



Exampro GCSE Chemistry

C1 Chapter 4 Higher

Name:

Class:

Author:

Date:

Time: 58

Marks: 58

Comments:

Q1. This question is about oil reserves.

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

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

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

(3)

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

What are *alkanes*?

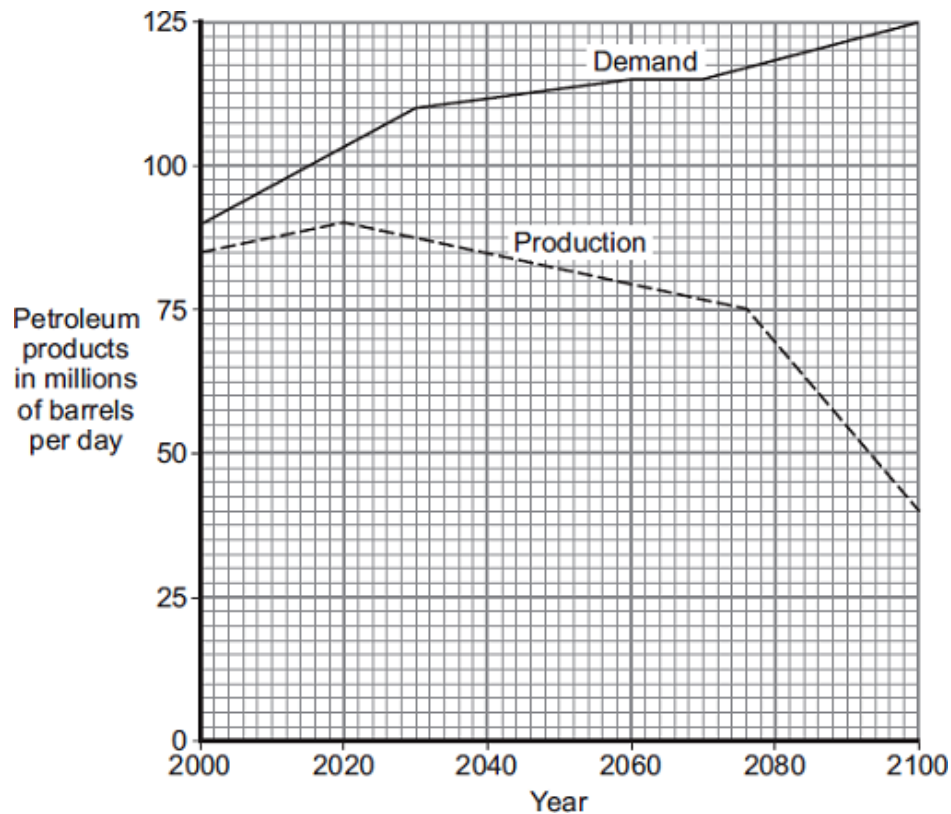
.....
.....
.....
.....
.....

(2)

- (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.

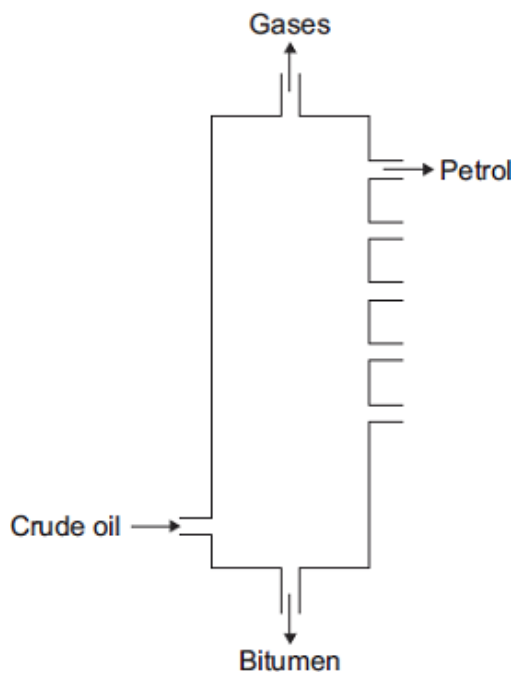
- (ii) Fuels react with oxygen to produce carbon dioxide.
The reaction of a fuel with oxygen can produce a different oxide of carbon.

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

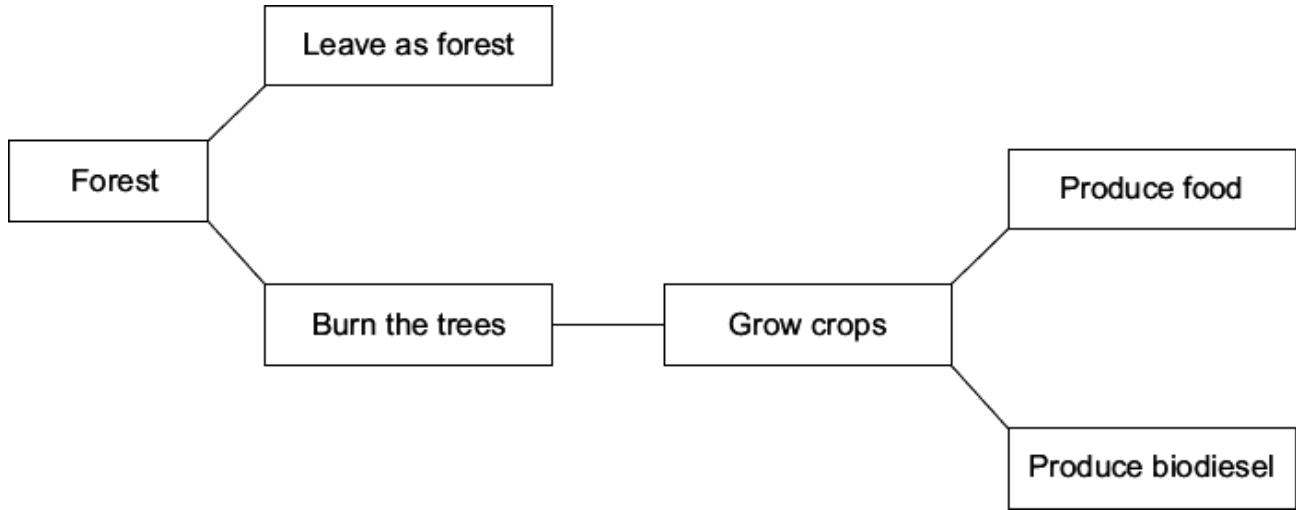
.....

.....

.....

(6)
(Total 9 marks)

Q3. 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)

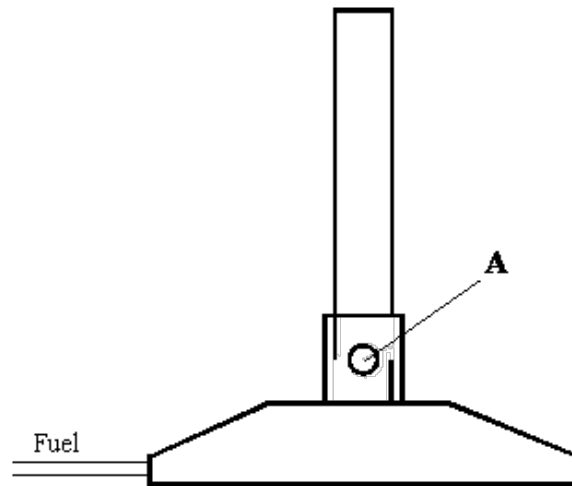
(ii) causes economic concerns.

.....
.....

(1)

(Total 7 marks)

Q4. The diagram below shows a bunsen burner.



Use words from the list to complete the passage about the Bunsen burner. You may use each word once, more than once or not at all.

- | | |
|-------------------|-------------------|
| air | methane |
| argon | mechanical energy |
| carbon dioxide | nitrogen |
| chemical | physical |
| electrical energy | potential energy |
| heat | oxygen |
| kinetic energy | water vapour |

In the Bunsen burner the fuel is mixed with

which enters through the hole labelled A.

When the fuel burns it reacts with the gas called

and energy is given out as

The fuel used in the Bunsen burner contains carbon and hydrogen which are changed

during burning into and

Burning is an example of a change because new

substances are formed.

(Total 6 marks)

Q5. There has been research into fuels for car engines.

Fuel	Content	Melting point in °C	Flashpoint in °C	Energy released in MJ per litre
Ethanol	C ₂ H ₅ OH	-114	+14	21.2
Diesel	hydrocarbons	About -24	+64	38.6
Petrol	hydrocarbons	About -57	-45	34.8
Rapeseed oil	fats	About +5	+130	32.8

The flashpoint is the lowest temperature a fuel vapour ignites in air.

(a) The melting point of ethanol is precise but the other melting points are approximate.

Suggest why.

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

(2)

(b) Ethanol is produced by fermentation of sugar cane. Rapeseed oil is produced by pressing rapeseeds. Waste plant material from both processes is used to feed animals.

(i) Describe how the process of fermentation is done.

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

(2)

Q6. Since 2000 there has been a lot more research into alternative, environmentally-friendly fuels for road transport.

Several pollutants are found in the exhaust emissions produced when fossil fuels are used for road transport.

Carbon monoxide (CO) interferes with the way that red blood cells carry oxygen. Carbon dioxide (CO₂) increases the level of carbon dioxide in the atmosphere and causes global warming.

Oxides of nitrogen (NO_x) are produced at high temperatures when nitrogen and oxygen from the atmosphere combine.

Sulfur dioxide (SO₂) is produced when sulfur impurities in the fuel combine with oxygen in the atmosphere.

Tiny particles of solids are produced when the fuel does not burn completely.

This increases the level of particulates (PM10) in the atmosphere.

(a) Name the environmental effect caused by:

(i) oxides of nitrogen (NO_x) and sulfur dioxide (SO₂)

.....

(1)

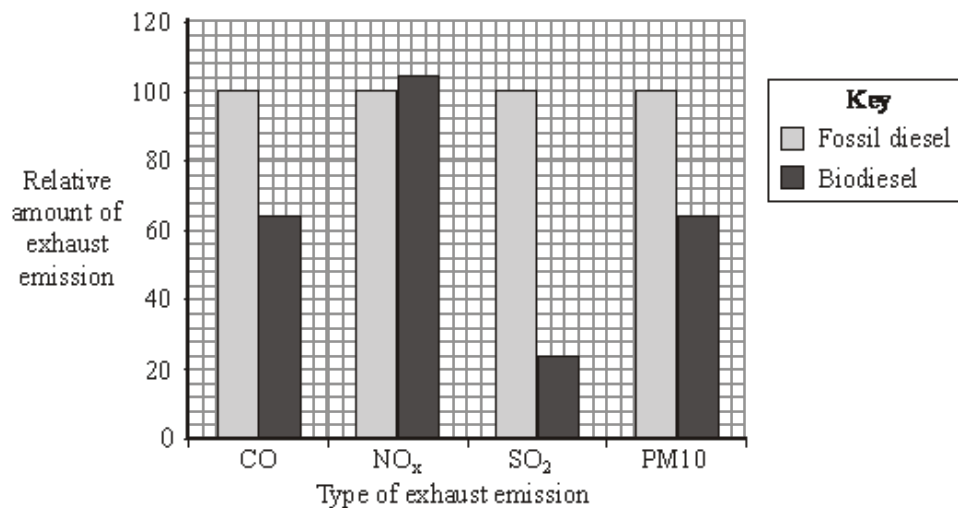
(ii) the increased level of particulates (PM10).

.....

(1)

(b) Diesel obtained from crude oil is often called fossil diesel. Biodiesel can be made from many vegetable oils. One research project compared the exhaust emissions when fossil diesel or biodiesel were used as fuels.

Some of the relative amounts of these exhaust emissions are shown in the bar chart.



(b) Octane is a *hydrocarbon*.

(i) What does *hydrocarbon* mean?

.....
.....

(1)

(ii) Give the molecular formula of octane.

.....

(1)

(c) The hydrocarbon **X** is used to make poly(ethene).

(i) What is the name of **X**?

.....

(1)

(ii) What is the name of the process in which **X** is changed into poly(ethene)?

.....

(1)

(Total 5 marks)

M1. (a) heat to vaporise (the crude oil)
do not accept cracking / burning 1

vapours condense 1

at different temperatures
allow they have different boiling points 1

(b) (alkanes) are hydrocarbons **or** are compounds of hydrogen and carbon only 1

alkanes are saturated **or** have only (carbon-carbon) single bonds
accept have no (carbon-carbon) double bonds
accept general formula is $C_n H_{2n+2}$ for 2 marks 1

(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a basic description of at least one advantage or one disadvantage of extracting petroleum products from oil sands.

Level 2 (3-4 marks)

There is a clear description of an advantage and a disadvantage of extracting petroleum products from oil sands.

Level 3 (5-6 marks)

There is a detailed description of both advantages and disadvantages of extracting petroleum products from oil sands.

Examples of the chemistry/environmental/economic/social points made in the response

Advantages:

- the oil sands are needed because crude oil is running out
- this crude oil is needed because demand is increasing
- the oil sands contain a large amount of crude oil
- the oil sands could improve Canada's economy
- the oil sands provide employment for a lot of people
- the trees / forest are used for wood products / fuel

Disadvantages:

- destruction of environment / habitats
- fewer trees / forests to absorb carbon dioxide
- specified pollution, for example, visual, noise, atmospheric (including dust), water (including river or drinking) with cause, e.g. gases / particulates from burning diesel
- large amounts of methane (natural gas) are used to provide energy
- energy / fuel needed for cracking and fractional distillation
- burning fuel releases carbon dioxide
- crude oil / natural gas contains locked up carbon
- crude oil is non-renewable

6
[11]

- M2.** (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]

M3. (a) (i) *use of carbon throughout = max 1*

burning biodiesel releases CO₂

ignore burning trees

1

CO₂ is absorbed / used by the crops/plants (used to produce the biodiesel)

allow CO₂ absorbed / used by trees

1

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

increases CO₂ / greenhouse effect

accept causes global warming

OR

allow causes climate change

less CO₂ is absorbed (from atmosphere)

ignore other correct effects

1

because burning trees releases CO₂

accept fewer trees to absorb CO₂

or *crops / plants do not absorb as much CO₂ 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]

M4. air or oxygen;
oxygen;
heat;
carbon dioxide;
water;
chemical

for 1 mark each

[6]

M5. (a) ethanol is made up of only one type of molecule **or** ethanol is a compound
allow ethanol is pure

1

diesel / petrol / rapeseed oil are mixtures

accept composition of diesel / petrol / rapeseed oil varies / changes

allow different hydrocarbons have different melting points

ignore diesel, petrol and rapeseed oil are impure

1

(b) (i) sugar is mixed with / dissolved in water
accept sugar cane for sugar

1

yeast (is added)

allow enzymes are added

if no other mark awarded, allow correct word or chemical equation for 1 mark

1

(ii) (growing sugar cane / rapeseed) plants absorbs carbon dioxide
accept carbon for carbon dioxide
accept carbon dioxide is used for photosynthesis

1

which is released (when the biofuel burns)

*do **not** accept no carbon dioxide is released (when biofuels burn)*

1

(c) nitrogen / N₂ **and** oxygen / O₂ (in the air)

*do **not** accept fuels contain nitrogen*

1

react in the hot engine / at high temperature

1

(d) any **three** from:

ignore references to melting point

3

- ethanol needs a higher temperature to burn than petrol **or** ethanol has a higher flashpoint than petrol
- ethanol releases less energy (per litre) than petrol
- sugar is renewable **or** crude oil is non-renewable / will run out
- sugar cane growth is unreliable / slow **or** crude oil is a reliable supply
*allow ethanol is not readily available **or** petrol is readily available*
- ethanol is made by a batch / slow process **or** petrol is made by a continuous / fast process
- ethanol is carbon neutral **or** petrol contains 'locked up' carbon dioxide
- sugar / sugar cane should be used for food not for fuels
accept idea of food shortages

a justified conclusion that adds value

*accept one **additional** point from the list above as long as one comparison of replacing petrol with ethanol is made*

1

[12]

M6.

- (a) (i) acid rain
accept consequences of acid rain
allow asthma / bronchitis
ignore toxic gas

1

- (ii) global dimming
accept dimming alone

1

(b) (i) **sustainable:**

maximum **two** from:

- crops (that produce oil) can be grown in most places owtte
- renewable
- use less fossil fuels / diesel
- use (refined) waste oils

low pollution:

maximum **two** from:

ignore references to CO₂ here

- most emissions are lower **or** any two named emissions from CO / SO₂ / PM₁₀ are lower
- much / lot less SO₂ emissions (than the others) owtte
- accept spillages / waste is biodegradable
- less new CO₂ **or** (more) carbon neutral

3

(ii) plants / photosynthesis use carbon (dioxide) from the air*

1

it / biodiesel releases carbon (dioxide) from plants / crops / photosynthesis*

() allow 1 mark for biodiesel is (more) carbon neutral*

1

(fossil) diesel releases 'locked up' / new carbon (dioxide) / doesn't absorb CO₂ / absorbed it millions of years ago

1

[8]

M7. (a) catalyst

1

(b) (i) made up of **only** carbon and hydrogen

1

(ii) C₈H₁₈

1

(c) (i) ethene

1

(ii) polymerisation

1

[5]

