

# Carbon dioxide + Methane as Greenhouse

## Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.9 Chemistry of the Atmosphere
Sub-Topic	Carbon dioxide + Methane as Greenhouse
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 54 minutes

Score: /54

Percentage: /100

Grade Boundaries:

**M1.(a)** (i) 2,4 drawn (as dots / crosses / e<sup>-</sup>)

1

(ii) Water (vapour) / steam  
*allow hydrogen oxide / H<sub>2</sub>O*  
*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*

4

[6]

**M2.(a)** (i) H<sub>2</sub>O

*must be formula*

1

CaO

*must be formula*

1

(ii) carbon dioxide from the air / (Earth's early) atmosphere

*it = carbon (dioxide)*

*accept carbon dioxide from millions of years ago*

1

formed (sedimentary) rocks **or** fossil fuels

*ignore trapped / stored*

1

(b) (i) decreases rapidly at first

*it = carbon (dioxide)*

1

then slowly **or** levels off

*allow both marks if the description is correct using either  
'rapidly' **or** 'slowly'*

*allow correct use of figures for either marking point*

*if no other mark awarded, allow CO<sub>2</sub> decreased for 1 mark*

1

(ii) any **two** from:

*it = carbon (dioxide)*

*accept photosynthesis*

- used by plants
- dissolved in oceans
- 'locked up' in fossil fuels **or** formed fossil fuels
- 'locked up' in rocks **or** formed rocks

2

(c) (yes)

*it = percentage of carbon (dioxide)*

*ignore yes or no*

because the percentage of carbon dioxide is increasing

1

which causes global warming (to increase)

*allow (carbon dioxide) causes greenhouse effect/climate change*

1

**or**

(no)

because the percentage of carbon dioxide is low (1)

compared to millions of years ago (1)

*allow global warming can be caused by other factors (e.g. Sun / water vapour / methane)*

[10]

**M3.** (a) (i)  $C_7H_{16}$

*mark answer line first*

*answer may be given in the table*

1

(ii)  $C_nH_{2n+2}$

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**  $19\text{O}_2$  (in reaction 1) **and**  $13\text{O}_2$  (in reaction 2)*

*ignore air*

1

(c) (i) 15 (%)

*ignore units*

1

(ii) water (vapour)/steam

*allow  $\text{H}_2\text{O}$  /  $\text{OH}_2$  / 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

[11]

**M4.** (a) (i) *use of carbon throughout = max 1*

burning biodiesel releases CO<sub>2</sub>

*ignore burning trees*

1

CO<sub>2</sub> is absorbed / used by the crops/plants (used to produce the biodiesel)

*allow CO<sub>2</sub> absorbed / used by trees*

1

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

increases CO<sub>2</sub> / greenhouse effect

*accept causes global warming*

**OR**

*allow causes climate change*

less CO<sub>2</sub> is absorbed (from atmosphere)

*ignore other correct effects*

1

because burning trees releases CO<sub>2</sub>

*accept fewer trees to absorb CO<sub>2</sub>*

*or crops / plants do not absorb as much CO<sub>2</sub> 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]

**M5.** (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]

**M6.** (a) carbon dioxide decreased (by plants / trees)

*allow plants / trees absorbed carbon dioxide*

1

oxygen increased (by plants / trees)

*allow plants / trees released oxygen*

*if neither of these marks awarded*

*allow plants / trees*

*photosynthesise for 1 mark*

1

because coal 'locks up' / traps / stores carbon dioxide / carbon

*allow trees 'locked up' carbon dioxide / carbon*

1

(b) carbon / C

hydrogen / H

sulfur / S

*all 3 correct 2 marks*

*1 or 2 correct 1 mark*

*allow H<sub>2</sub>*

*ignore oxygen*

2

(c) (i) 2 2

*balancing must be correct*

*do **not** accept changed formulae*

1

(ii) increases atmospheric pollution

carbon dioxide / CO<sub>2</sub> released

1

from the (thermal) decomposition of calcium carbonate **or**

*accept causes global warming **or** CO<sub>2</sub> is a greenhouse gas*

description of this decomposition **or** equation

*ignore sulfur dioxide and effects in this part*

1

decreases atmospheric pollution

sulfur dioxide / SO<sub>2</sub> is removed

*accept less acid rain produced*

1

by reaction with calcium oxide **or** calcium carbonate

*accept neutralisation **or** forms calcium sulfate*

1

[10]