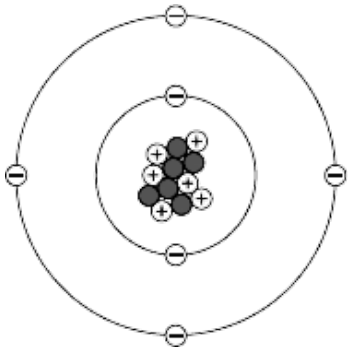
Q1. The picture shows a diamond ring.

Photograph supplied by Comstock/Thinkstock

(a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	-1

(2)

(b) Use the Chemistry Data Sheet to help you to answer these questions.

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

Gold and carbon are

compounds.
elements.
mixtures.

(1)

(ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal

and carbon is a .....

(1)

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

Pure gold is not used to make the ring because pure gold is too

hard.

reactive.

soft.

The gold ring is made by mixing pure gold with other metals to form

a compound.

an atom.

an alloy.

(2)

(d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

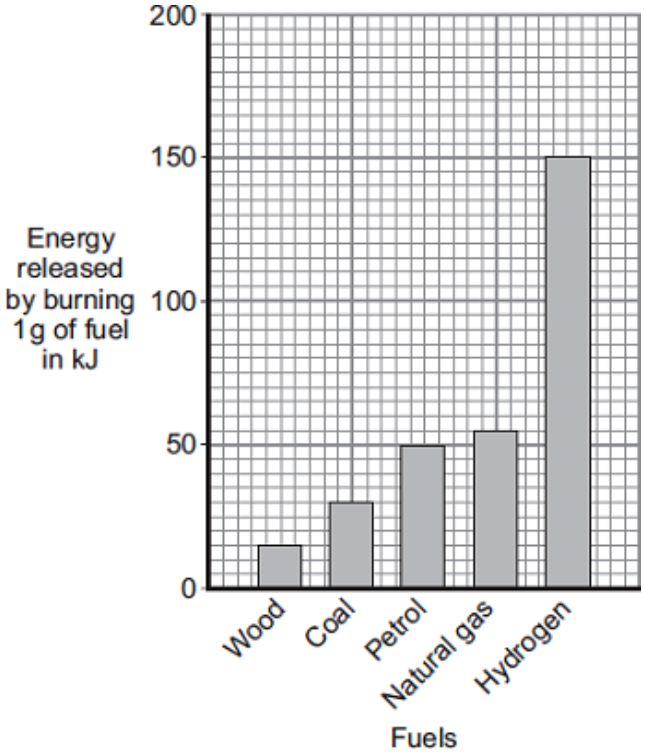
Question	Answer
What is the percentage of gold in this ring?	29
	61
How many electrons are there in a copper atom?	75
How many neutrons are in an atom of silver with a mass number of 108?	79

(3)

(Total 9 marks)

Q2. 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_2O
Sulfur dioxide	SO_2

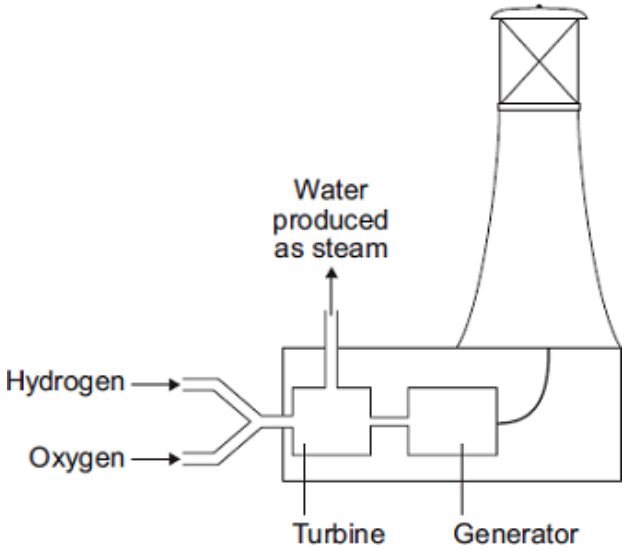
Use information from the table to name **one** element that is in coal.

.....

(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)

Q3. Cans for food and drinks are made from steel or aluminium.
The main metal in steel is iron.

(a) Reacting iron oxide with carbon produces iron.

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

The reaction to produce iron from iron oxide is

decomposition.
oxidation.
reduction.

(1)

(b) Aluminium cannot be produced by reacting aluminium oxide with carbon.

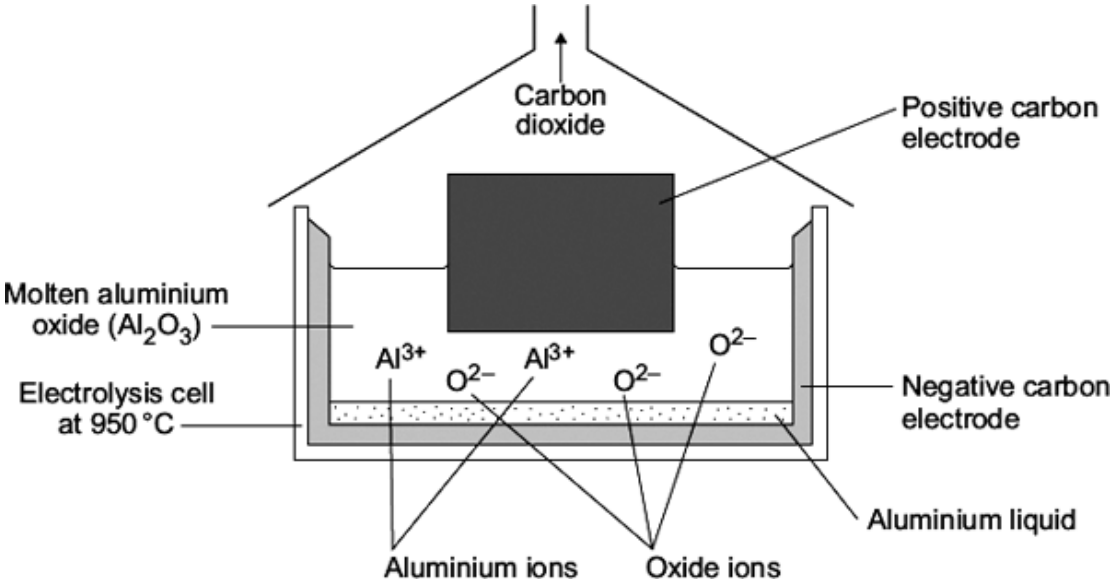
Why does aluminium oxide **not** react with carbon?

Tick (✓) the correct answer.

Answer	Tick (✓)
aluminium is less reactive than carbon	
carbon is less reactive than aluminium	
oxygen is more reactive than carbon	

(1)

(c) Aluminium can be produced by electrolysis.



Why do the aluminium ions collect at the negative electrode?

.....

.....

.....

.....

(2)

(d) Some statements about aluminium are given below.

Tick (✓) **two** statements that are correct reasons why aluminium is used to make cans.

Statement	**Tick (✓)**
aluminium conducts electricity	
aluminium is not a transition metal	
aluminium has a low density	
aluminium is resistant to corrosion	

(2)

(e) Recycling aluminium cans uses less fossil fuels than producing aluminium from its ore.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling aluminium to make aluminium cans.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
aluminium is the most common metal in the Earth's crust		
less carbon dioxide is produced		
more aluminium ore needs to be mined		
used aluminium cans have to be collected and transported		

(2)
(Total 8 marks)

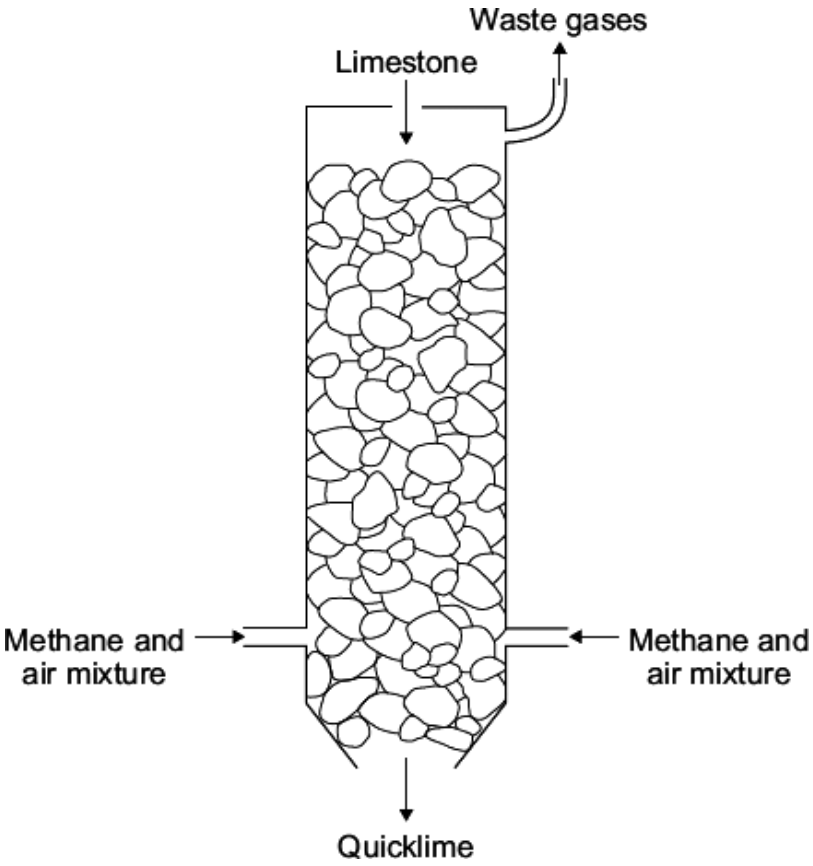
Q4. Limestone is mainly calcium carbonate, $CaCO_3$

(a) Complete the **two** empty boxes in the table.

Symbol	Element	Number of atoms in the formula $CaCO_3$
Ca	calcium	1
C	carbon	.....
O	oxygen	.....

(2)

(b) The diagram shows a lime kiln.
A lime kiln is used to heat limestone to make quicklime.



Use the diagram to help you to answer these questions.

(i) Draw a line from each substance to the name of the main chemical(s) that the substance contains.

Substance	Name of the main chemical(s)
air	nitrogen and oxygen
quicklime	calcium oxide
waste gases	nitrogen and carbon dioxide
	calcium carbonate
	methane

(3)

(ii) A mixture of methane and air is used in the lime kiln.

Explain why.

.....

.....

.....

.....

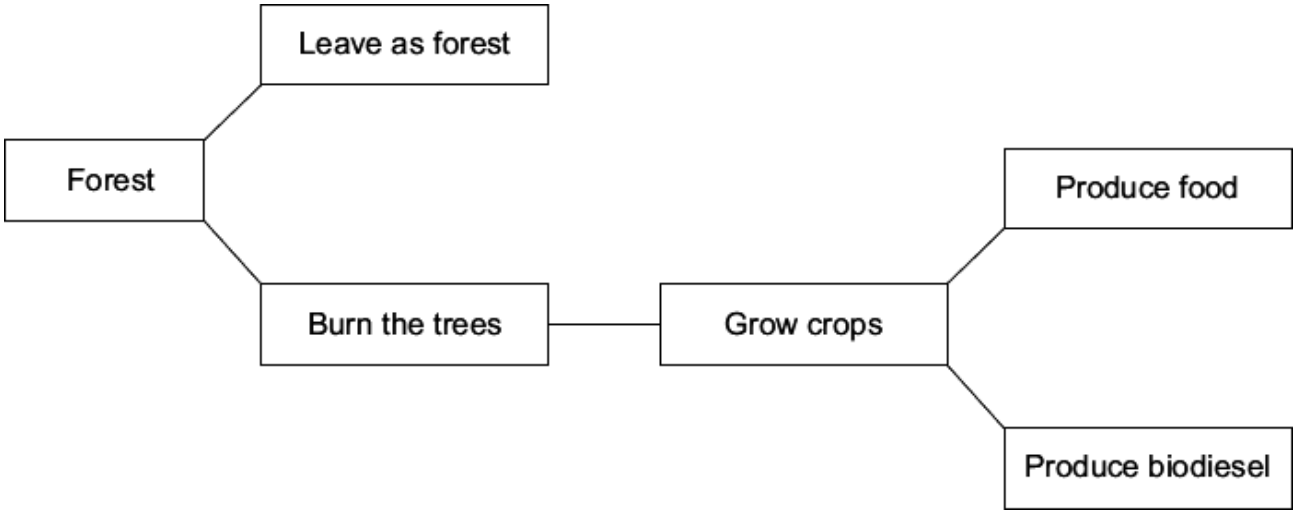
(2)

(c) Tick (✓) **two** uses of limestone.

Use of limestone	Tick (✓)
as a building material	
to make poly(ethene)	
as a fuel	
to make cement	

(2)
(Total 9 marks)

Q5. Petroleum diesel is a fuel made from crude oil.
Biodiesel is a fuel made from vegetable oils.
To make biodiesel, large areas of land are needed to grow crops from which the vegetable oils are extracted.
Large areas of forest are cleared by burning the trees to provide more land for growing these crops.



(a) Use this information and your knowledge and understanding to answer these questions.

(i) Carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere.

Suggest why adverts claim that using biodiesel is carbon neutral.

.....

.....

.....

.....

.....

.....

(2)

(ii) Explain why clearing large areas of forest has an environmental impact on the atmosphere.

.....

.....

.....

.....

.....

.....

(2)

(b) Why is there an increasing demand for biodiesel?

.....

.....

(1)

(c) Suggest why producing biodiesel from crops:

(i) causes ethical concerns

.....

.....

(1)

(ii) causes economic concerns.

.....

.....

(1)

(Total 7 marks)

Q6. Crude oil is a mixture of many different chemical compounds.

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

(i) Fuels react with oxygen to release energy.

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

.....

(1)

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

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

.....

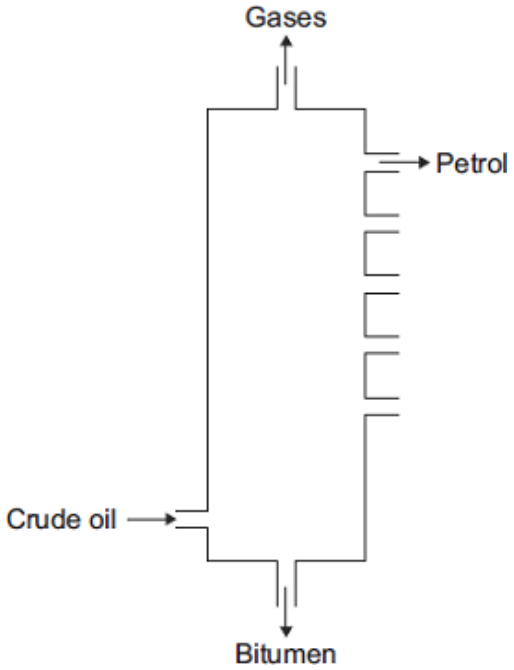
.....

.....

.....

(2)

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



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

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

Use the diagram and your knowledge to answer this question.

.....

.....

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.....

.....

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.....

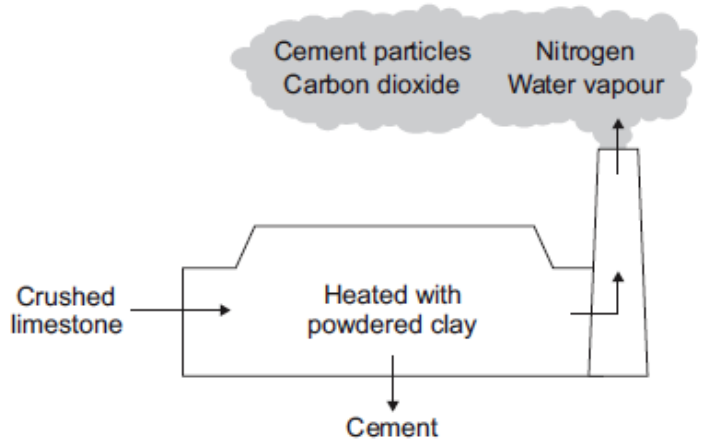
.....

.....

.....

(6)
(Total 9 marks)

Q7. The diagram shows some of the substances used and produced at a cement works.



(a) Limestone is mainly calcium carbonate ($CaCO_3$).

Write the correct answer in each box.

(i) The formula shows that calcium carbonate ($CaCO_3$) contains ☐ different elements.

(1)

(ii) The total number of atoms in the formula $CaCO_3$ is ☐.

(1)

(b) Name **one** of the substances produced at the cement works that causes atmospheric pollution.

State **one** effect of this atmospheric pollution.

Name .....

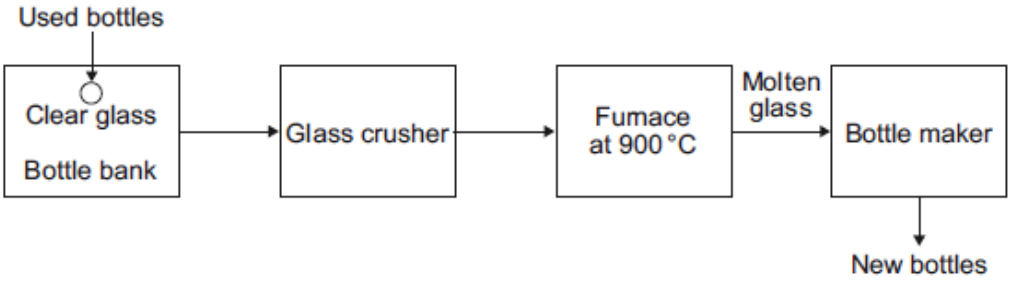
Effect .....

.....

.....

(2)

(c) Limestone is used to produce glass bottles.
In recent years we have become more aware of the need to recycle glass bottles. Used glass bottles can be recycled if they are put into bottle banks.



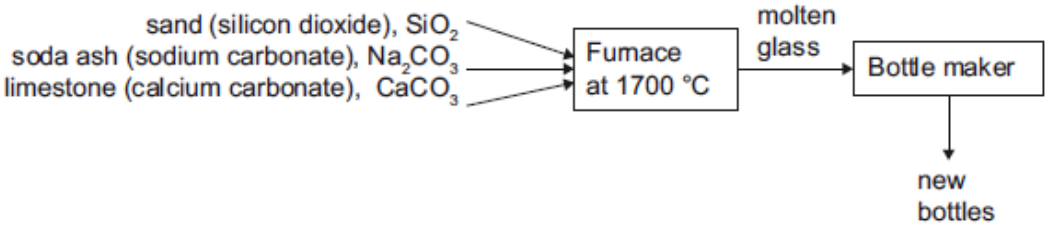
(i) Suggest **two** reasons why light bulbs should **not** be put into bottle banks.

1 .....

2 .....

(2)

(ii) New glass bottles can also be produced by heating a mixture of raw materials:



Suggest **two** environmental reasons why we should recycle glass bottles to make new glass bottles.

1 .....

.....

2 .....

.....

(2)
(Total 8 marks)

M1. (a) +1/+

*do **not** accept 1 without the +*

1

electron

allow phonetic spelling

1

(b) (i) elements

1

(ii) non-metal

1

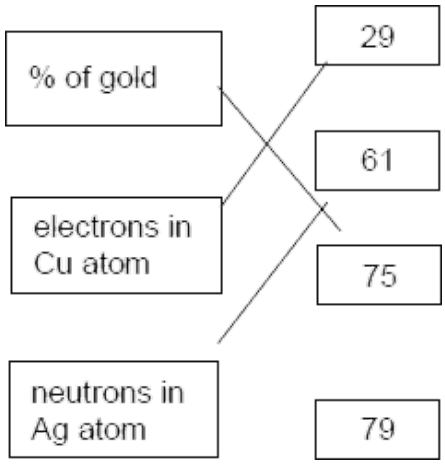
(c) soft

1

an alloy

1

(d)



***one** mark for each correct link*

extra lines lose the mark

3

[9]

M2. (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]

M3. (a) reduction

1

(b) carbon is less reactive than aluminium

1

(c) aluminium (ions) / they are positively charged

they = aluminium ions

ignore particle names

accept aluminium (ions) / they are cations

allow aluminium (ions they have an opposite charge

1

so they are attracted **or** they move towards the negative electrode

OR

aluminium (ions) / they need to gain electrons (1)

which come from the negative electrode (1)

*if no other marks awarded allow 'opposites attract' for **1** mark*

1

(d) aluminium has a low density

1

aluminium is resistant to corrosion

1

(e) **advantage** less carbon dioxide is produced

1

disadvantage used aluminium cans have to be collected and transported

1

[8]

M4. (a) 1 / one

1

3 / three

1

(b) (i) air linked to nitrogen and oxygen

1

quicklime linked to calcium oxide

1

waste gases linked to nitrogen and carbon dioxide

1

(ii) mixture burns / combusts

accept methane reacts with air / oxygen

accept as a fuel

1

to provide energy / heat

1

(c) as a building material

1

to make cement

1

[9]

M5. (a) (i) *use of carbon throughout* = ***max 1***

<u>burning biodiesel</u> releases CO_2

ignore burning trees

1

CO_2 is <u>absorbed</u> / <u>used</u> by the crops/plants (used to produce the biodiesel)

allow CO_2 <u>absorbed</u> / <u>used</u> by trees

1

(ii) *allow use of carbon for carbon dioxide throughout*

increases CO_2 / greenhouse effect

accept causes global warming

OR

allow causes climate change

less CO_2 is absorbed (from atmosphere)

ignore other correct effects

1

because burning trees releases CO_2

accept fewer trees to absorb CO_2

***or** crops / plants do not absorb as much CO_2 as trees*

OR

because there is less photosynthesis

ignore habitats / biodiversity

*if no other mark awarded global dimming because of smoke / particles gains **1** mark*

1

(b) any **one** from:

ignore carbon neutral / cost / less harmful / environmentally friendly

- crude oil / fossil fuel is running out / non-renewable
  allow biodiesel is renewable / sustainable
- demand for fuels / energy is increasing
  ignore demand for biodiesel is increasing
- new legislation / protocols

1

(c) (i) uses crops / land that could be used for food

*allow destroys habitats **or** reduces biodiversity*

ignore cost

1

(ii) increases the cost of food / land

ignore cost of machinery / process

ignore cheaper to produce biodiesel

1

[7]

M6. (a) (i) exothermic

accept combustion

*allow burning **or** oxidation **or** redox*

1

(ii) carbon monoxide / *CO* (is produced)

allow monoxide (is produced) ignore carbon oxide

1

because there is incomplete / partial combustion (of the fuel)

accept because there is insufficient oxygen / air (to burn the fuel)

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a statement that crude oil is heated **or** that substances are cooled. However there is little detail and any description may be confused or inaccurate.

Level 2 (3-4 marks)
There is some description of heating / evaporating crude oil **and either** fractions have different boiling points **or** there is an indication of a temperature difference in the column.

Level 3 (5-6 marks)
There is a reasonable explanation of how petrol is or fractions are separated from crude oil using evaporating **and** condensing.

If cracking is given as a preliminary or subsequent process to fractional distillation then ignore.

However, if cracking / catalyst is given as part of the process, maximum is **level 2**.

Examples of chemistry points made in the response could include:

- Some / most of the hydrocarbons (or petrol) evaporate / form vapours or gases
- When some of / a fraction of the hydrocarbons (or petrol) cool to their boiling point they condense
- Hydrocarbons (or petrol) that have (relatively) low boiling points and are collected near the top of the fractionating column or hydrocarbons with (relatively) high boiling points are collected near the bottom of the fractionating column
- The process is fractional distillation
- Heat the crude oil / mixture of hydrocarbons or crude oil / mixture is heated to about 350°C
- Some of the hydrocarbons remain as liquids
- Liquids flow to the bottom of the fractionating column
- Vapours / gases rise up the fractionating column
- Vapours / gases cool as they rise up the fractionating column
- The condensed fraction (or petrol) separates from the vapours / gases and flows out through a pipe
- Some of the hydrocarbons remain as vapours / gases
- Some vapours / gases rise out of the top of the fractionating column
- There is a temperature gradient in the fractionating column or the fractionating column is cool at the top and hot at the bottom

6

[9]

M7. (a) (i) 3 / three

1

(ii) 5 / five

1

(b) carbon dioxide / CO_2

for a correct emission

1

(causes) global warming / climate change / greenhouse gas

explanation must be correct for named emission

ignore ozone layer

or

(cement) particles / smoke (1)

(causes) asthma / dust / (global) dimming (1)

accept breathing problems

or

sulfur dioxide / SO_2 / nitrogen oxides / NO_x (1)

(causes) acid rain (1)

*do **not** accept nitrogen or water vapour for emissions*

*do **not** accept no named emission*

1

(c) (i) any **two** from:

ignore contamination without explanation

- contain metals/ filaments / wires
  accept named metal(s)
- contain other / toxic chemicals / materials
  accept named chemical(s) / material(s)
- different type of glass
  accept glass would not metl
  ignore thicker / thinner glass

2

(ii) any **two** from:

allow converse arguments

- low / <u>less energy</u> / heat or lower temperature needed
  ignore <u>no</u> <u>energy</u> without explanation
- low / <u>less</u> <u>fuel</u> burned
  ignore <u>no</u> <u>fuel</u> without explanation
  accept <u>less</u> <u>fuel</u> for extraction / transportation of raw materials
- no / less carbon dioxide / global warming / less use of carbonate(s)
  accept name(s) of this carbonate(s)
- less landfill
  ignore less litter
- less use of resources / raw materials

2

[8]