



Chemistry C1 Revision Questions



Mar 2015



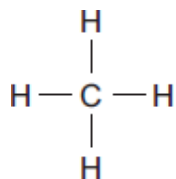
99 minutes



99 marks

Q1. Saturated hydrocarbons, for example methane and octane, are often used as fuels.

(a) Methane can be represented as:



(i) The formula of methane is (1)

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

In a saturated hydrocarbon molecule all of the bonds are

- | |
|------------------------------|
| double.
ionic.
single. |
|------------------------------|

(1)

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

The homologous series that contains methane and octane is called the

- | |
|-----------------------------------|
| alcohols.
alkanes.
alkenes. |
|-----------------------------------|

(1)

(b) (i) The complete combustion of petrol produces carbon dioxide, water vapour and sulfur dioxide.

Name **three** elements petrol must contain.

- 1
- 2
- 3

(3)

(ii) The exhaust gases from cars can contain oxides of nitrogen.

Complete the sentence.

Nitrogen in the oxides of nitrogen comes from

(1)

(iii) The sulfur dioxide and oxides of nitrogen from cars cause an environmental problem.

Name the problem and describe **one** effect of the problem.

Name of problem

Effect of problem

.....

(2)

(c) When a fuel burns without enough oxygen, there is incomplete combustion.

One gaseous product of incomplete combustion is carbon monoxide.

Name **one** solid product of incomplete combustion.

.....

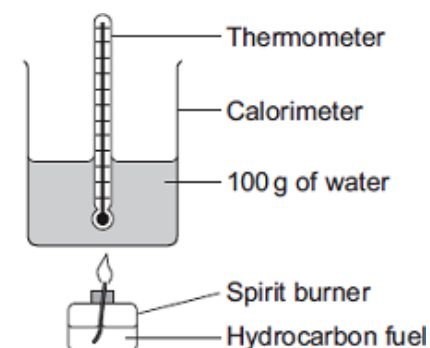
(1)

(d) A student investigated how well different hydrocarbon fuels would heat up 100 g of water.

Her hypothesis was:

The more carbon atoms there are in a molecule of any fuel, the better the fuel is.

The apparatus the student used is shown in the diagram.



She burned each hydrocarbon fuel for 2 minutes.

Her results are shown in the table.

Name of hydrocarbon fuel	Number of carbon atoms in a molecule of hydrocarbon fuel	Temperature change of water in °C after 2 minutes	Temperature change per g of fuel burned	Observations
Pentane	5	30	60	no smoke
Hexane	6	40	57	very small amount of smoke
Octane	8	55	55	small amount of smoke
Decane	10	57	52	large amount of smoke
Dodecane	12	60	43	very large amount of smoke

The student investigated only hydrocarbons.

Look carefully at her results.

How well do the student's results support her hypothesis?

The more carbon atoms there are in a molecule of any fuel, the better the fuel is.

Give reasons for your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(e) A 0.050 mol sample of a hydrocarbon was burned in excess oxygen.
The products were 3.60 g of water and 6.60 g of carbon dioxide.

(i) Calculate the number of moles of carbon dioxide produced.
Relative atomic masses: C = 12; O = 16.

.....

.....

Moles of carbon dioxide =

(2)

(ii) When the hydrocarbon was burned 0.20 mol of water were produced.
How many moles of hydrogen atoms are there in 0.20 mol of water?

.....

Moles of hydrogen atoms =

(1)

(iii) The amount of hydrocarbon burned was 0.050 mol.

Use this information and your answers to parts (e) (i) and (e) (ii) to calculate the molecular formula of the hydrocarbon.

If you could not answer parts (e) (i) or (e) (ii) use the values of 0.20 moles carbon dioxide and 0.50 moles hydrogen. These are **not** the answers to parts (e) (i) and (e) (ii).

.....

Formula =

(2)
 (Total 19 marks)

Q2. 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 ₂ H ₄)	-169	-104
decane (C ₁₀ H ₂₂)	-30	+174
icosane (C ₂₀ H ₄₂)	+37	+343

(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)

(b) Petrol contains a mixture of compounds, including octane (C₈H₁₈).

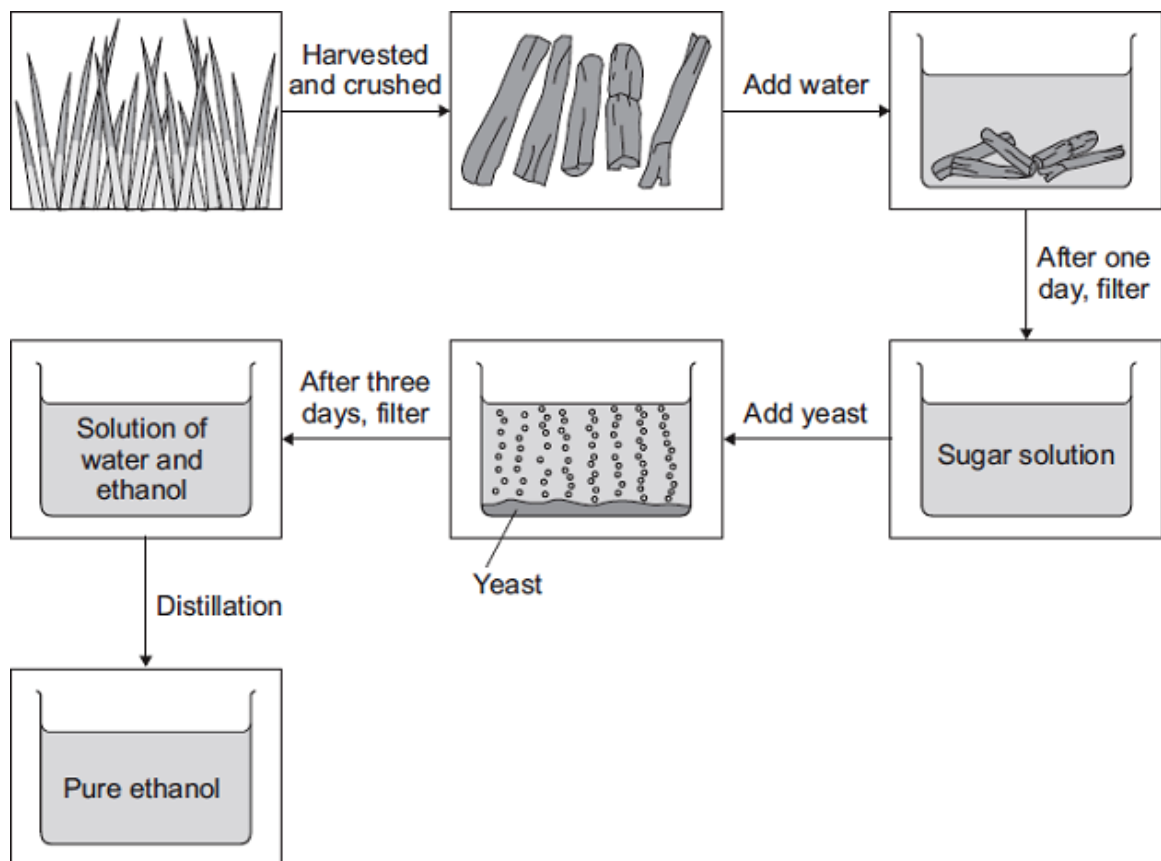
Complete the word equation for the complete combustion of octane.

octane + oxygen → +

(2)

(c) Most petrol used in cars contains about 5% ethanol (C_2H_5OH).

Ethanol can be produced from sugar cane.



(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)

(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)

- (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

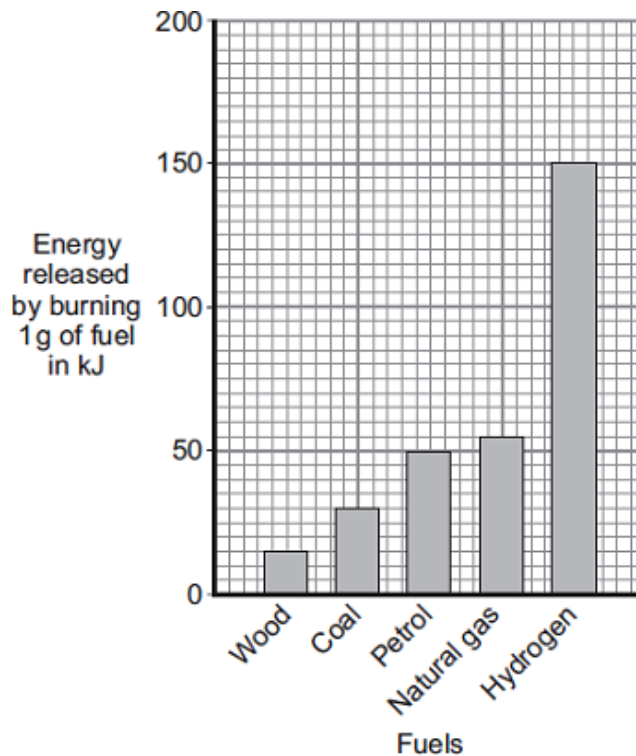
.....

.....

(2)
(Total 9 marks)

Q3. Energy is released by burning fuels.

- (a) The bar chart shows the energy in kilojoules, kJ, released by burning 1 g of five different fuels.



- (i) Which fuel releases least energy by burning 1 g?

.....

(1)

- (ii) How much energy is released by burning 1 g of coal?

Energy =kJ

(1)

- (iii) Calculate the mass of petrol that will release the same amount of energy as 1 g of hydrogen.

Use information from the bar chart to help you.

.....

.....

Mass = g

(1)

- (b) Coal burns in oxygen and produces the gases shown in the table.

Name	Formula
Carbon dioxide	CO ₂
Water vapour	H ₂ O
Sulfur dioxide	SO ₂

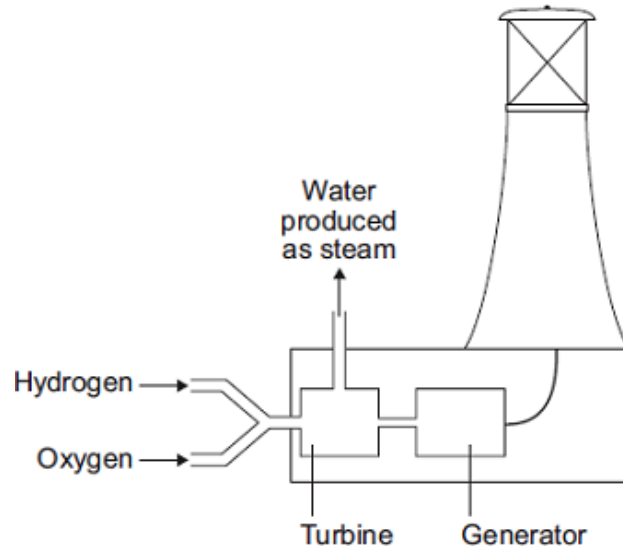
Use information from the table to name **one** element that is in coal.

.....

(1)

- (c) Hydrogen can be made from fossil fuels.
Hydrogen burns rapidly in oxygen to produce water only.

A lighthouse uses electricity generated by burning hydrogen.



Suggest **two** advantages of using hydrogen as a fuel.

Use information from the bar chart and the diagram above to help you.

- 1
-
- 2
-

(2)
(Total 6 marks)

Q4. Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth's atmosphere has changed.

(a) Millions of years ago the Earth's atmosphere was probably just like that of Mars today.

The table shows data about the atmosphere of Mars and Earth today.

Mars today		Earth today	
nitrogen	3%	nitrogen	78%
oxygen	trace	oxygen	21%
water	trace	water	trace
Carbon dioxide	95%	Carbon dioxide	trace
Average surface temperature -23°C		Average surface temperature 15°C	

The percentages of some gases in the Earth's atmosphere of millions of years ago have changed to the percentages in the Earth's atmosphere today.

For **two** of these gases describe how the percentages have changed **and** suggest what caused this change.

.....

.....

.....

.....

(2)

- (b) Titan is the largest moon of the planet Saturn.
Titan has an atmosphere that contains mainly nitrogen.
Methane is the other main gas.

Main gases in Titan's atmosphere	Percentage (%)	Boiling point in °C
Nitrogen	95	-196
Methane	5	-164
Average surface temperature -178°C		

When it rains on Titan, it rains methane!

Use the information above and your knowledge and understanding to explain why.

.....
.....
.....
.....
.....
.....

(2)

- (c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene (C_2H_4) and propene (C_3H_6) from methane in Titan's atmosphere.

State the general formula for alkenes.

.....

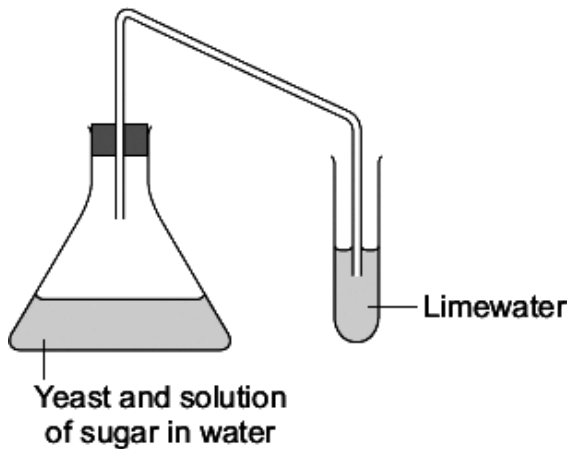
(1)

(Total 5 marks)

Q5. Two fuels that can be used for cars are:

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

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



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

This reaction to make ethanol from sugar is

- | |
|----------------|
| combustion. |
| decomposition. |
| fermentation. |

(1)

(ii) Complete the sentences.

The limewater turns

This happens because

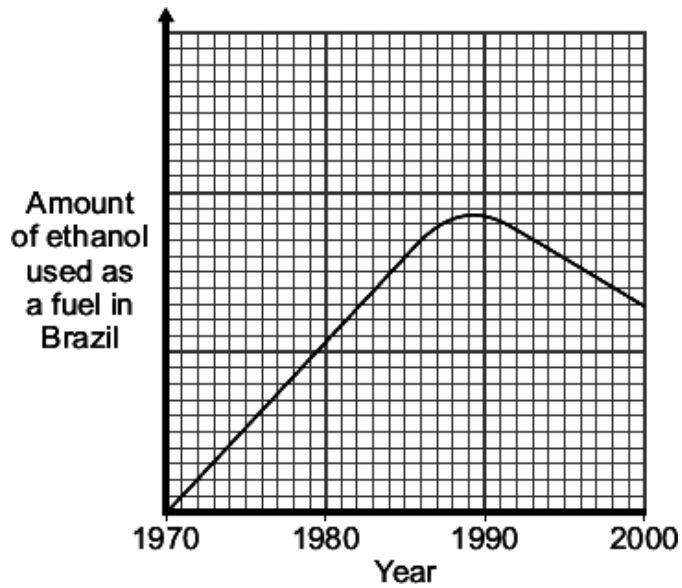
(2)

(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.



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

.....

.....

.....

.....

(2)

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

Suggest **one** reason for their decision.

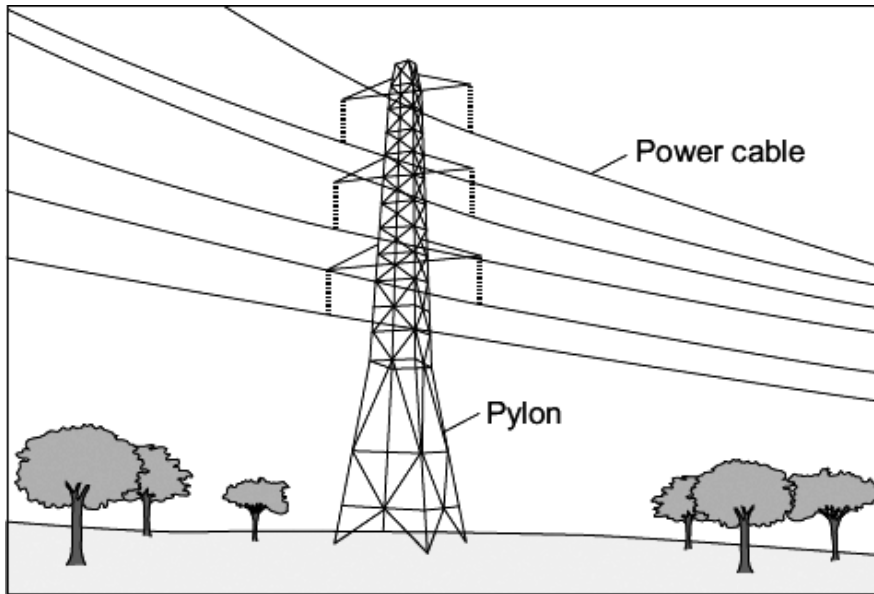
.....

.....

(1)

(Total 6 marks)

Q6. Metals are used in the manufacture of pylons and overhead power cables.



(a) Suggest **one** reason why iron (steel) is used to make pylons.

.....

(1)

(b) The table shows some of the properties of two metals.

Metal	Density in g per cm ³	Melting point in °C	Percentage(%) relative electrical conductivity	Percentage(%) abundance in Earth's crust
copper	8.92	1083	100	0.007
aluminium	2.70	660	60	8.1

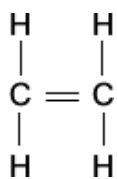
Use the information in the table to suggest why aluminium and **not** copper is used to conduct electricity in overhead power cables.

.....

(2)

(c) A polymer can be used to cover and insulate power cables.

The polymer is made from the alkene:



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

(i) The chemical formula of this alkene is

CH

CH₄

C₂H₄

(1)

(ii) The two lines between the carbon atoms are called a

double bond.

nucleus.

single bond.

(1)

(iii) The name of the polymer formed when many of these alkene molecules join together

poly(ethene).

is

poly(ethanol).

poly(propene).

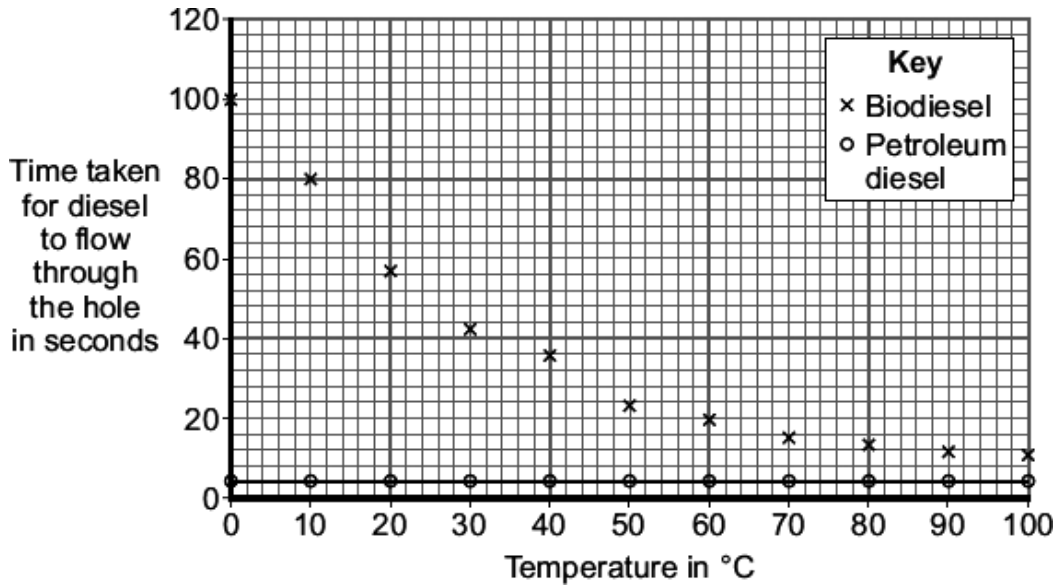
(1)

(Total 6 marks)

Q7. There are two main types of diesel fuel used for cars:

- biodiesel, made from vegetable oils
- petroleum diesel, made from crude oil.

(a) A scientist compared the viscosity of biodiesel with petroleum diesel at different temperatures.
 The scientist measured the time for the same volume of diesel to flow through a small hole in a cup.
 The scientist's results are plotted on the grid.



(i) Draw a line of best fit for the biodiesel results.

(1)

(ii) What conclusions can the scientist make about the viscosity of biodiesel compared with the viscosity of petroleum diesel at different temperatures?

.....

.....

.....

.....

(2)

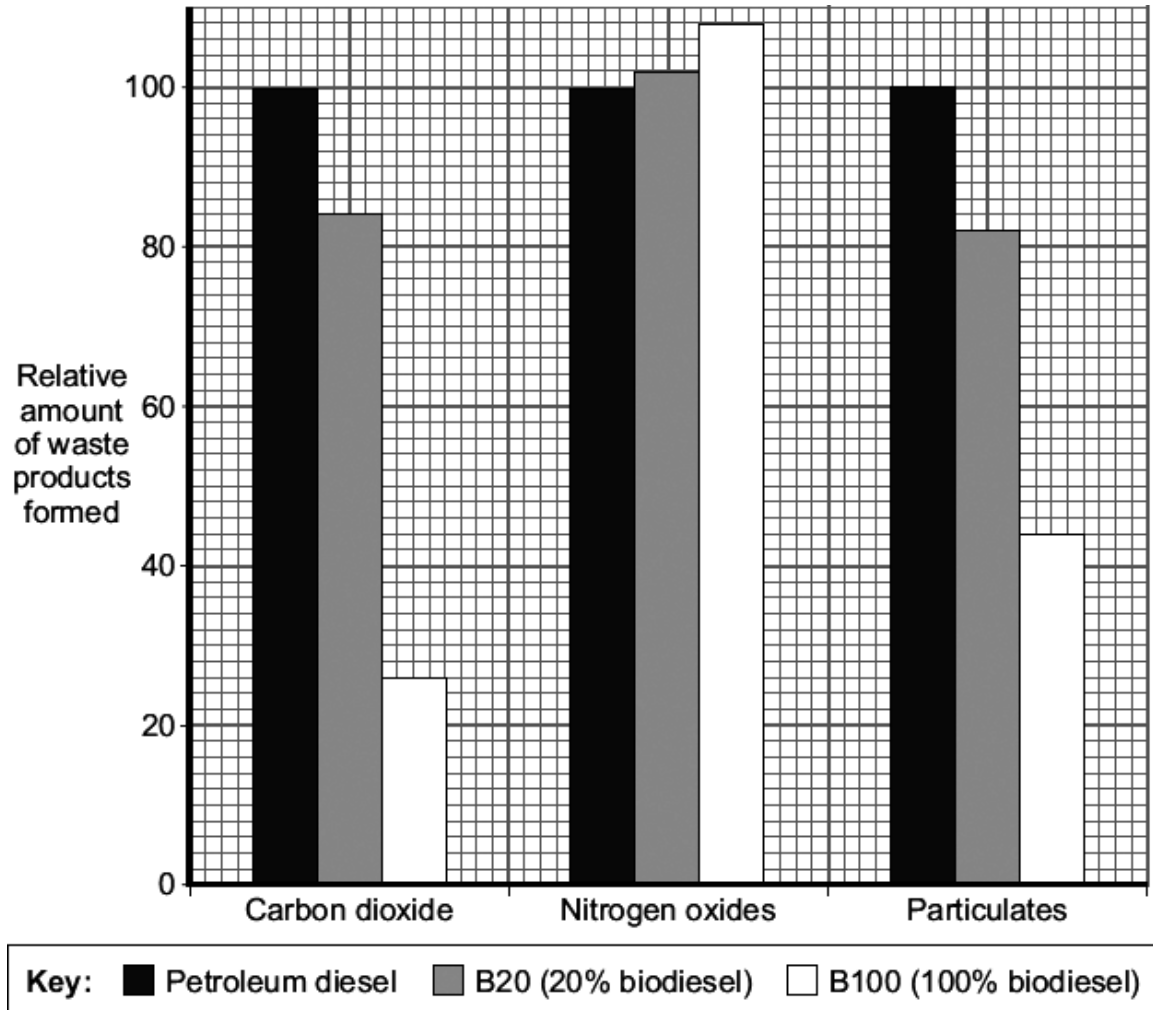
(iii) Biodiesel may be less suitable than petroleum diesel as a fuel for cars. Use these results to suggest **one** reason why.

.....

.....

(1)

- (b) Biodiesel can be mixed with petroleum diesel to make a fuel for cars. In a car engine, the diesel fuel burns in air. The waste products leave the car engine through the car exhaust system. The bar chart compares the relative amounts of waste products made when three different types of diesel fuel burn in a car engine.



Nitrogen oxides and sulfur dioxide cause a similar environmental impact.

- (i) What environmental impact do particulates from car exhaust systems cause?

.....

(1)

- (ii) What is the percentage reduction in particulates when using B100 instead of petroleum diesel?

..... %

(1)

- (iii) Replacing petroleum diesel with biodiesel increases one type of environmental pollution.

Use the bar chart and the information given to explain why.

.....
.....
.....
.....

(2)

- (iv) A carbon neutral fuel does **not** add extra carbon dioxide to the atmosphere.

Is biodiesel a carbon neutral fuel?

Use the bar chart and your knowledge to explain your answer.

.....
.....
.....
.....

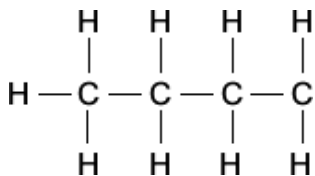
(2)

(Total 10 marks)

Q8. Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

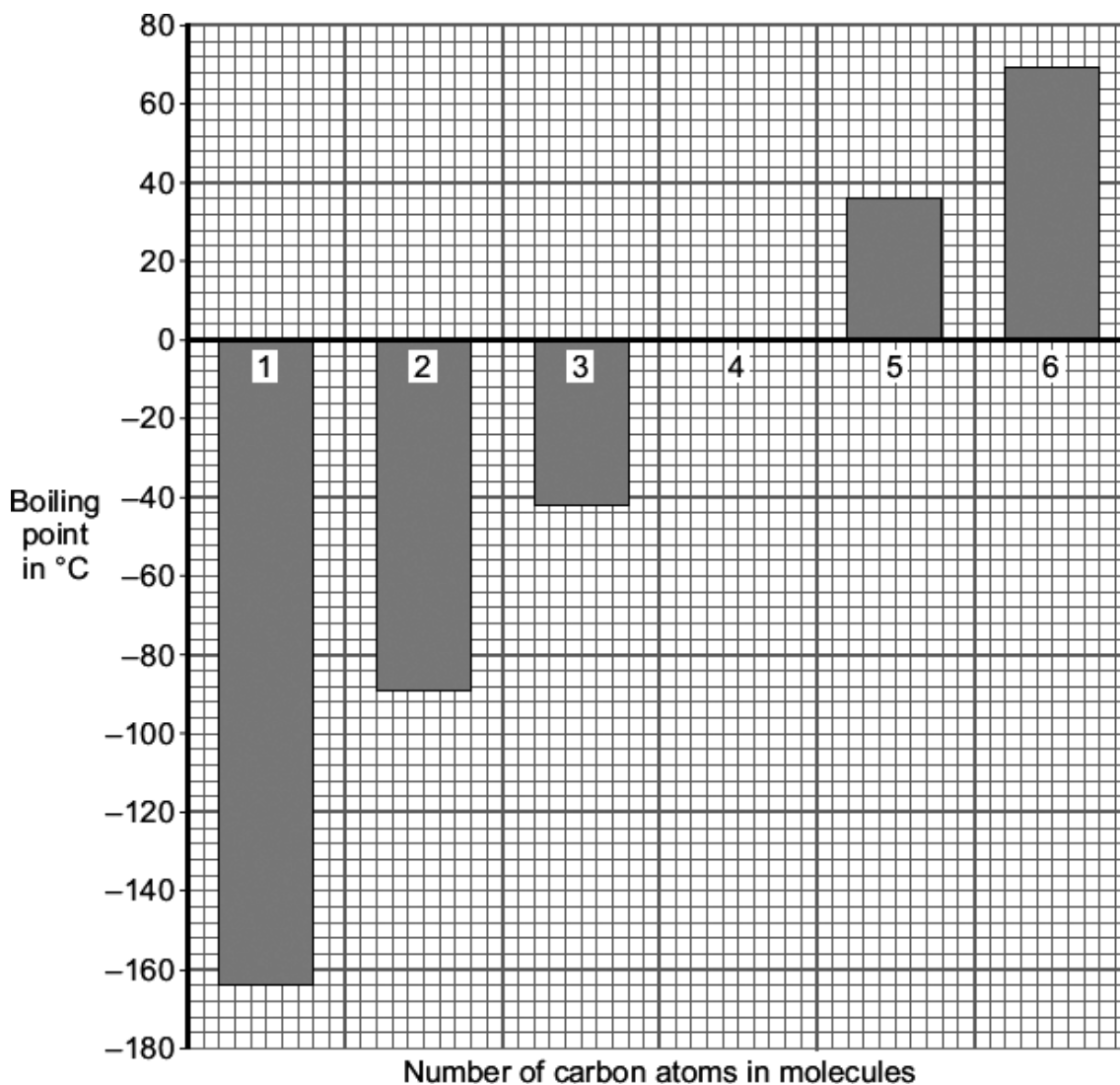
- (a) The general formula of an alkane is C_nH_{2n+2}

Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1)

(b) The boiling points of alkanes are linked to the number of carbon atoms in their molecules.



(i) Describe the link between the number of carbon atoms in an alkane molecule and its boiling point.

.....
.....

(1)

(ii) Suggest **two** reasons why all of the alkanes in the bar chart are better fuels than the alkane with the formula $C_{30}H_{62}$

1

.....

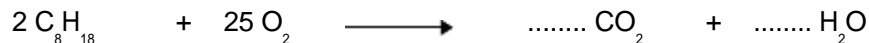
2

.....

(2)

(c) During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %.
 Over the last 100 years the percentage of carbon dioxide in the atmosphere has increased to about 0.04 %.
 Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport.
 Fossil fuels contain carbon that has been locked up for millions of years.

(i) Burning fossil fuels, such as petrol, releases this locked up carbon. Balance the chemical equation for the combustion of one of the alkanes in petrol.



(1)

(ii) Where did the carbon that is locked up in fossil fuels come from?

.....

(1)

(iii) The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %.
 Explain why.

.....

(2)

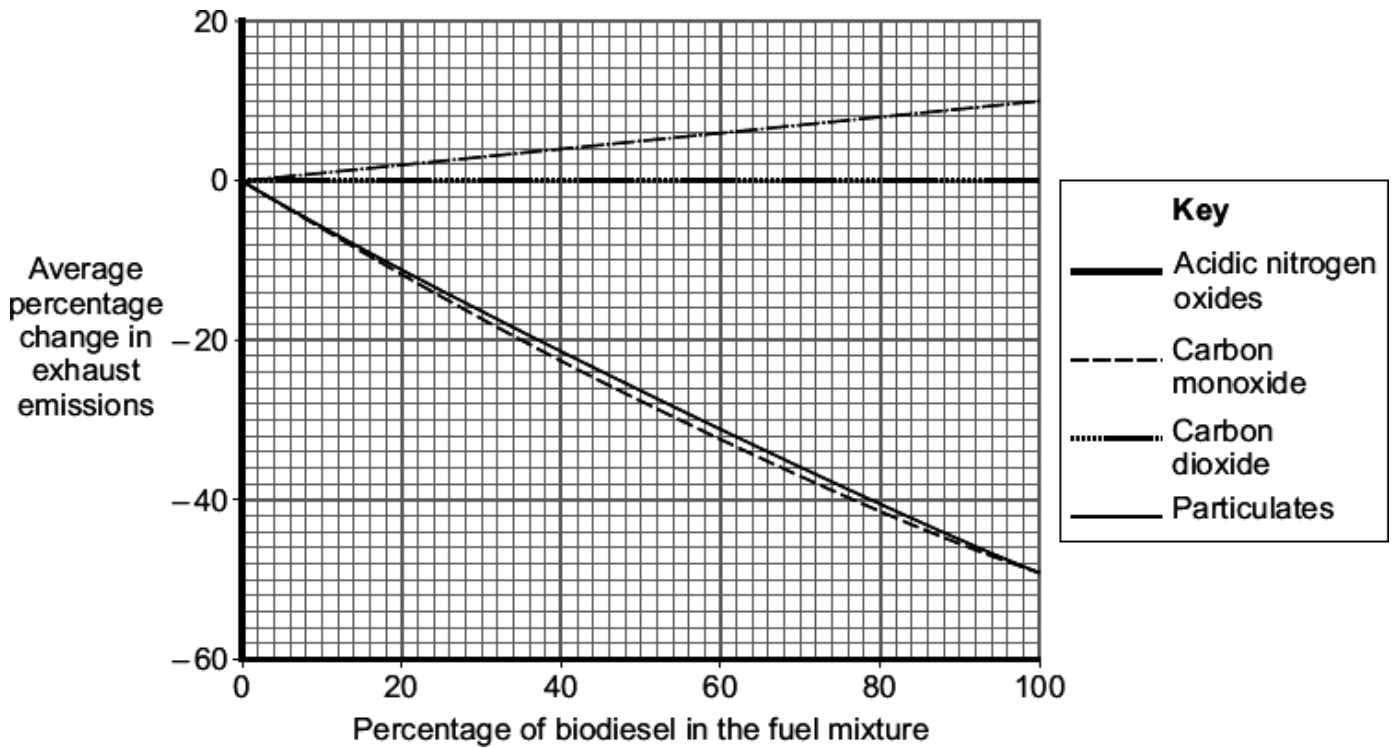
(Total 8 marks)

Q9. Petroleum diesel is produced from crude oil.

Most vehicles that use petroleum diesel as fuel can also use biodiesel or a mixture of these two fuels. In the UK (in 2010) there must be 5 % biodiesel in all petroleum diesel fuel.

Biodiesel is produced from plant oils such as soya. The crops used to produce biodiesel can also be used to feed humans. The benefit that biodiesel is 'carbon neutral' is outweighed by the increasing demand for crops. This increasing demand is causing forests to be burnt to provide land for crops to produce biodiesel. Only a huge fall in the price of petroleum diesel would halt the increasing use of biodiesel.

The graph shows the average percentage change in exhaust emissions from vehicles using different mixtures of petroleum diesel and biodiesel.



There is no difference in carbon dioxide emissions for all mixtures of petroleum diesel and biodiesel.

Use the information and your knowledge and understanding to evaluate the use of plant oils to produce biodiesel.

Remember to give a conclusion to your evaluation.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

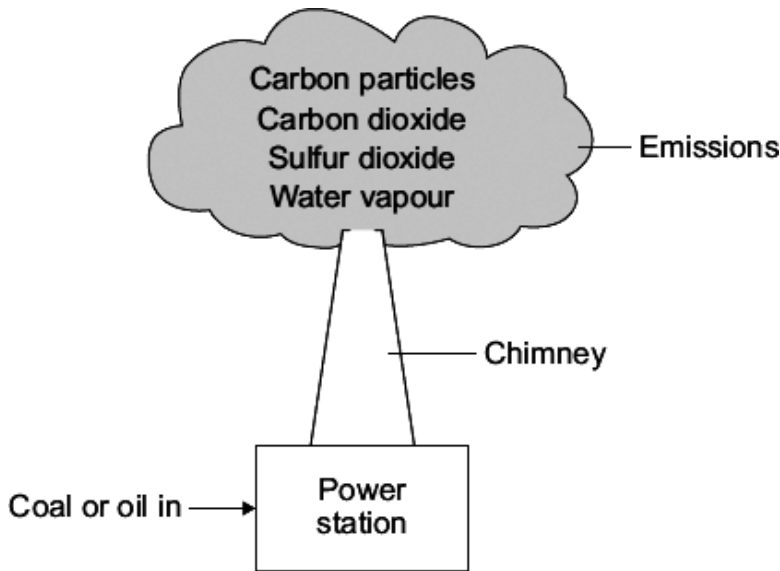
.....

.....

.....

(5)
(Total 5 marks)

Q10. In the future more coal-fired and fewer oil-fired power stations will be used to generate electricity.
When coal and oil are burned they produce the same types of emissions which can cause environmental problems.



(a) Emissions from the chimney can cause acid rain, global dimming and global warming. Draw **one** straight line from each possible environmental problem to the emission that causes it.

Possible environmental problem	Emission that causes it
acid rain	carbon particles
global warming	carbon dioxide
global dimming	sulfur dioxide
	water vapour

.....

(3)

(b) Draw a ring around the correct word in the box to complete each sentence.

(i) Incomplete combustion of coal or oil is caused by too little

- carbon dioxide.
 - nitrogen.
 - oxygen.

(1)

carbon monoxide.
hydrogen.
oxygen.

(ii) A gas formed by the incomplete combustion of coal or oil is

(1)

(c) The table shows the world production for both coal and oil in 2000.

The world production figures after 2000 are predicted.

Year	World production of coal (billions of tonnes per year)	World production of oil (billions of barrels per year)
2000	3.5	12.5
2050	4.5	5.6
2100	5.0	1.7
2150	5.5	0.5
2200	6.0	0.0

(i) How is the world production of oil predicted to change from 2000 to 2200?

.....
.....

(1)

(ii) Suggest **two** reasons why the world production of coal is predicted to increase.

1

.....

2

.....

(2)

(Total 8 marks)

Q11. Medical evidence suggests that eating saturated fats, compared with unsaturated fats, is associated with a higher risk of circulatory and heart problems.

Each of the oils listed in the table contains a mixture of saturated and unsaturated fats.

Oil	Melting point in °C	Iodine number
palm	24	54
olive	-6	85
rapeseed	-10	98
sunflower	-17	127

The iodine number is the mass of iodine in grams that reacts with 100 cm³ of the oil. The iodine number shows the amount of unsaturated fat in each oil.

(a) (i) What would be seen if a solution containing 1 g of iodine was added to 100 cm³ of any of these oils?

.....

(1)

(ii) What does the word *unsaturated* mean?

.....

(1)

(iii) Which oil in the table would **probably** cause the highest risk of circulatory and heart problems?

Use the information in the table to give a reason for your answer.

Oil

Reason

.....

(2)

(b) Sunflower oil can be hardened so that it can be used to make margarine.

Explain how sunflower oil can be hardened.

.....

.....

.....

.....

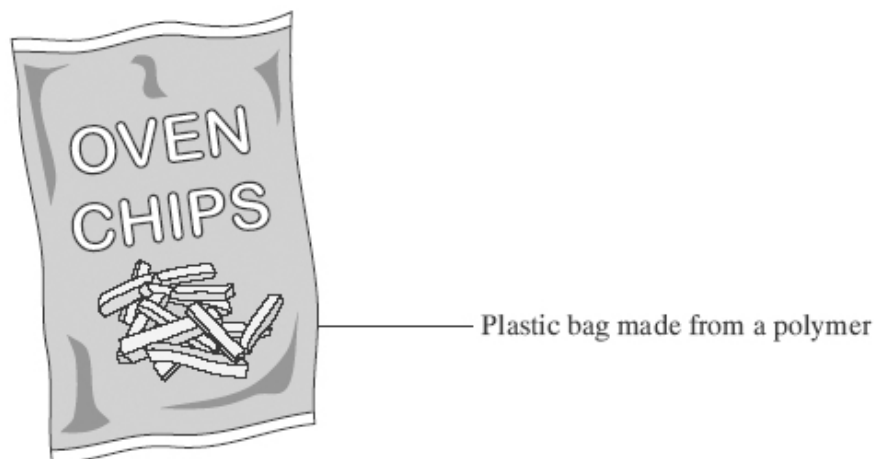
.....

.....

(3)
(Total 7 marks)

Q12. 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.



(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)

(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)

(iii) The hydrocarbon ethene has the formula C_2H_4

Complete the sentence about ethene.

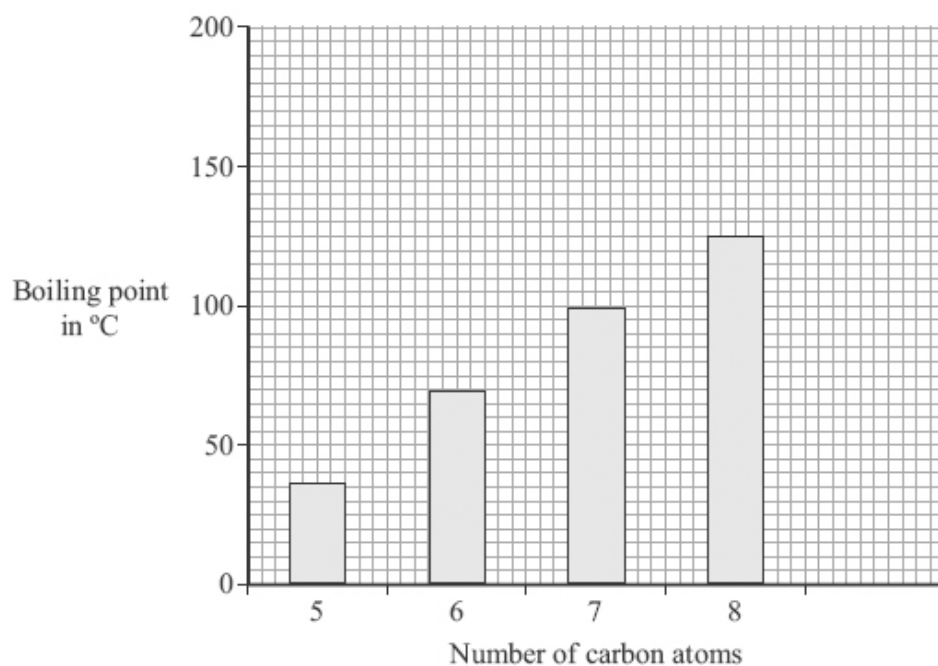
Ethene is a hydrocarbon made up of carbon and atoms.

(1)

(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)

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

.....

(1)

- (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)

- (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)
(Total 10 marks)

M1.	(a) (i) CH ₄		
		<i>allow H₄C</i>	
		<i>do not allow lower-case h</i>	
		<i>do not allow superscript</i>	1
	(ii) single		1
	(iii) alkanes		1
(b)	(i) carbon / C	<i>any order</i>	1
		hydrogen / H	
		<i>allow phonetic spelling</i>	1
		sulfur / sulphur / S	1
	(ii) air / atmosphere		1
	(iii) acid rain		1
		damages trees / plants or kills aquatic organisms or damages buildings / statues or causes respiratory problems	
		<i>allow harmful to living things</i>	1
(c)	carbon / C	<i>accept soot / particulates / charcoal</i>	1
(d)	any four from:		
	<ul style="list-style-type: none"> • (supports hypothesis) because when the fuel contained more carbon the temperature of the water went up more / faster (in 2 minutes) • (does not support hypothesis as) temperature change per gram decreases as the number of carbons increases • (does not support hypothesis) because the more carbon in the fuel the more smoke or the dirtier / sootier it is • only tested hydrocarbons / alkanes / fuels with between 5 and 12 carbon atoms • valid, justified, conclusion 		
		<i>accept converse statements</i>	4

(e) (i) 0.15

correct answer with or without working gains 2 marks

if answer incorrect, M_r carbon dioxide = 44 gains 1 mark

allow 0.236 / 0.24 / 0.2357142 (ecf from M_r of 28) for 1 mark

2

(ii) 0.4(0)

1

(iii) C_3H_8

correct formula with or without working scores 2 marks

$$0.15 / 0.05 = 3$$

allow ecf from (e)(i)

and

$$0.4 / 0.05 = 8 (1)$$

allow ecf from (e)(ii)

allow 1 mark for correct empirical formula from their values

If use 'fall-back-values:

$$0.50 / 0.05 = 10$$

and

$$0.20 / 0.05 = 4$$

1 mark

C_4H_{10}

1 mark

if just find ratio of C to H using fall-back values, get C_2H_5 allow 1

mark

2

[19]

M2. (a) Methane has the lowest melting point and icosane has the highest boiling point

1

Decane and icosane are liquid at 100°C

1

(b) water / H_2O

either order

1

carbon dioxide / CO_2

allow hydrogen oxide

1

(c) (i) fermentation

1

(ii) any **two** from:

- sugar cane / plants absorb carbon dioxide
ignore oxygen released
- growing sugar cane / plants reduces global warming
allow ethanol from plants is carbon neutral
- renewable resource / sustainable
accept conserves fossil fuels / petrol

2

(iii) any **two** from:

- destruction of habitats / forests (to grow sugar cane/crops)
- fermentation releases carbon dioxide
- production plants cause visual pollution
- pollution from the transportation of sugar cane / Ethanol
- growing sugar cane / plants uses a lot of land

2

[9]

M3. (a) (i) wood

1

(ii) 30 (kJ)

1

(iii) 3 / three (g)

1

(b) carbon / C

or hydrogen / H

or sulfur / S

allow oxygen / O

1

(c) releases most energy

accept releases a lot of energy / burns rapidly

ignore references to cost

1

no harmful gases / no or less pollution formed / no global warming / no climate change / no greenhouse gas

accept produces water (only) / steam

accept does not produce sulfur dioxide / carbon dioxide / carbon monoxide / particles / smoke

1

[6]

M4. (a) any **two** from:

*asks for cause therefore no marks for just describing the change
must link reason to a correct change in a gas*

carbon dioxide has decreased due to:

accept idea of 'used' to indicate a decrease

- plants / microorganisms / bacteria / vegetation / trees
- photosynthesis
ignore respiration
- 'locked up' in (sedimentary) rocks / carbonates / fossil fuels
- dissolved in oceans
ignore volcanoes

oxygen has increased due to:

accept idea of 'given out / produced'

- plants / bacteria / microorganisms / vegetation / trees
- photosynthesis
ignore respiration

nitrogen increased due to:

accept idea of 'given out / produced'

- ammonia reacted with oxygen
- bacteria / micro organisms
ignore (increase in) use of fossil fuels / deforestation

2

(b) (because methane's) boiling point is greater than the average / surface temperature
or Titan's (average / surface) temperature is below methane's boiling point

*ignore references to nitrogen **or** water*

1

any methane that evaporates will condense

accept boils for evaporates

accept cooling and produce rain for condensing

1

(c) C_nH_{2n}

1

[5]

M5. (a) (i) fermentation

1

(ii) cloudy

accept milky / white

1

there is carbon dioxide / CO₂

accept calcium carbonate forms

1

allow a (white) solid / precipitate forms

- (b) (i) (the amount of ethanol used) increases (from 1970) to 1989
if no year(s) or incorrect year(s) indicated then max 1
correct year(s) only needs to be indicated once to gain full marks
accept values in range 1987-1992

1

then it decreases from 1989 (to 2000)

1

(ii) any **one** from:

- Brazil had more oilfields
- cost of crude oil had decreased
- cost of ethanol / sugar (cane) had increased
- demand for ethanol / sugar (cane) had increased
- availability of ethanol / sugar (cane) had decreased
accept availability of land to grow sugar (cane) had decreased
- climate change affects growing sugar (cane)

1

[6]

M6. (a) (iron (steel) is) strong

*allow abundant **or** easy to extract **or** cheap*
ignore other correct properties

1

(b) less dense

allow low mass

1

more abundant

accept copper is 'running out'
allow copper is more expensive
ignore other correct statements

1

(c) (i) C₂H₄

1

(ii) double bond

1

(iii) poly(ethene)

1

[6]

M7. (a) (i) a reasonable attempt at a smooth curve

allow a curve which is close to but does not necessarily touch all points

1

(ii) any **two** from:

allow thicker / thinner / runny for viscous

- biodiesel is more viscous than petroleum diesel at all / lower temperatures
- biodiesel – as the temperature increases the viscosity decreases or vice versa
- petroleum diesel – the viscosity does not change
if no other mark awarded
allow 1 mark for any correct conclusion based on time or rate of flow

2

(iii) does not flow as easily (through pipes / engine)

allow could form a solid / block pipes / engine at low temperatures

or

needs a high temperature to flow

allow more difficult to vaporise / ignite

ignore burning

ignore references to viscosity

1

(b) (i) global dimming

allow correct description

1

(ii) 56 (%)

1

(iii) (increases) acid rain

1

because there is more nitrogen oxide(s)

ignore sulfur dioxide

if no other mark awarded

allow 1 mark for nitrogen oxide(s) given

1

- (iv) *answer yes or no does not gain credit because the marks are for an explanation*
ignore references to petroleum diesel
allow carbon for carbon dioxide

no

because carbon dioxide (26%) is released / produced

1

this will not all be absorbed by photosynthesis / growing plants for biodiesel
accept growing plants / farming uses machinery / fossil fuels
releases carbon dioxide

OR

yes

because although carbon dioxide (26%) is released / produced (1)

this was absorbed by photosynthesis / growing plants (for biodiesel) (1)
allow this will be absorbed by photosynthesis / growing plants for biodiesel

1

[10]

- M8.** (a) complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)

1

- (b) (i) the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa
allow as the (carbon) chain gets longer the boiling point increases
ignore melting points
*do **not** accept reference to greater number of molecules*

1

(ii) *they = hydrocarbons from the graph*
it = C₃₀H₆₂

any **two** from:

- low boiling point / volatile
accept they are gases or liquids
- low viscosity
- high flammability
accept easier to burn / ignite
- small molecules
accept short chains
ignore number of carbon atoms
- burn completely
ignore speed of burning

2

(c) (i) 16 (CO₂) + 18 (H₂O)

1

(ii) (carbon dioxide in the Earth's early) atmosphere
accept from volcanoes (millions of years ago)
or *from dead plants / animals*
allow dead sea creatures
ignore shells

1

(iii) increase in burning / use of fossil fuels

1

locked up carbon (carbon dioxide) is released
allow carbon / carbon dioxide from millions of years ago is released
accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)

1

[8]

M9. any **four** from:
to gain 4 marks both pros and cons should be given

Arguments for biodiesel

max **three** from:

- sustainable / renewable
- (carbon neutral) absorbs CO₂ when growing / during photosynthesis
- burning biodiesel produces low amounts particulates / carbon monoxide
allow burning biodiesel produces little / low amount of global dimming
ignore sulfur dioxide
- can use waste vegetable oils / fats (from food industry) **or** can use waste plant material
- can be used to conserve crude oil (instead of / mixed with petroleum diesel)
- produced by a low energy / temperature process
accept produced by a low tech process
- biodegrades (easily)
ignore engine effects

Arguments against biodiesel

max **three** from:

- creates food shortages
accept price of food increases
- deforestation to plant more crops leads to loss of habitat / biodiversity **or** deforestation leads to a reduction in absorption of CO₂
allow burning trees increases CO₂
allow deforestation increases global warming
- burning biodiesel produces high amounts of nitrogen oxides
allow increases acid rain
- crops takes time to grow
allow crops can fail
- vast areas of land needed to grow crops

4

conclusion supported by the argument presented, which must give added value to the points for and against given above

1

[5]

M10.	(a) acid rain → sulfur dioxide	1
	global warming → carbon dioxide	1
	global dimming → carbon particles	1
(b)	(i) oxygen	1
	(ii) carbon monoxide	1
(c)	(i) decreasing <i>accept running out / none left</i>	1
	(ii) any two from: <i>it = coal</i>	
	<ul style="list-style-type: none"> • world needs (more) energy <i>accept population is increasing</i> <i>allow (greater) demand for coal / fuels / energy</i> • plentiful supply <i>accept readily available</i> <i>allow coal will 'last longer'</i> • (many) countries have coal • easy to find / extract • oil / gas is running out <i>accept need to use less oil / gas</i> <i>accept need to use it to replace oil / gas</i> • cheap or cheaper than oil 	2
		[8]
M11.	(a) (i) (iodine is) decolourised <i>accept colourless</i> <i>allow oil decolourised</i> <i>ignore initial colour of iodine / nothing / clear</i>	1
	(ii) (molecule / compound) has a double (carbon carbon) bond <i>allow C = C</i>	1

(iii) palm 1

any **one** from:

*only allow this mark if correct **or** no answer in first part
ignore references to iodine number / melting point*

- contains less / low amount of unsaturated fat(s)
- contains more / high amount of saturated fat(s)

1

(b) any **three** from:

cracking / emulsification = max 2

- (react with) hydrogen
*accept by hydrogenation
do **not** accept cracking / emulsify*
- with a (nickel) catalyst
- at about 60°C
*allow hot **or** range 50°C to 120°C*
- increase *the* melting point

3

[7]

M12. (a) (i) poly(ethene)
accept polythene

1

(ii) cracking

1

(iii) hydrogen

1

- (b) (i) bar labelled 9 1
- bar drawn to correct height 1
- (ii) (boiling point) increases 1
- (iii) heat / evaporate (the crude oil)
accept separate by boiling point 1
- cool / condense (hydrocarbons at different temperatures)
accept smaller molecules go to top / larger molecules stay at bottom
*accept fractional distillation for two marks **or** distillation / fractionation for **one** mark* 1
- (c) **yes**
- any **two** from:
- because plastic does not biodegrade **or** running out of space for landfills **or** land cannot be used for a long time
 - it provides heat energy
 - which can be used to generate electricity / heat homes or greenhouses
 - any other advantage of burning
 - any other disadvantage of landfill
- or**
- no**
- burning plastic produces carbon dioxide / carbon emissions / toxic gases
accept landfill does not produce carbon dioxide / carbon emissions
 - causes global warming / climate change / increase greenhouse effect / global dimming / acid rain
 - any other disadvantage of burning
 - any other advantage of landfill
- 2

[10]

