



1.

Older cars are tested each year to measure the amount of pollutants contained in exhaust fumes. The table below shows the maximum allowed percentages of exhaust pollutants for petrol cars.

Age of car in years	Maximum allowed percentage (%) of exhaust pollutant	
	Carbon monoxide	Unburned hydrocarbons
16–24	0.30	0.02
3–16	0.20	0.02

(a) Explain how carbon monoxide is produced when petrol is burned in car engines.

(2)

(b) Suggest **two** reasons why the maximum allowed percentage of carbon monoxide has been decreased for newer cars.

1. _____

2. _____

(2)

(c) Give **one** reason for having a maximum allowed percentage of unburned hydrocarbons in exhaust fumes.

(1)

Oxides of nitrogen are also pollutants contained in exhaust fumes.



(d) Describe how oxides of nitrogen are produced when petrol is burned in car engines.

(2)

Catalytic converters are fitted to car exhausts to reduce the amount of pollutants released into the atmosphere.

(e) Nitrogen dioxide is an oxide of nitrogen.

Nitrogen dioxide reacts to produce nitrogen and oxygen in catalytic converters.

Complete the equation for this reaction.

The equation should be balanced.



(2)

(f) Give **two** effects of atmospheric pollution which are reduced by using catalytic converters.

1.

2.

(2)



(g) The catalyst in catalytic converters is a mixture of three elements.

Where in the periodic table are these elements most likely to be found?

Tick **one** box.

Alkali metals

Halogens

Noble gases

Transition metals

(1)

(Total 12 marks)

2.

Coal is used as a fuel in power stations.

The table shows the percentage of carbon and sulfur in four different coal samples.

Sample	Percentage (%) by mass in coal	
	Carbon	Sulfur
A	22.1	0.4
B	46.8	0.6
C	66.3	0.9
D	92.0	0.7

(a) Sulfur produces a gas that causes acid rain.

Name the gas.

(1)

(b) Give **one** environmental effect caused by acid rain.

(1)



(c) Which coal sample produces the most acid rain from 1 kg of coal?

Use the table above.

Give a reason for your answer.

Sample _____

Reason _____

(2)

(d) Calculate the mass of coal sample **A** that would produce the same amount of carbon dioxide as 1 kg of coal sample **C**.

Mass of coal sample **A** = _____ kg

(2)

(e) Incomplete combustion of coal can produce carbon monoxide.

Carbon monoxide is a toxic gas.

Give **two** reasons why people may be unaware of the presence of carbon monoxide.

1. _____

2. _____

(2)

(Total 8 marks)

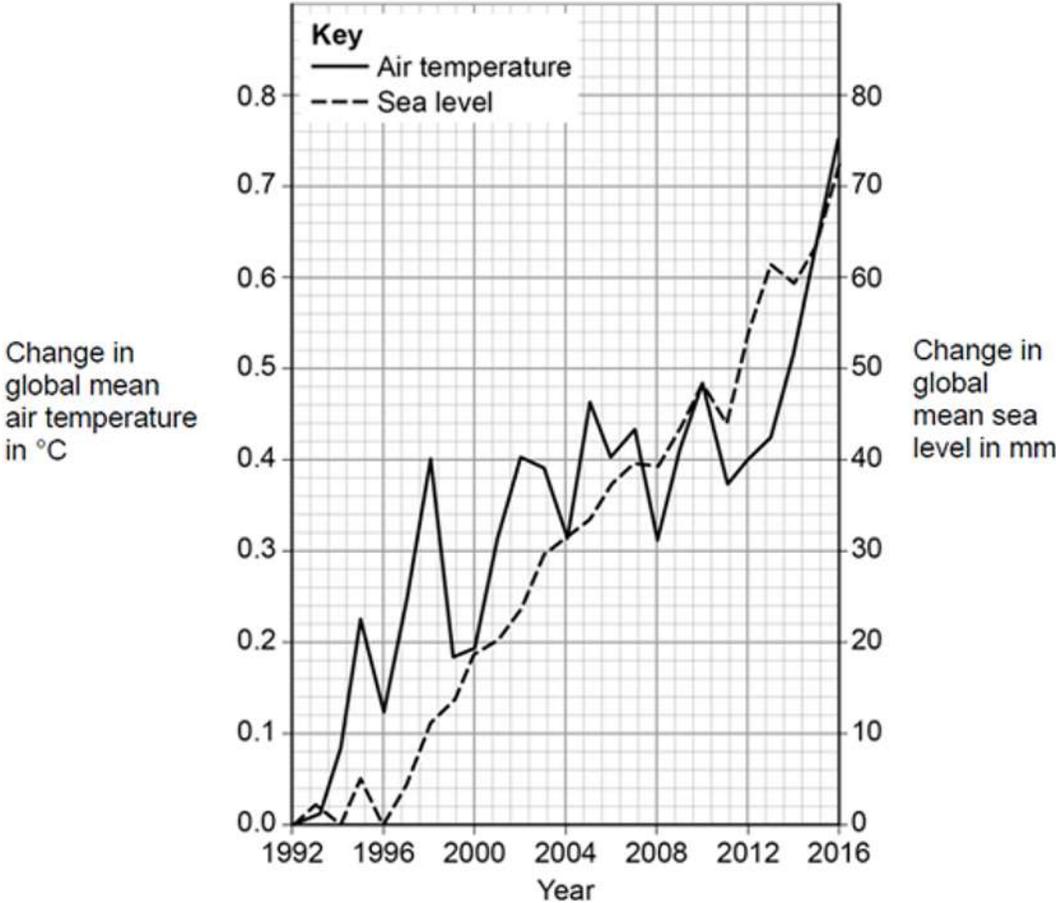
3.

This question is about climate change.



Figure 1 shows the changes in the global mean air temperature and global mean sea level from 1992 to 2016.

Figure 1



(a) Calculate the mean yearly increase in sea level between 1992 and 2016.

Use **Figure 1**.

Mean yearly increase in sea level = _____ mm / year

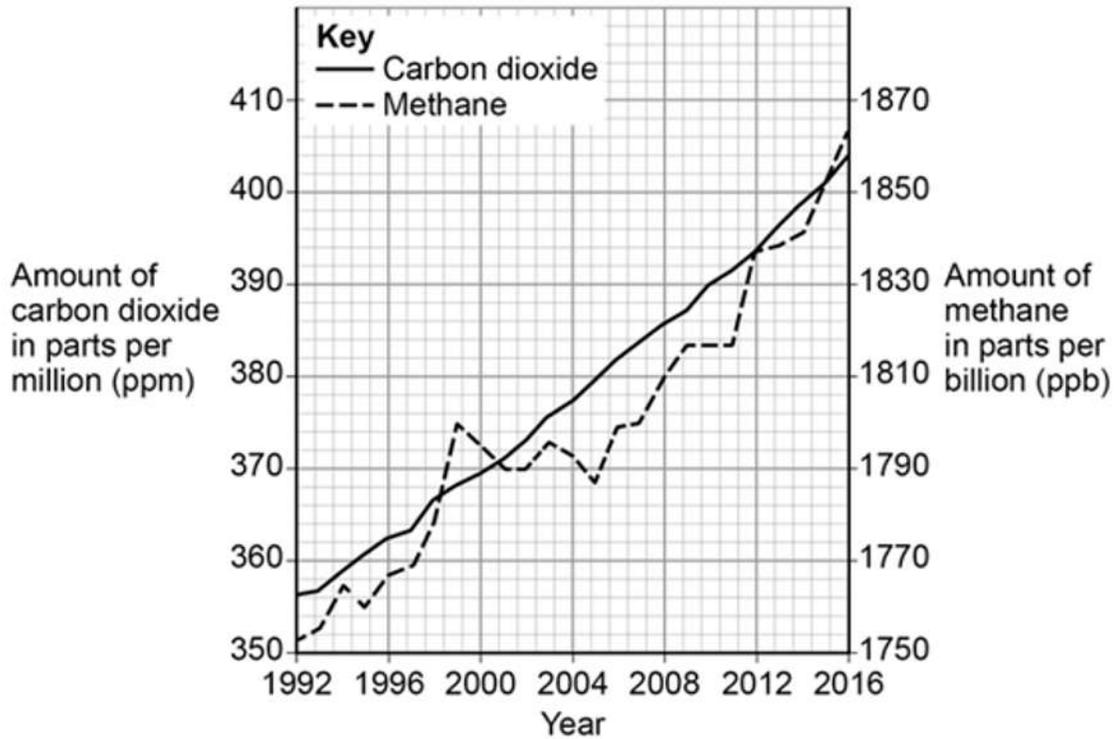
(2)

Most scientists think carbon dioxide and methane are a cause of global climate change.



Figure 2 shows the amounts of these gases in the atmosphere from 1992 to 2016.

Figure 2



(b) Describe the changes in **Figure 1** and in **Figure 2**.

Explain how these changes have taken place.

(6)

(c) The data was collected by a single scientific group.

Give **two** reasons why more evidence is needed to support any conclusions made by this scientific group.

1. _____

2. _____

(2)

(Total 10 marks)

4.

Sulfur is a non-metal.

Sulfur burns in the air to produce sulfur dioxide, SO₂



(a) Why is it important that sulfur dioxide is **not** released into the atmosphere?

Tick (✓) **one** box.

Sulfur dioxide causes acid rain.

Sulfur dioxide causes global dimming.

Sulfur dioxide causes global warming.

(1)

(b) Sulfur dioxide dissolves in water.

What colour is universal indicator in a solution of sulfur dioxide?
Give a reason for your answer.

(2)

(c) Sulfur dioxide is a gas at room temperature.

The bonding in sulfur dioxide is covalent.

Explain, in terms of its structure and bonding, why sulfur dioxide has a low boiling point.

(3)

(d)



Sulfur dioxide is produced when fossil fuels are burned.

It is important that sulfur dioxide is not released into the atmosphere.

Three of the methods used to remove sulfur dioxide from gases produced when fossil fuels are burned are:

- wet gas desulfurisation (**W**)
- dry gas desulfurisation (**D**)
- seawater gas desulfurisation (**S**).

Information about the three methods is given in the bar chart and in **Table 1** and **Table 2**.

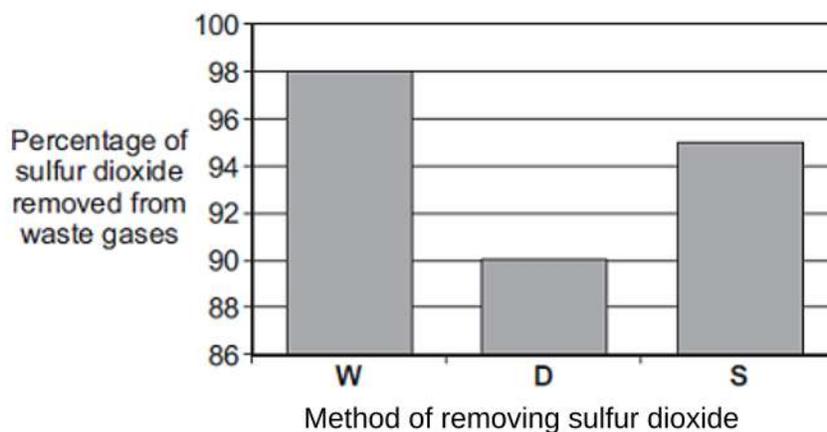


Table 1

Method	Material used	How material is obtained
W	Calcium carbonate, CaCO_3	Quarrying
D	Calcium oxide, CaO	Thermal decomposition of calcium carbonate: $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$
S	Seawater	From the sea

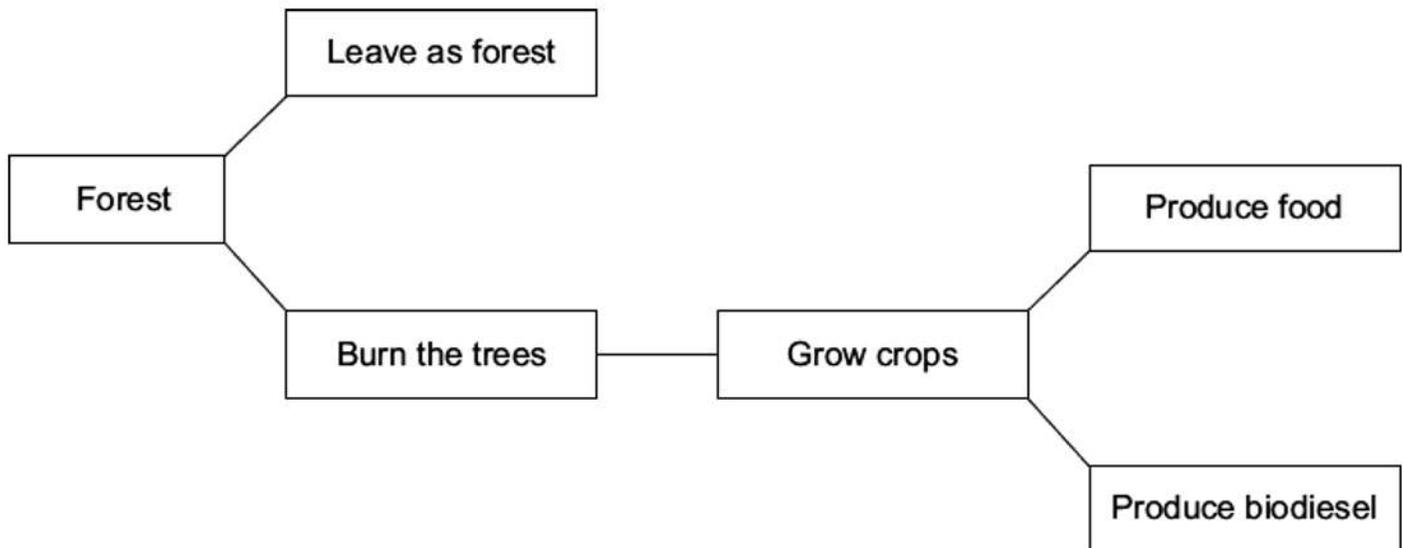
5.

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)