

GCSE Combined Science: Trilogy

Worksheet: Atmospheric pollutants from fuels

TIME 30 min	TOTAL 26 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Atmospheric pollutants from fuels

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1 Which pollutant is produced when a fuel containing sulfur is burned?

Tick (✓) **one** box.

Carbon monoxide

☐

Oxides of nitrogen

☐

Soot

☐

Sulfur dioxide

☐

[1 mark]

0 1 . 2 Name the toxic gas produced by the incomplete combustion of fuels.

.....

.....

.....

[1 mark]

0 1 . 3

Name the **two** products of the complete combustion of a hydrocarbon.

.....

.....

.....

.....

[2 marks]

0 2

0 2 . 1

Which pollutant is formed from gases in the air, rather than from substances in the fuel itself?

Tick (✓) **one** box.

Carbon monoxide

Sulfur dioxide

Oxides of nitrogen

Soot / particulates

☐
☐
☐
☐

[1 mark]

0 2 . 2

State the condition inside a car engine that causes this pollutant to form.

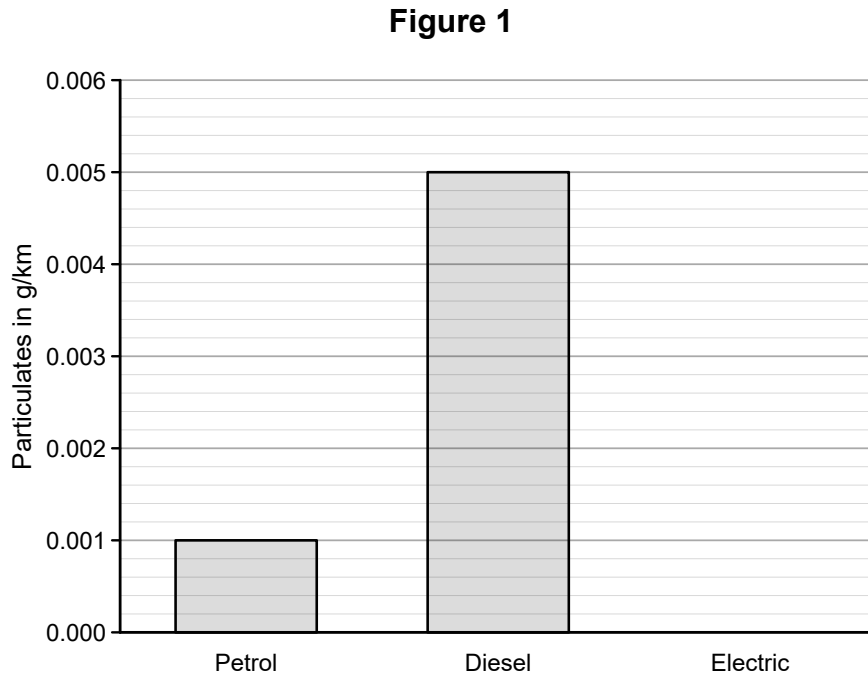
.....

.....

[1 mark]

0 3

Figure 1 compares the approximate mass of particulates emitted per km travelled by three types of car.



0 3 . 1

Use Figure 1 to calculate how many times more particulates a diesel car emits per km than a petrol car.

.....

.....

.....

Factor =

[1 mark]

0 3 . 2

Explain why petrol and diesel cars emit particulates from their engines, but an electric car does not.

.....

.....

.....

.....

[2 marks]

0 4

The products of burning a fuel depend on what the fuel contains and the conditions in which it burns.

0 4 . 1

Methane burns completely in a plentiful supply of air.

Write a balanced equation for the reaction.

.....

.....

.....

.....

[2 marks]

0 4 . 2

A power station burns coal that contains carbon, hydrogen and sulfur. The coal burns at a high temperature, and some parts of the furnace have a limited supply of air.

Predict **three** pollutants released by the power station.

.....

.....

.....

.....

.....

.....

[3 marks]

0 4 . 3

Some buses have engines that burn hydrogen.

A student said:

‘Burning hydrogen in an engine produces no pollutants.’

Explain why the student is wrong.

.....

.....

.....

.....

[2 marks]

0 5

Petrol and diesel are fuels used in car engines. The exhaust gases contain pollutants.

0 5 . 1

Explain how oxides of nitrogen are produced in a car engine.

.....

.....

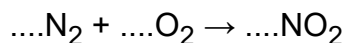
.....

.....

[2 marks]

0 5 . 2

Balance the equation for the formation of nitrogen dioxide.



.....

.....

[1 mark]

0 5 . 3

Incomplete combustion of the fuel produces carbon monoxide and soot.
Explain why incomplete combustion happens.

.....

.....

[1 mark]

0 5 . 4

Some fuels also produce sulfur dioxide when they burn.
Explain why.

.....

.....

.....

.....

[2 marks]

0 6

0 6 . 1

Fuel suppliers now sell 'low-sulfur' diesel and petrol.

Explain why removing most of the sulfur from a fuel reduces its environmental impact when burned.

[2 marks]

0 7

A gas boiler burns methane to heat a house. The boiler has not been serviced for many years, and its air supply has become partly blocked.

0 7 . 1

Explain why this boiler could produce carbon monoxide.

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Atmospheric pollutants from fuels · 26 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: Sulfur dioxide

01.2 [1 mark]

Answer: carbon monoxide

- carbon monoxide (1)
-

01.3 [2 marks]

- carbon dioxide (1)
 - water (vapour) (1)
-
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: Oxides of nitrogen

02.2 [1 mark]

- a high temperature (1)
-
-

Question 3 (3 marks)

03.1 [1 mark]

Answer: 5

- 5 (1)
-

03.2 [2 marks]

- particulates (soot / carbon) are produced by incomplete combustion of the fuel in petrol and diesel engines (1)
 - an electric car does not burn any fuel, so there is no combustion (1)
-

Question 4 (7 marks)

04.1 [2 marks]

Answer: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

- $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (correct formulae) (1)
- correctly balanced: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ (1)

04.2 [3 marks]

- sulfur dioxide (1)
- carbon monoxide (1)
- soot / carbon particles / particulates / unburned hydrocarbons (1)
- oxides of nitrogen (1)

Any 3 of the points above.

Notes: Ignore carbon dioxide and water (vapour).

04.3 [2 marks]

- oxides of nitrogen are produced (1)
- because nitrogen and oxygen from the air react at the high temperature in the engine (1)

Question 5 (6 marks)

05.1 [2 marks]

- nitrogen and oxygen from the air react (1)
- at the high temperature in the engine (1)

Notes: Do not accept 'nitrogen from the fuel'.

05.2 [1 mark]

Answer: $\text{N}_2 + 2\text{O}_2 \rightarrow 2\text{NO}_2$

- $\text{N}_2 + 2\text{O}_2 \rightarrow 2\text{NO}_2$ (1)

05.3 [1 mark]

- there is not enough / a limited supply of oxygen (for all the carbon to form carbon dioxide) (1)

05.4 [2 marks]

- the fuel contains sulfur (compounds) as an impurity (1)
 - the sulfur reacts with / is oxidised by oxygen when the fuel burns (1)
-

Question 6 (2 marks)

06.1 [2 marks]

- fuel that contains sulfur produces sulfur dioxide when it burns (1)
 - sulfur dioxide causes acid rain and respiratory problems, so a fuel with less sulfur produces less of this pollutant when burned (1)
-

Question 7 (2 marks)

07.1 [2 marks]

- less oxygen reaches the fuel, so there is not enough oxygen for complete combustion (1)
 - the incomplete combustion of methane produces carbon monoxide (1)
-