

Carbon dioxide + Methane as Greenhouse

Question Paper 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	Question Paper 1

Time Allowed: 54 minutes

Score: /54

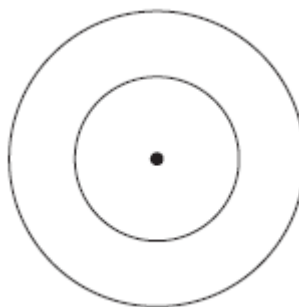
Percentage: /100

Grade Boundaries:

Q1. Fossil fuels contain carbon and hydrogen.

- (a) (i) Use the Chemistry Data Sheet to help you to answer this question.

Complete the figure below to show the electronic structure of a carbon atom.



(1)

- (ii) Complete the word equation for the oxidation of hydrogen.

hydrogen + oxygen \longrightarrow

(1)

- (b) Coal is a fossil fuel.

Coal contains the elements hydrogen, sulfur, oxygen and carbon.

Name **two** products of burning coal that have an impact on the environment.

What impact does each of the products you named have on the environment?

.....

.....

.....

.....

.....

.....

.....

.....

(4)

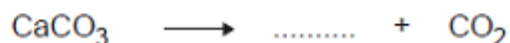
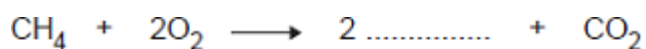
(Total 6 marks)

Q2. The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was formed. The amount of carbon dioxide continues to change because of human activities.

- (a) Cement is produced when a mixture of calcium carbonate and clay is heated in a rotary kiln. The fuel mixture is a hydrocarbon and air.

Hydrocarbons react with oxygen to produce carbon dioxide.
Calcium carbonate decomposes to produce carbon dioxide.

- (i) Complete each chemical equation by writing the formula of the other product.



(2)

- (ii) Hydrocarbons and calcium carbonate contain *locked up* carbon dioxide.

What is *locked up* carbon dioxide?

.....

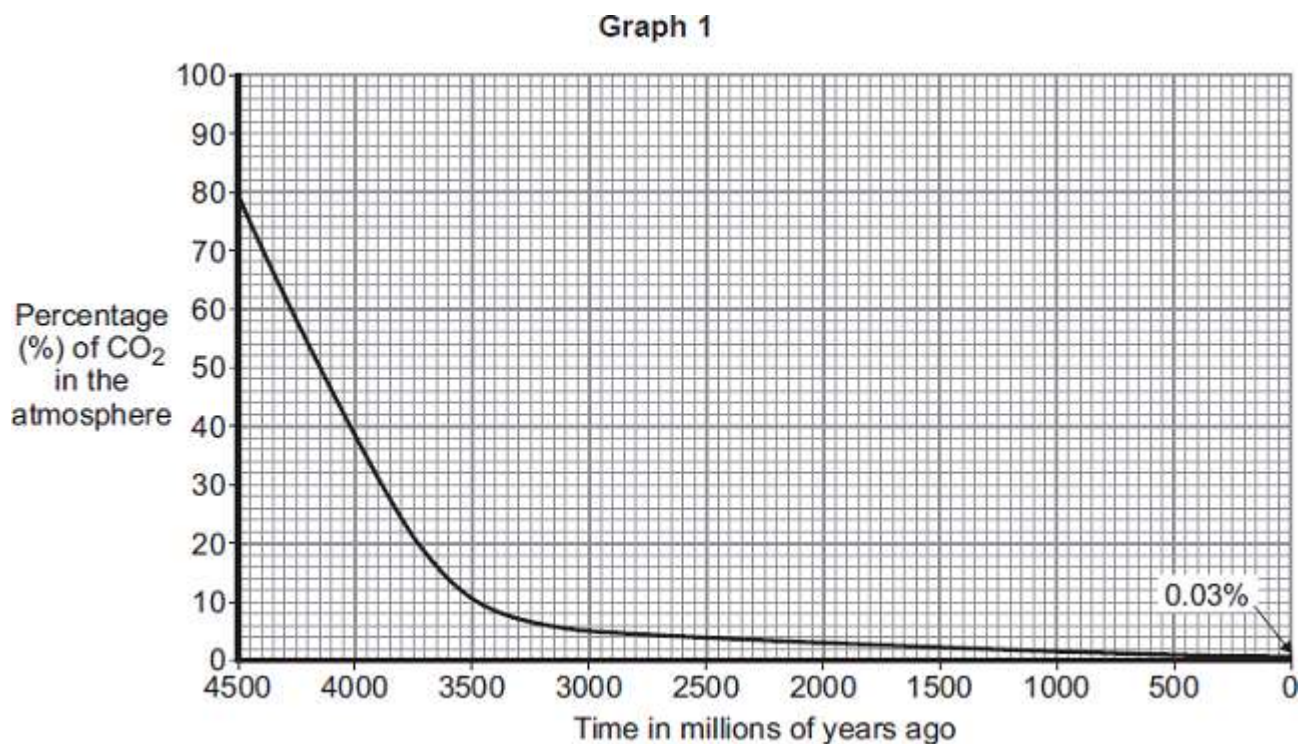
.....

.....

.....

(2)

- (b) **Graph 1** shows how the percentage of carbon dioxide in the atmosphere changed in the last 4500 million years.



Use information from **Graph 1** to answer these questions.

- (i) Describe how the percentage of carbon dioxide has changed in the last 4500 million years.

.....

.....

.....

.....

(2)

- (ii) Give **two** reasons why the percentage of carbon dioxide has changed.

.....

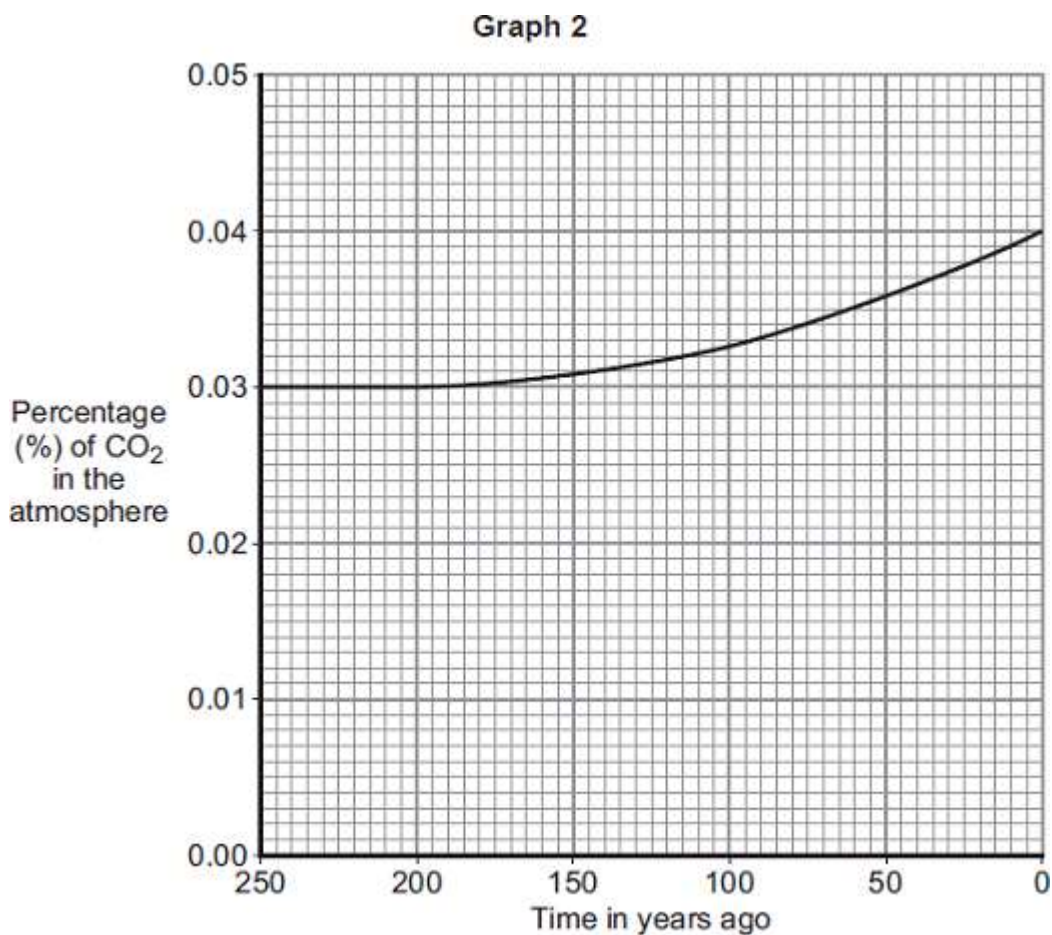
.....

.....

.....

(2)

- (c) **Graph 2** shows how the percentage of carbon dioxide in the atmosphere changed in the last 250 years.



Should we be concerned about this change in the percentage of carbon dioxide?

Explain your answer.

.....

.....

.....

.....

(2)
(Total 10 marks)

Q3. A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol		Air	
Alkane	Formula	Gas	Percentage (%)

hexane	C_6H_{14}	nitrogen	78
heptane		oxygen	21
octane	C_8H_{18}	carbon dioxide	0.035
nonane	C_9H_{20}	Small amounts of other gases and water vapour	
decane	$C_{10}H_{22}$		

(a) Use the information above to answer these questions.

(i) Give the formula for heptane

.....

(1)

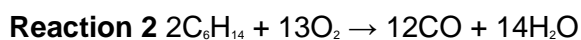
(ii) Complete the general formula of alkanes.
n = number of carbon atoms

C_nH

(1)

(b) Alkanes in petrol burn in air.

The equations represent two reactions of hexane burning in air.



Reaction 2 produces a different carbon compound to **Reaction 1**.

(i) Name the carbon compound produced in **Reaction 2**.

.....

(1)

(ii) Give a reason why the carbon compounds produced are different.

.....

.....

(1)

(c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

- (i) What is the percentage of the other gases in the table?

.....

(1)

- (ii) What is the name of the compound that makes up most of the other gases?

.....

(1)

- (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

.....

.....

(1)

- (iv) State how nitrogen oxides are produced in a petrol engine.

.....

.....

.....

.....

(2)

- (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

.....

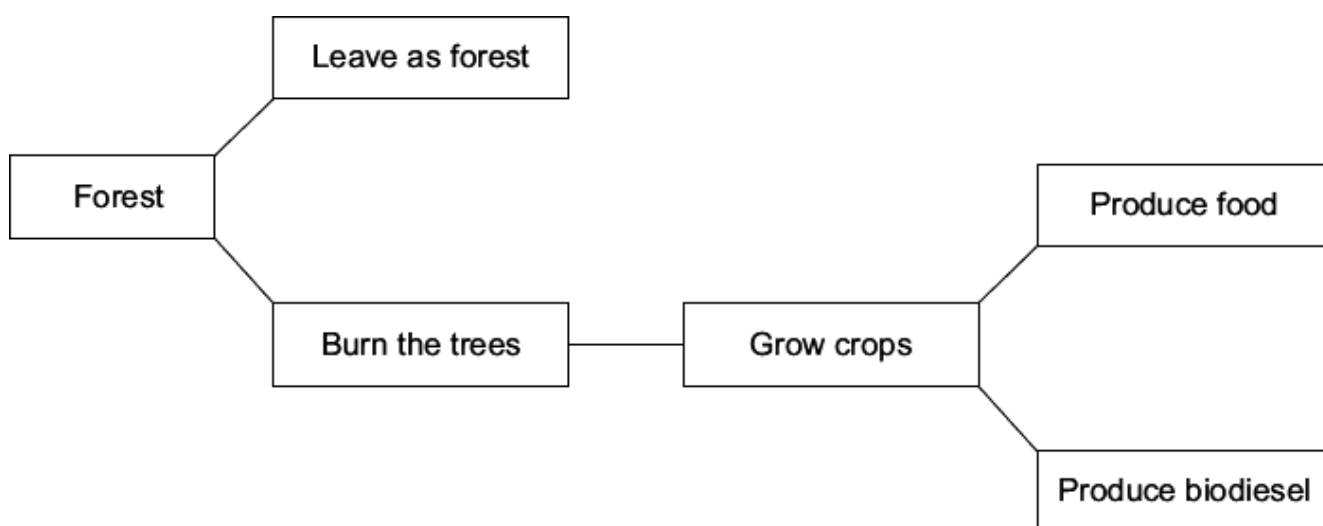
.....

.....

.....

(2)
(Total 11 marks)

- Q4.** 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)

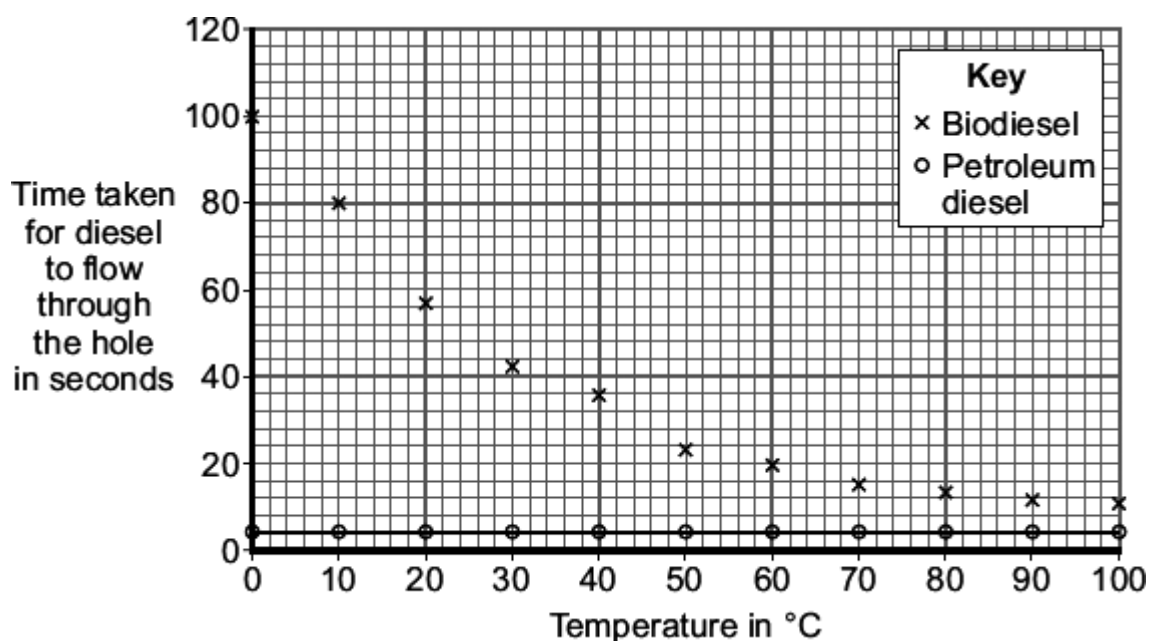
- (ii) causes economic concerns.

(1)
(Total 7 marks)

Q5. There are two main types of diesel fuel used for cars:

- biodiesel, made from vegetable oils
- petroleum diesel, made from crude oil.

- (a) A scientist compared the viscosity of biodiesel with petroleum diesel at different temperatures.
The scientist measured the time for the same volume of diesel to flow through a small hole in a cup.
The scientist's results are plotted on the grid.



- (i) Draw a line of best fit for the biodiesel results.

(1)

- (ii) What conclusions can the scientist make about the viscosity of biodiesel compared with the viscosity of petroleum diesel at different temperatures?

.....

.....

.....

(2)

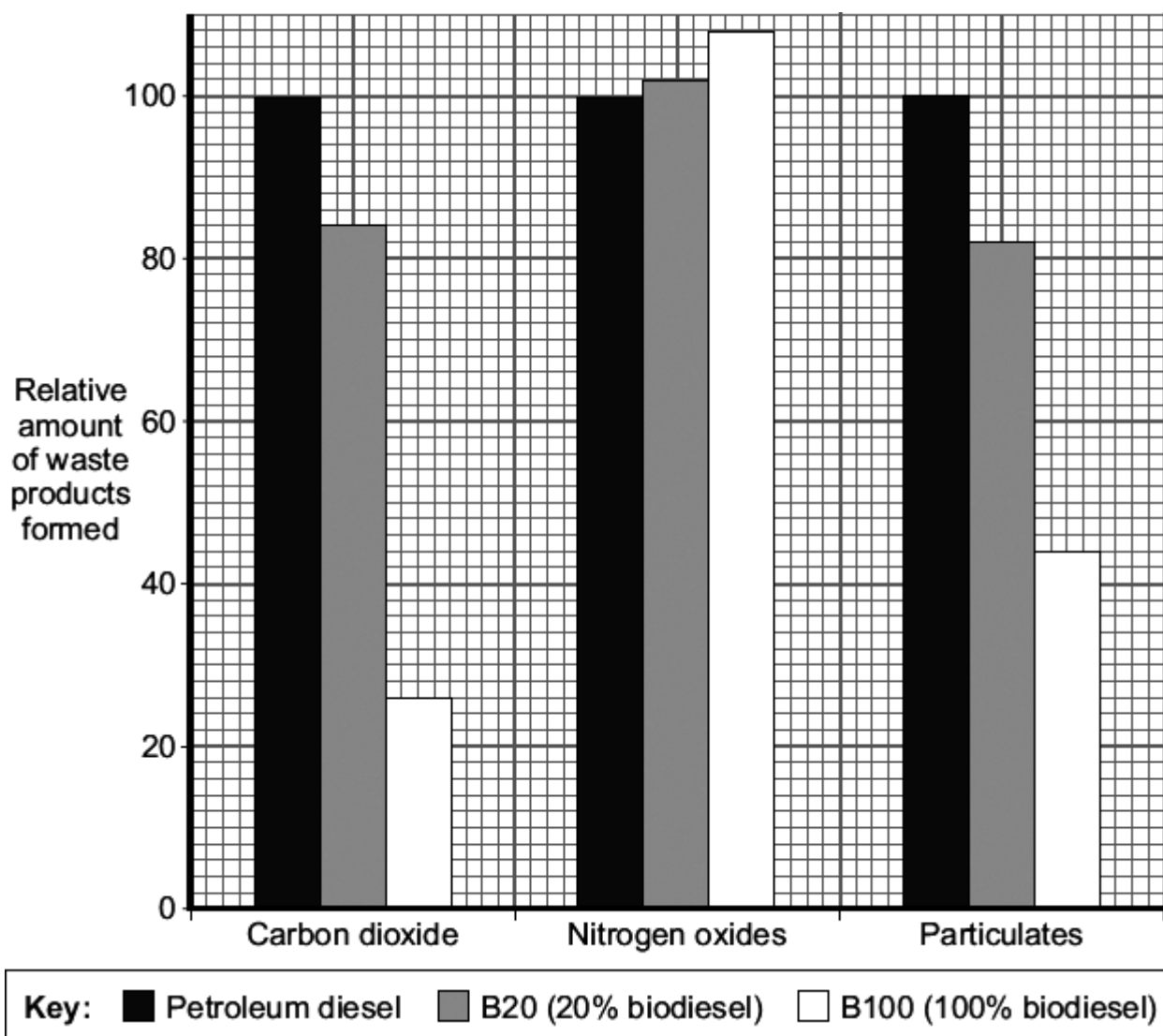
- (iii) Biodiesel may be less suitable than petroleum diesel as a fuel for cars.
Use these results to suggest **one** reason why.

.....

.....

(1)

- (b) Biodiesel can be mixed with petroleum diesel to make a fuel for cars.
In a car engine, the diesel fuel burns in air.
The waste products leave the car engine through the car exhaust system.
The bar chart compares the relative amounts of waste products made when three different types of diesel fuel burn in a car engine.



Nitrogen oxides and sulfur dioxide cause a similar environmental impact.

- (i) What environmental impact do particulates from car exhaust systems cause?

.....

(1)

- (ii) What is the percentage reduction in particulates when using B100 instead of petroleum diesel?

..... %

(1)

- (iii) Replacing petroleum diesel with biodiesel increases one type of environmental pollution.

Use the bar chart and the information given to explain why.

.....

.....

.....

.....

(2)

- (iv) A carbon neutral fuel does **not** add extra carbon dioxide to the atmosphere.

Is biodiesel a carbon neutral fuel?

Use the bar chart and your knowledge to explain your answer.

.....

.....

.....

.....

(2)

(Total 10 marks)

- Q6.** About 3000 million years ago, carbon dioxide was one of the main gases in the Earth's atmosphere.

About 400 million years ago, plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

- (a) Describe and explain how the composition of the Earth's atmosphere was changed by the formation of coal.

(3)

- Name **three** elements that are in this coal.

(2)

- (i) Many chemical reactions happen when this mixture is burned. The chemical equation represents one of these reactions.

Balance the chemical equation.



- (ii) Explain how the use of calcium carbonate in the mixture:

increases atmospheric pollution

Page 14

.....

.....

.....

decreases atmospheric pollution.

.....

.....

.....

.....

(4)
(Total 10 marks)