

Carbon Compounds as Fuels + Feedstock

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.7 Organic Chemistry
Sub-Topic	Carbon Compounds as Fuels + Feedstock
Difficulty Level	Bronze Level
Booklet	Mark Scheme 1

Time Allowed: 55 minutes

Score: /54

Percentage: /100

Grade Boundaries:

- M1.(a)** 4 (C₂H₄) 1
- (b) cracking involves a catalyst 1
- distillation does not
- or**
- distillation does not involve a chemical change
- but cracking does 1
- (c) Decomposition 1
- (d) **Level 3 (5–6 marks):**
A logically structured evaluation with links involving several comparisons. Nearly all points made are relevant and correct.
- Level 2 (3–4 marks):**
Some valid comparisons made between the two types of bag. There may be some incorrect or irrelevant points.
- Level 1 (1–2 marks):**
A vague response with few correct and relevant points and with no direct comparisons.
- 0 marks:**
No relevant content
- Indicative content**
- Accept converse in terms of plastic bags for all statements
- Paper bags are made from a renewable resource
 - Plastic bags are made from a finite resource
 - Paper bags require more energy to manufacture
 - Paper bags produce more waste
 - Paper bags are biodegradable
 - Paper bags create more CO₂
 - CO₂ created by paper bags offset by photosynthesis in growing wood

- Paper bag requires much more fresh water
- Paper bags cannot be recycled
- Agree because non-renewability less important than other factors **or** disagree because of converse **or** can't say because data inconclusive / incomplete

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[10]

M2.(a) (i) ethanol

1

(ii) oxidised

1

(iii) **Test**

add any named carbonate or hydrogen carbonate
*the first mark is for the test; the second is for the result
if the test is incorrect award 0 marks.*

1

Result

A will effervesce (carbon dioxide) **or** **B** will not effervesce.
if the result is incorrect, award the first mark only

1

or

*candidates do not have to name a gas but penalise an
incorrect gas.*

Test

add a named (magnesium, aluminium, zinc, iron or tin) metal
give credit to any test that will work.

Result

A will effervesce (hydrogen), **B** will not
*allow a test that would identify **B**.*

or

Test

add an acid-base indicator

Result

credit any acid colour for that indicator eg for universal indicator allow red, yellow or orange

give credit for the neutral colour for **B**

or

Test

add an alcohol (+ acid catalyst)

Result

sweet or fruity smell of esters.

(b) (i) H_2O 1

(ii) ethyl ethanoate 1

(iii) any **one** from:

- flavourings
- perfumes
- solvents
- plasticisers

allow any correct use of esters 1 [7]

M3. (a) (i) C_7H_{16}
mark answer line first
answer may be given in the table

1

(ii) $\text{C}_n\text{H}_{2n+2}$

1

- (b) (i) carbon monoxide
*do **not** accept carbon oxide*
*do **not** accept water*
ignore CO

1

- (ii) because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)
*allow because there is less / insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) **or** 19O_2 (in reaction 1) **and** 13O_2 (in reaction 2)*
ignore air

1

- (c) (i) 15 (%)
ignore units

1

- (ii) water (vapour)/steam
allow H_2O / OH_2 / hydrogen oxide

1

- (iii) sulfur in petrol / crude oil (reacts with oxygen)
it = sulfur dioxide

1

- (ii) because nitrogen **and** oxygen (are in the air and) react
*allow nitrogen **and** oxygen burn*
*accept nitrogen + oxygen \rightarrow nitrogen oxide **or** symbol equation*
ignore air

1

at high temperature (inside a petrol engine)

allow heat / hot (engine)

1

- (d) because carbon dioxide / it causes global warming **or**
allow because carbon dioxide / it causes greenhouse effect / climate change

1

because carbon dioxide / it has an impact on oceans

because this carbon dioxide / carbon / it was 'locked up' (in fossil fuels) **or**

because the percentage/amount of carbon dioxide / it in the atmosphere is increasing

1

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- M4.(a)** (i) 2,4 drawn (as dots / crosses / e⁻)

1

- (ii) Water (vapour) / steam
allow hydrogen oxide / H₂O
*do **not** accept hydroxide*

1

- (b) any **two** pairs from:

carbon dioxide (1)

causes global warming (1)

allow greenhouse effect / climate change / sea level rise / melting of polar ice caps

or

carbon (particles) / soot (1)

allow particulates

causes global dimming (1)

*allow blocks out sunlight / smog / prevents plant growth /
causes breathing difficulties*

or

carbon monoxide (1)

is toxic (1)

or

sulfur dioxide (1)

causes acid rain (1)

allow kills plants / erosion / acidifies water

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M5.(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_nH_{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 marksNo 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

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 marksNo 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

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