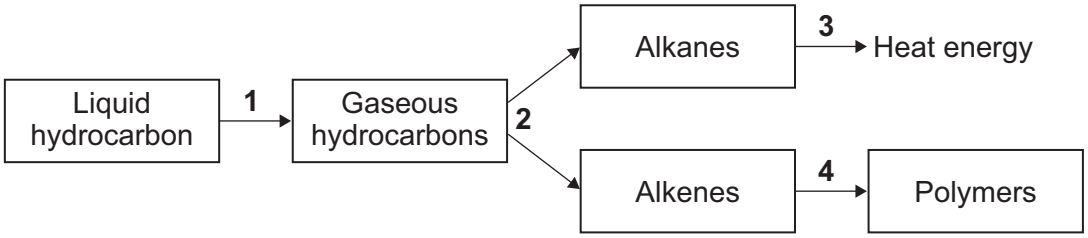
4.7.1.3 Properties of hydrocarbons

Question 28

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

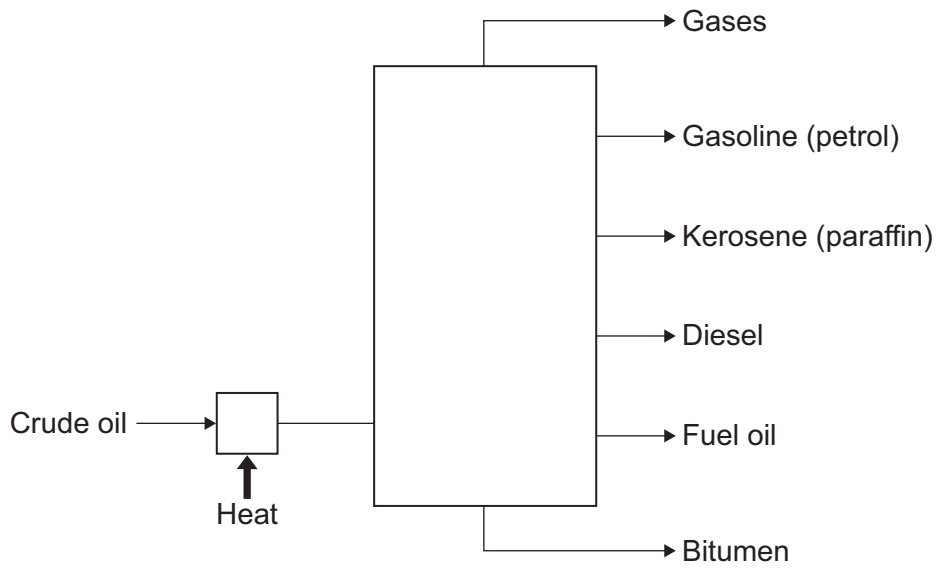
4.7.1.3 Properties of hydrocarbons

Question 29

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.

.....

.....

.....

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.....

.....

(3 marks)

4.7.1.3 Properties of hydrocarbons

Question 29 · 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

4.7.1.3 Properties of hydrocarbons

Question 30

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.

4.7.1.3 Properties of hydrocarbons

Question 31

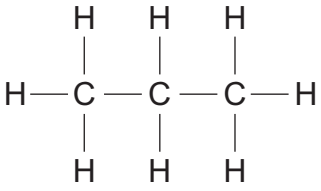
March 2011 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

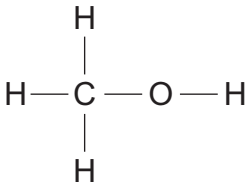
This question is about the formulae of four compounds.

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

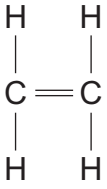
A



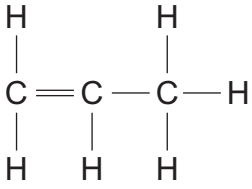
B



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.

4.7.1.3 Properties of hydrocarbons

Question 32

June 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

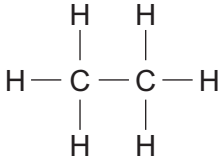
This question is about four alkanes, **A**, **B**, **C** and **D**.

	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** . . . .

4.7.1.3 Properties of hydrocarbons

Question 33 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

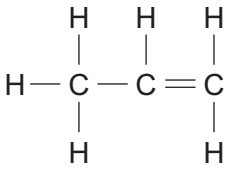
4.7.1.3 Properties of hydrocarbons

Question 34

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)

4.7.1.3 Properties of hydrocarbons

Question 34 · 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

4.7.1.3 Properties of hydrocarbons

Question 35

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.

4.7.1.3 Properties of hydrocarbons

Question 36

November 2011 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

This question is about the viscosity of engine oils.

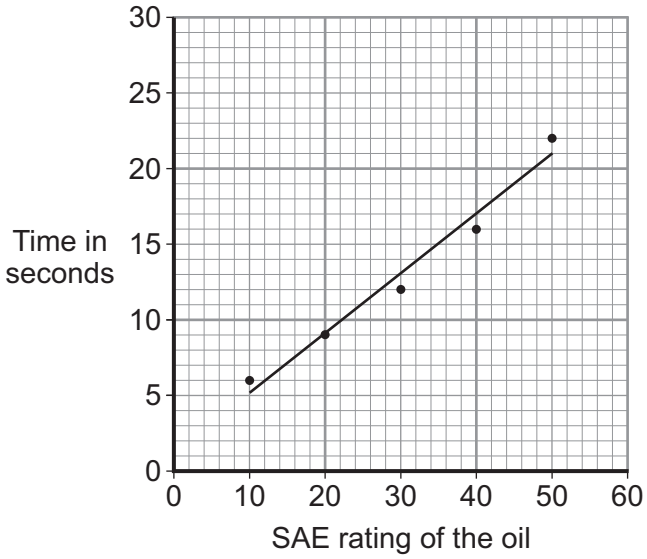
Viscosity is a measure of how easily a liquid will flow.
The less viscous a liquid is, the more easily it will flow.
The viscosities of engine oils are given a rating by the Society of Automotive Engineers (SAE rating).

A student investigated the viscosity of oils with different SAE ratings. She poured a fixed volume of an oil of SAE 10 into a funnel with a narrow spout and started a stopwatch. She measured how long it took for all of the oil to flow out of the funnel.

She repeated the experiment with four different oils.

Here are her results.

SAE rating	Time in seconds
10	6
20	9
30	12
40	16
50	22



6A The experiment shows that . . .

1 an SAE 15 oil would take 15 seconds to flow through the funnel.

2 the SAE 40 oil takes twice as long to flow through the funnel as SAE 20 oil.

3 all five oils have a similar viscosity.

4 viscosity increases as the SAE rating increases.

4.7.1.3 Properties of hydrocarbons

Question 36 · continued

6B The reliability of the results could be improved . . .

1 by using a larger funnel.

2 by repeating each test.

3 by using a smaller volume of oil.

4 by using oils with lower SAE ratings.

6C Three months later, the student did the same experiment in the same laboratory, using samples of the same oils.

She found that all the oils took longer to flow through the funnel.

This could be because . . .

1 long oil molecules break into shorter ones when they are stored.

2 the laboratory was at a lower temperature.

3 she had used a funnel with a wider spout.

4 she started the stopwatch only when the oil started to drip out.

6D The student was unsure about the trend shown by the line of best fit through her points.

This is because . . .

1 a curve passing through all the points is always better than a straight line.

2 the points on her graph were plotted incorrectly.

3 none of the points lies on the line.

4 she did not have enough oils to show whether the line should be curved or straight.

4.7.1.3 Properties of hydrocarbons

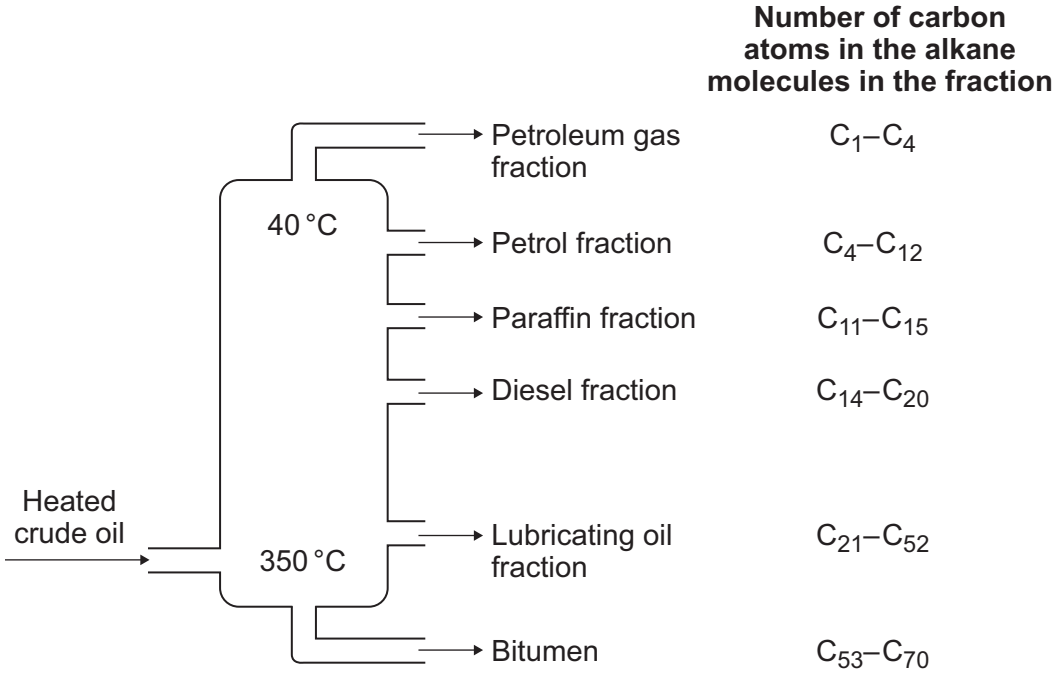
Question 37

November 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

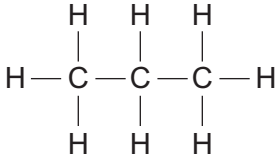
Crude oil can be separated into fractions.

Each fraction contains several alkanes.



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

1



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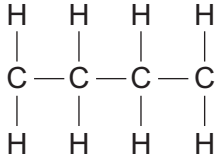

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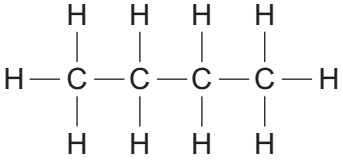

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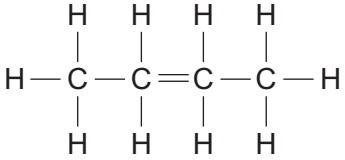


4.7.1.3 Properties of hydrocarbons

Question 37 · 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

4.7.1.3 Properties of hydrocarbons

Question 38

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

4.7.1.3 Properties of hydrocarbons

Question 38 · 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)

4.7.1.3 Properties of hydrocarbons

Question 38 · continued

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

Explain why.

.....

.....

.....

.....

(2 marks)

11

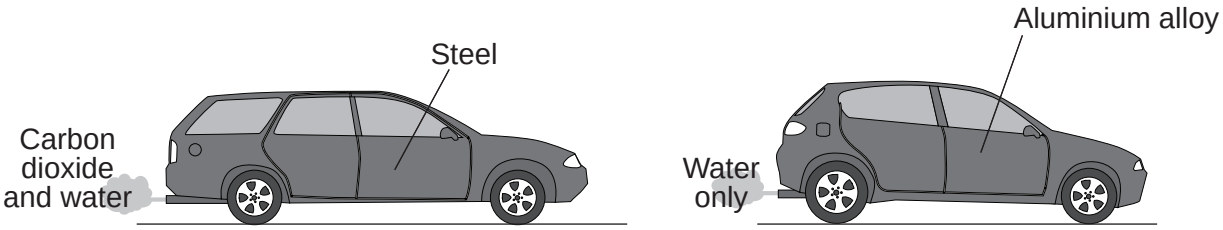
Turn over for the next question

4.7.1.3 Properties of hydrocarbons

Question 39

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)

4.7.1.3 Properties of hydrocarbons

Question 39 · continued June 2012 | CH1FP | Original Q3 | Legacy

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

4.7.1.3 Properties of hydrocarbons

Question 40

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).

.....

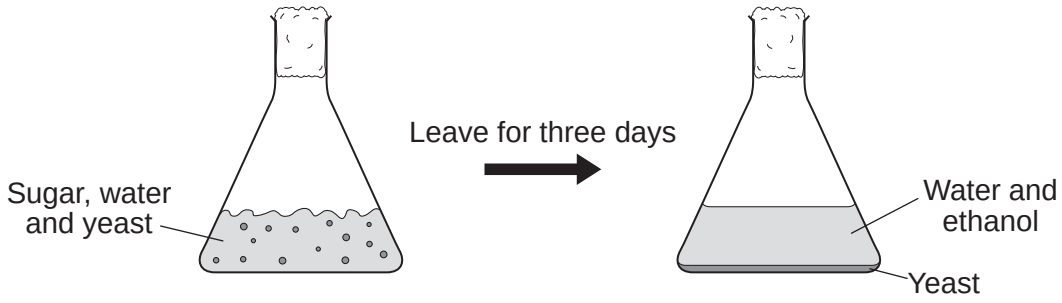
(1 mark)

4.7.1.3 Properties of hydrocarbons

Question 40 · 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

4.7.1.3 Properties of hydrocarbons

Question 41

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 → ..... + ...

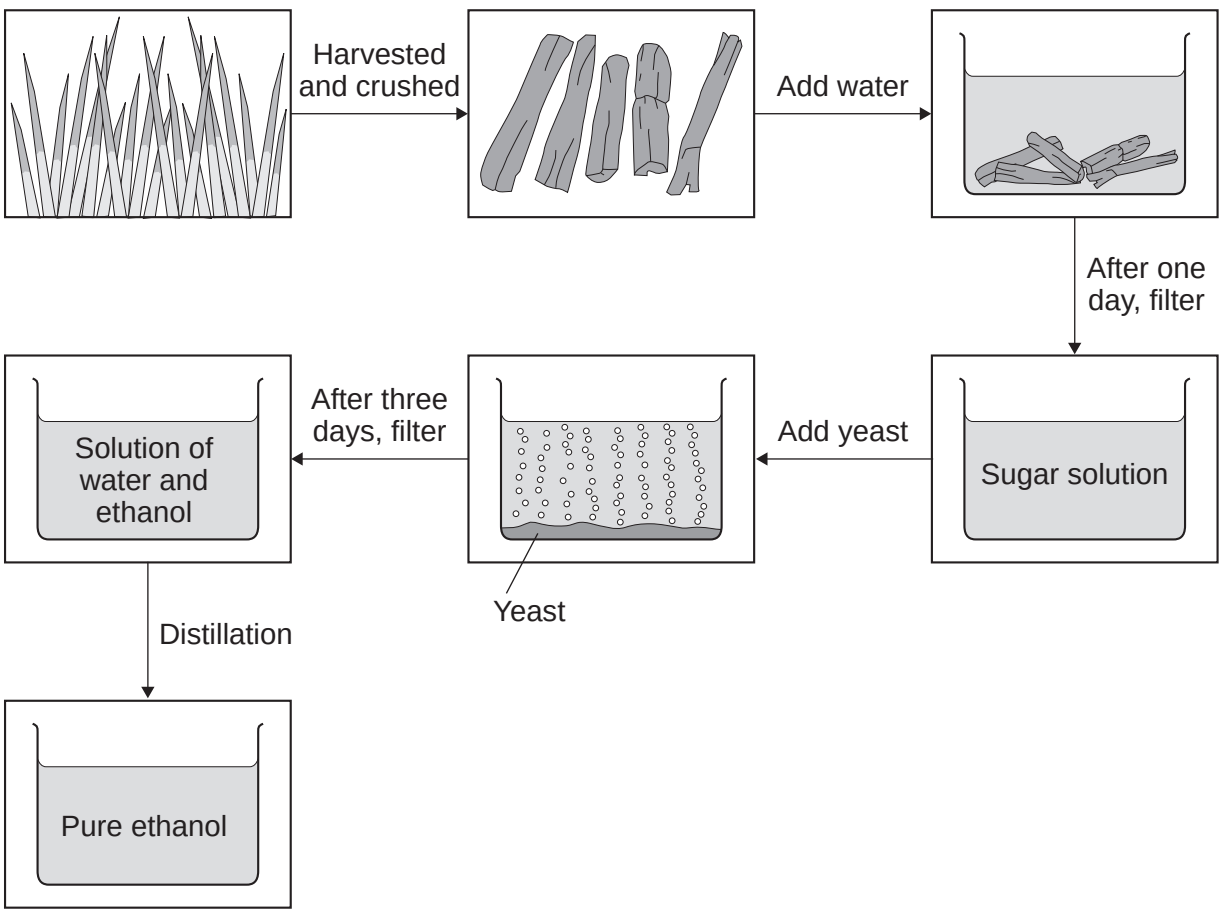
(2 marks)

Question 5 continues on the next page

4.7.1.3 Properties of hydrocarbons

Question 41 · 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)

4.7.1.3 Properties of hydrocarbons

Question 41 · continued

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

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

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

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

9

4.7.1.3 Properties of hydrocarbons

Question 42

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*?

.....

.....

.....

.....

.....

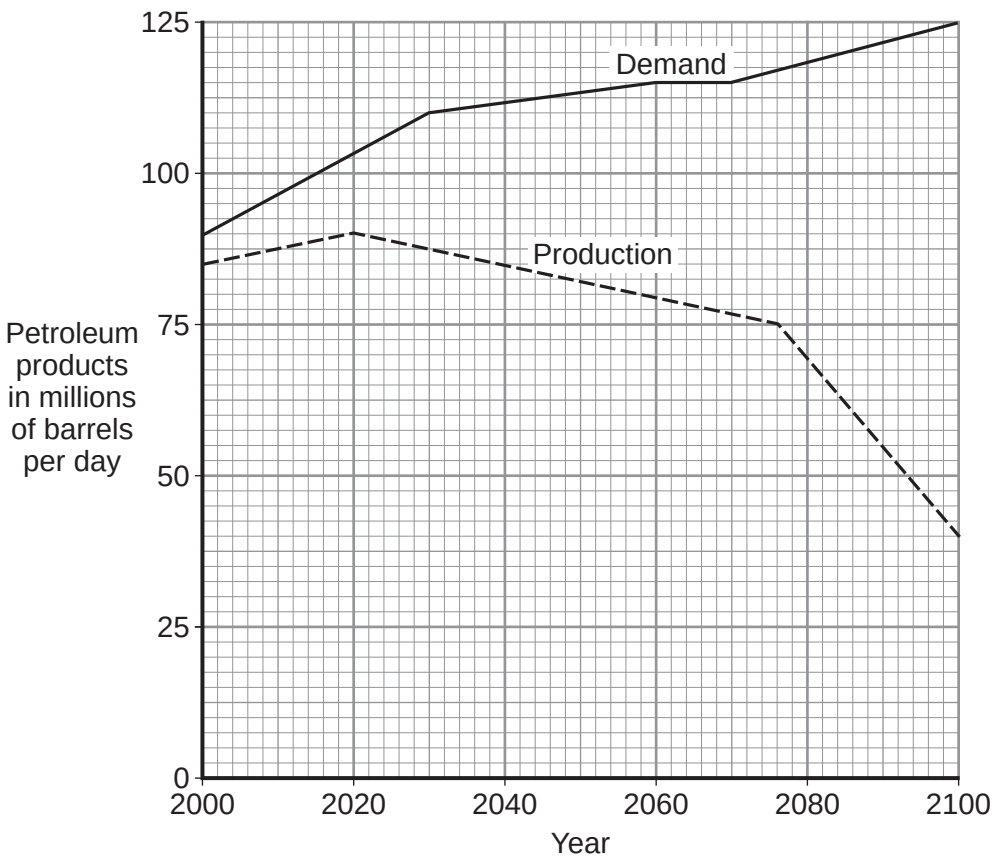
(2 marks)

Question 7 continues on the next page

Question 42 · 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.

4.7.1.3 Properties of hydrocarbons

Question 42 · 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

4.7.1.3 Properties of hydrocarbons

Question 43

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:

$$C + O_2 \longrightarrow CO_2$$

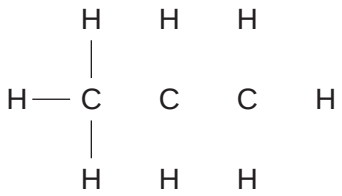
Complete the word equation for this reaction.

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)

4.7.1.3 Properties of hydrocarbons

Question 43 · 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)

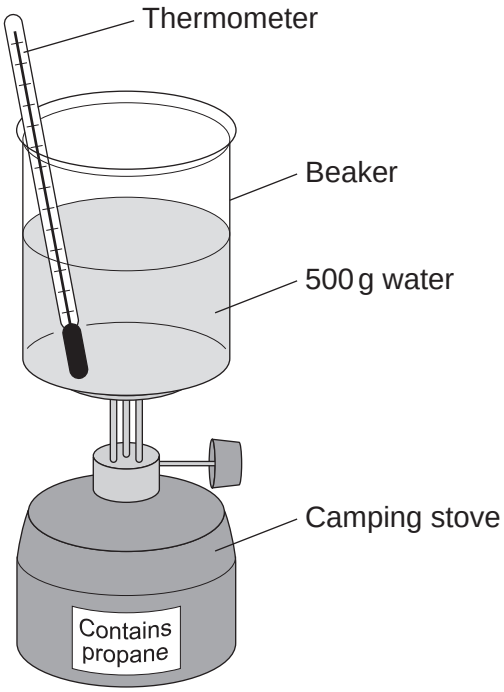
6

4.7.1.3 Properties of hydrocarbons

Question 44

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).

.....

.....

Energy released = ... J

(2 marks)

4.7.1.3 Properties of hydrocarbons

Question 44 · continued

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

1 .....

.....

2 .....

.....

(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.	

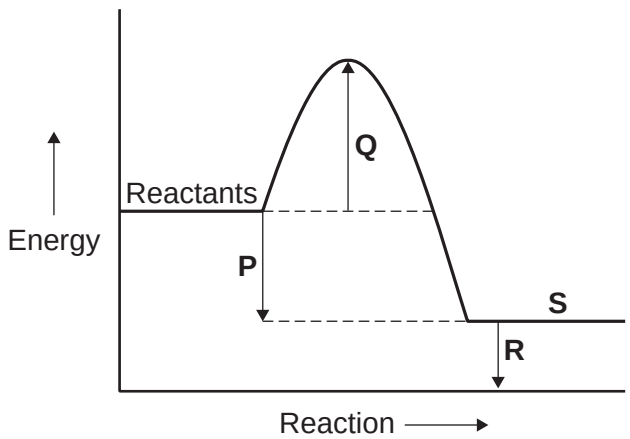
(2 marks)

Question 4 continues on the next page

4.7.1.3 Properties of hydrocarbons

Question 44 · 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)

4.7.1.3 Properties of hydrocarbons

Question 44 · 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 .....

.....

2 .....

.....

(2 marks)

11

4.7.1.3 Properties of hydrocarbons

Question 45

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 ..... .

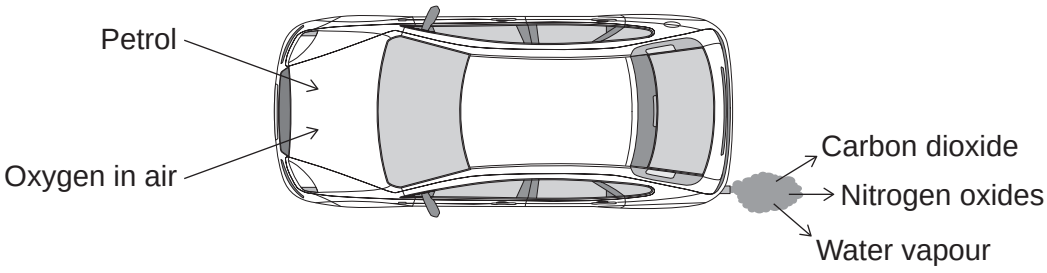
[1 mark]

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



4.7.1.3 Properties of hydrocarbons

Question 45 · 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]

.....

.....

.....

.....

Question 3 continues on the next page

4.7.1.3 Properties of hydrocarbons

Question 45 · 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]



4.7.1.3 Properties of hydrocarbons

Question 45 · 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

4.7.1.3 Properties of hydrocarbons

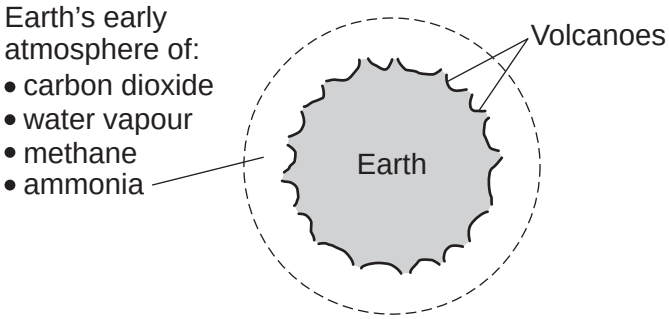
Question 46

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

4.7.1.3 Properties of hydrocarbons

Question 46 · 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.

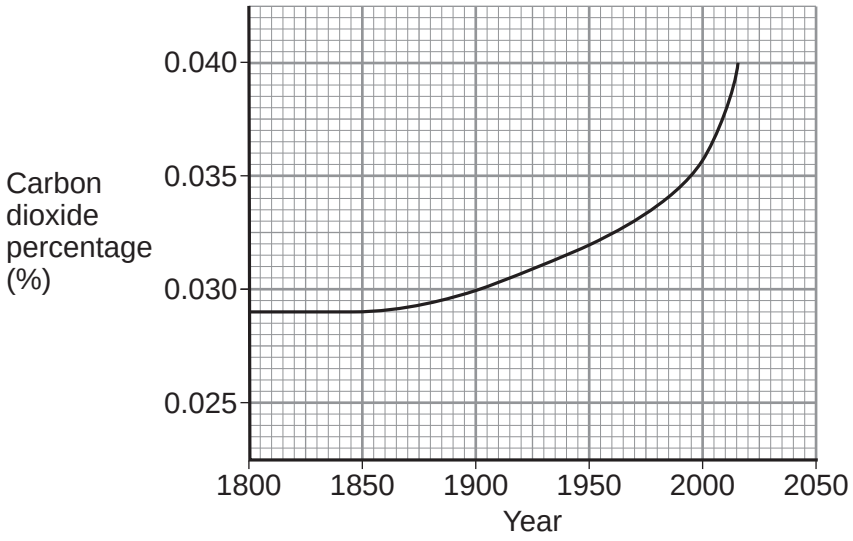
- about 40% ☐
- about 60% ☐
- about 80% ☐

4.7.1.3 Properties of hydrocarbons

Question 46 · 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

4.7.1.3 Properties of hydrocarbons

Question 47

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]

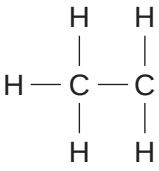
When alkenes react with bromine water the colour changes

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

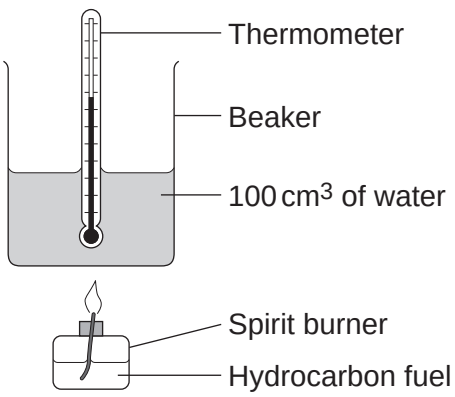
4.7.1.3 Properties of hydrocarbons

Question 47 · 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

4.7.1.3 Properties of hydrocarbons

Question 47 · 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

4.7.1.3 Properties of hydrocarbons

Question 47 · 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]

4.7.1.3 Properties of hydrocarbons

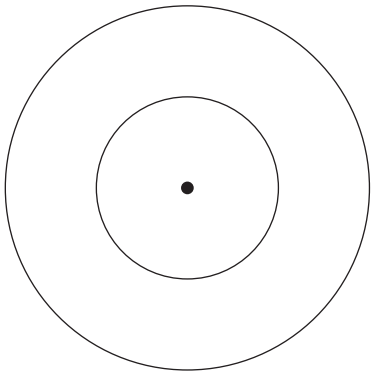
Question 48

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]

_____

_____

4.7.1.3 Properties of hydrocarbons

Question 48 · 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

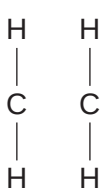
Alkenes

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]

4.7.1.3 Properties of hydrocarbons

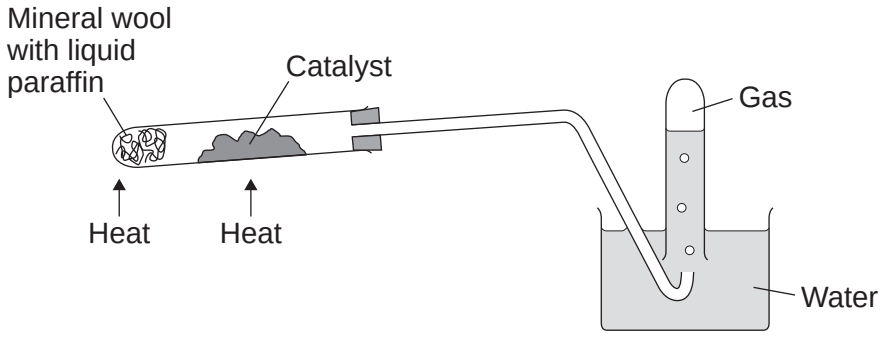
Question 48 · continued

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

4.7.1.3 Properties of hydrocarbons

Question 49

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

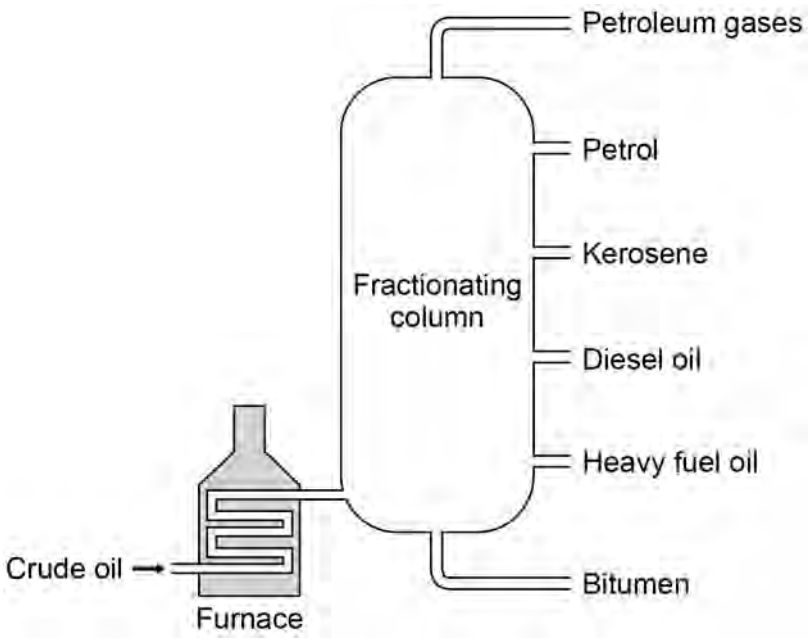


Table 5 gives information about some of the fractions.

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

4.7.1.3 Properties of hydrocarbons

Question 49 · continued

June 2019 | 8462/2F | Original Q8

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

4.7.1.3 Properties of hydrocarbons

Question 49 · 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]

4.7.1.3 Properties of hydrocarbons

Question 49 · 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

4.7.1.3 Properties of hydrocarbons

Question 50

November 2021 | 8462/2F | Original Q7

0 7 This question is about organic compounds.

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

Complete the sentence.

Choose the answer from the box.

[1 mark]

fertiliser	**formulation**	**fuel**

Butane can be used as a _____.

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

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

[1 mark]

Tick (✓) **one** box.

Propane ☐

Propanoic acid ☐

Propanol ☐

Propene ☐

4.7.1.3 Properties of hydrocarbons

Question 50 · continued

Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:

ethene + steam ⇌ ethanol

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

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

The percentage yield of ethanol is less than 100%

Calculate the percentage yield of ethanol.

Use the equation:

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

[2 marks]

Percentage yield = _____ %

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

[2 marks]

Tick (✓) **two** boxes.

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

4.7.1.3 Properties of hydrocarbons

Question 50 · 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

4.7.1.3 Properties of hydrocarbons

Question 51

0 9 This question is about alkanes.

Table 6 shows information about some alkanes.

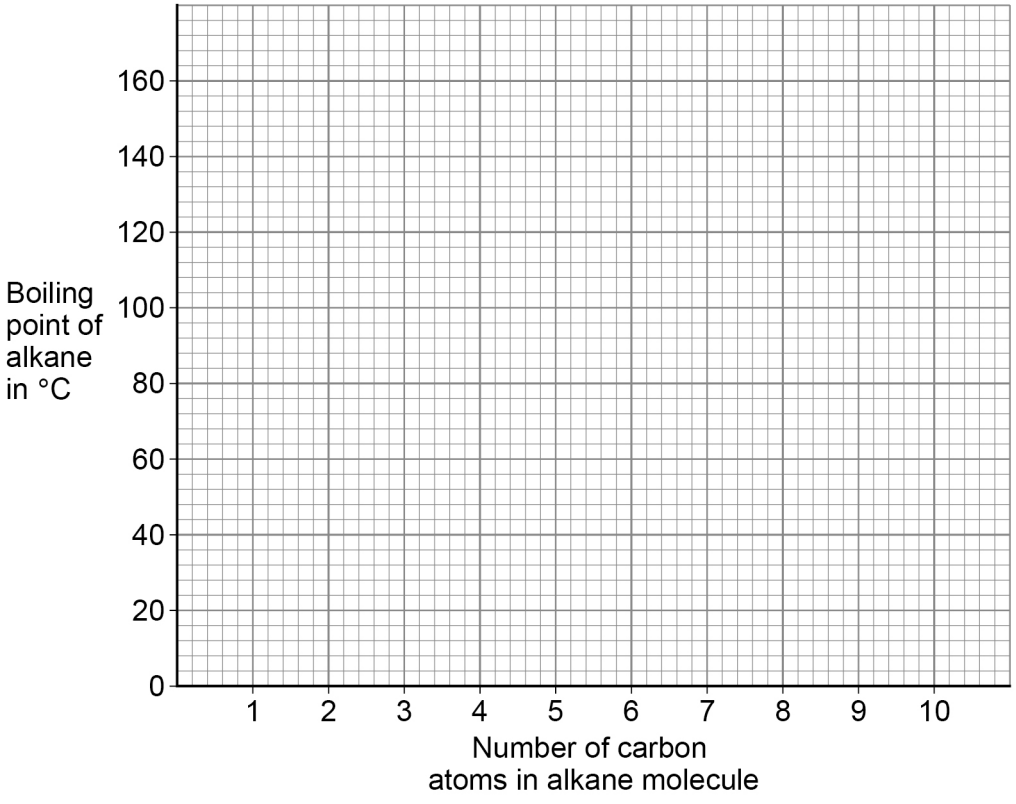
Table 6

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



4.7.1.3 Properties of hydrocarbons

Question 51 · 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

4.7.1.3 Properties of hydrocarbons

Question 51 · 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

4.7.1.3 Properties of hydrocarbons

Question 52

0 2 This question is about hydrocarbons in crude oil.

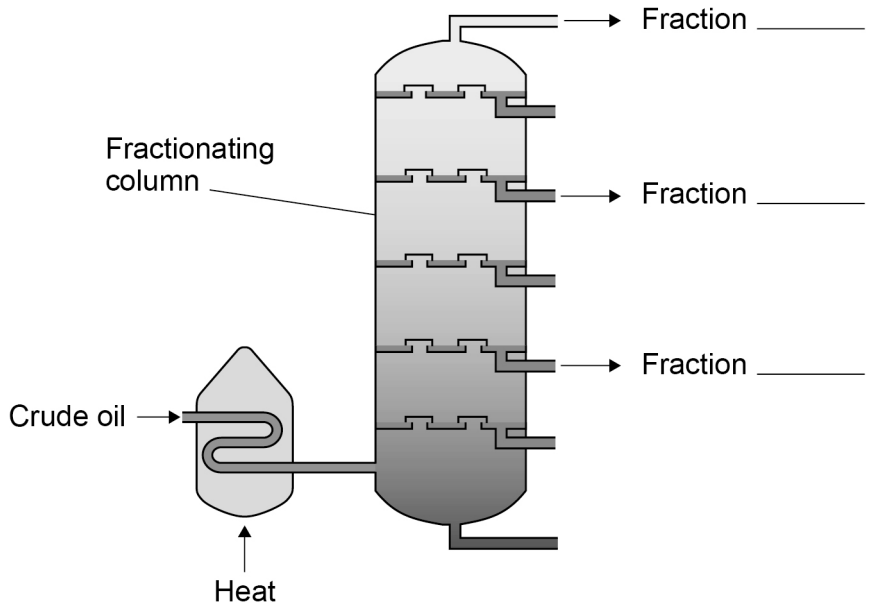
0 2 . 1 **Table 2** shows information about three fractions obtained from crude oil.

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]

4.7.1.3 Properties of hydrocarbons

Question 52 · 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 52 · 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**.

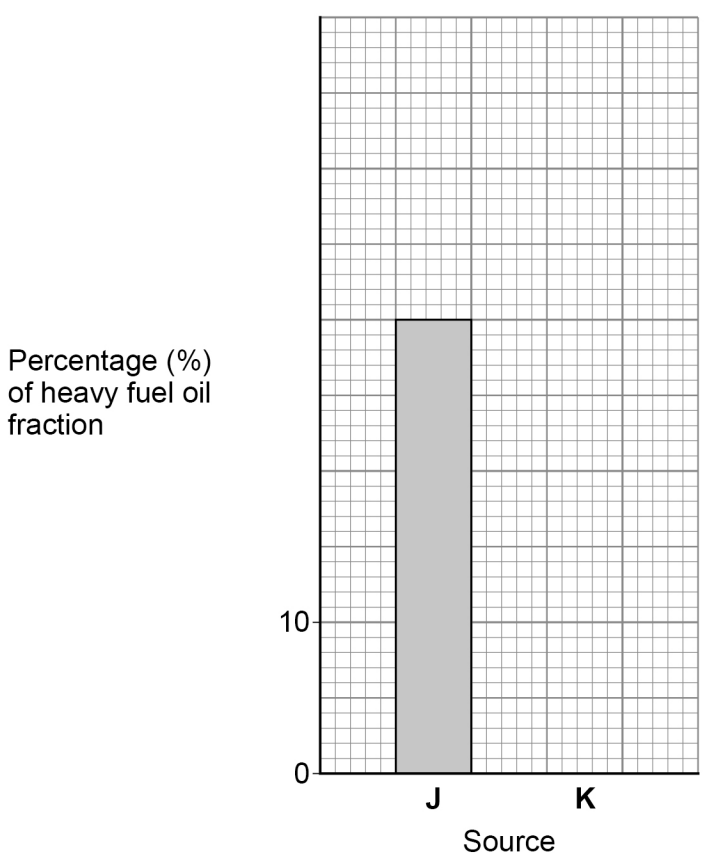
You should:

- 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



4.7.1.3 Properties of hydrocarbons

Question 52 · 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]

$C_{11}H$___

4.7.1.3 Properties of hydrocarbons

Question 52 · 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

4.7.1.3 Properties of hydrocarbons

Question 53

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]

_____

_____

4.7.1.3 Properties of hydrocarbons

Question 53 · continued

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

[1 mark]

Tick (✓) **one** box.

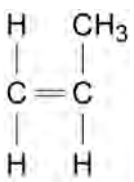
Boron trioxide ☐

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]

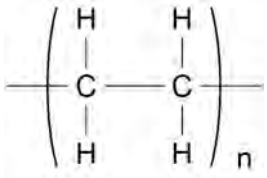
4.7.1.3 Properties of hydrocarbons

Question 53 · continued

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

[1 mark]

Tick (✓) **one** box.



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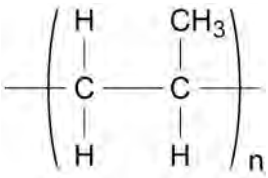

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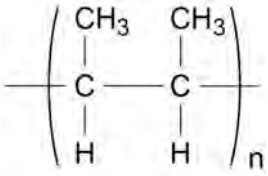


☐

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 _____.

4.7.1.3 Properties of hydrocarbons

Question 53 · 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 ☐

12

4.7.1.3 Properties of hydrocarbons

Question 54

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} ☐

4.7.1.3 Properties of hydrocarbons

Question 54 · continued

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

[1 mark]

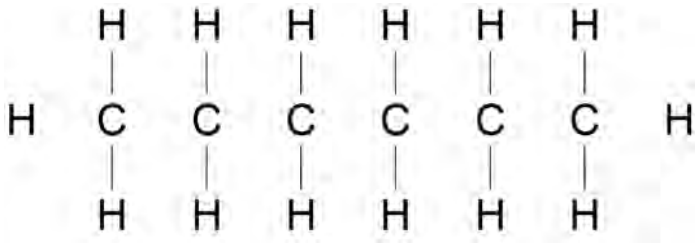
Tick (✓) **one** box.

- 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

4.7.1.3 Properties of hydrocarbons

Question 54 · 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]

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

4.7.1.3 Properties of hydrocarbons

Question 54 · continued

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

- 84% C
- 16% H

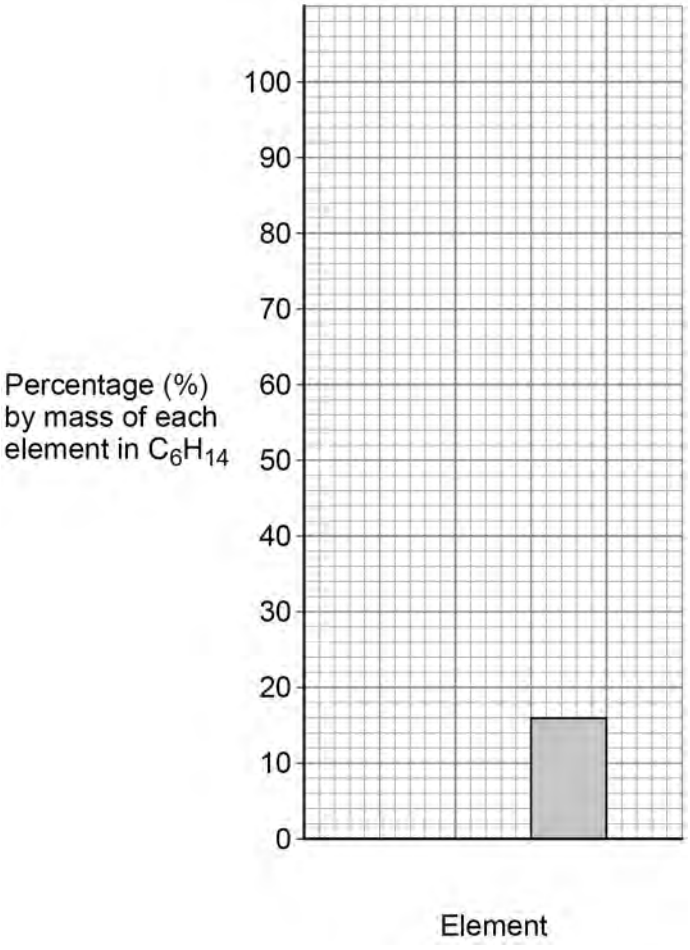
Complete **Figure 2**.

You should:

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

[2 marks]

Figure 2



12

4.7.1.3 Properties of hydrocarbons

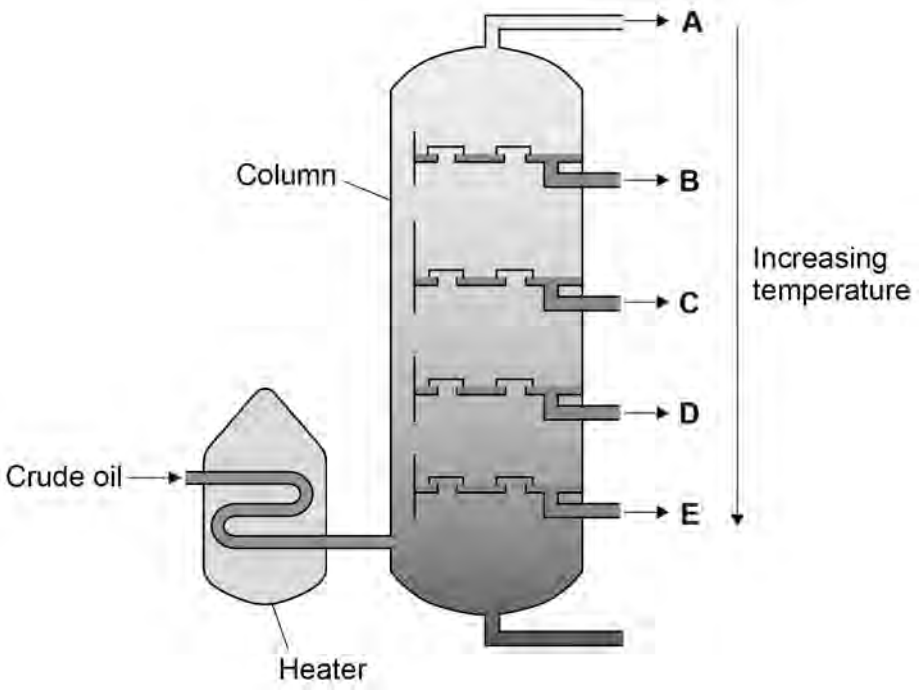
Question 55

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 55 · continued

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 ☐

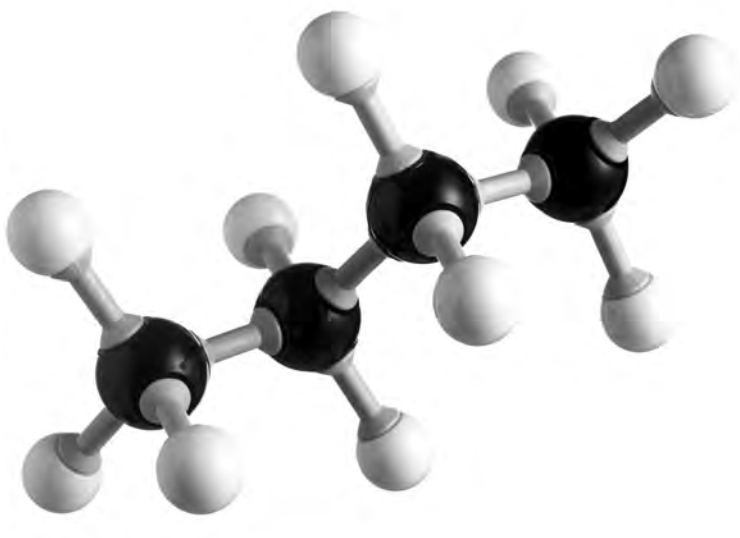
4.7.1.3 Properties of hydrocarbons

Question 55 · 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