1 The Earth's atmosphere today has changed, when compared with the Earth's earliest atmosphere.

(a) Two processes that caused changes were the cooling of the atmosphere and photosynthesis.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

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(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

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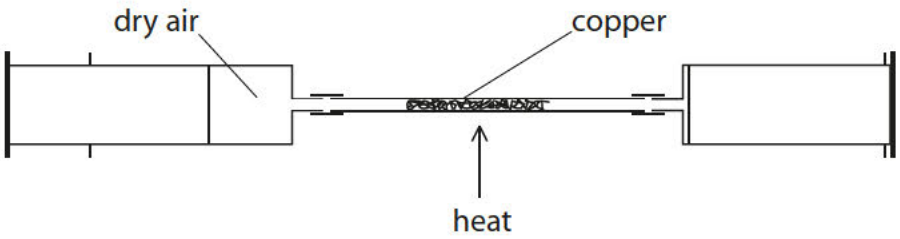
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(b) In an experiment, dry air is passed backwards and forwards over hot, excess copper in the apparatus shown.

The oxygen in the air reacts with the hot copper to form copper oxide, CuO.



(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

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(ii) When the copper has reacted with all the oxygen, the apparatus is allowed to cool.

The initial volume of dry air in the apparatus was 50 cm^3, measured at room temperature and pressure.
During the experiment the volume of gas in the apparatus decreased.

Calculate the final volume of gas remaining in the apparatus after allowing it to cool to room temperature.
(percentage of oxygen in dry air is 21%)

(2)

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final volume of gas remaining in apparatus = ... cm^3

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

After the reaction between dry air and copper is complete, most of the gas remaining in the apparatus is

(1)

☐ **A** argon

☐ **B** carbon dioxide

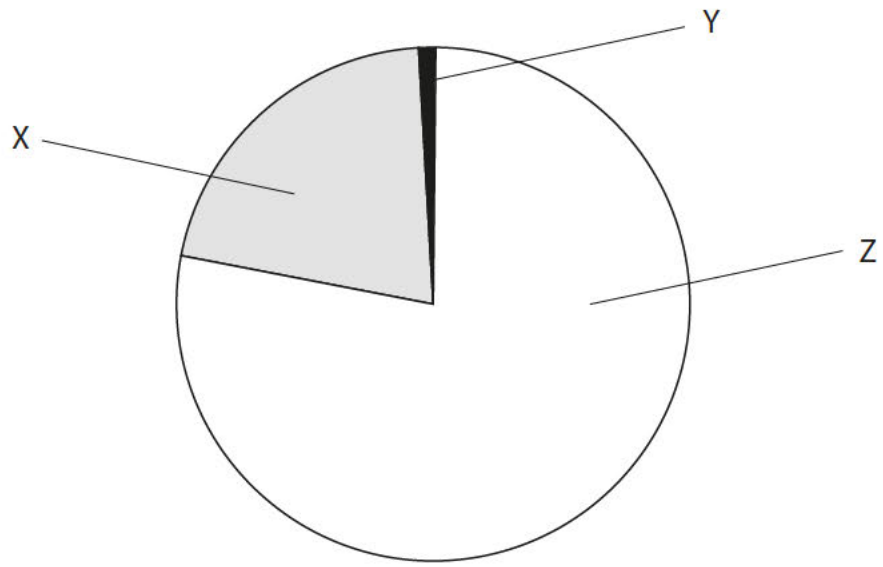
☐ **C** nitrogen

☐ **D** oxygen

(Total for Question 1 = 9 marks)

2 The Earth's atmosphere today contains a mixture of different gases.

(a) The pie chart shows the percentages of nitrogen, oxygen and other gases in the atmosphere.



Which row of the table identifies X, Y and Z correctly?

Put a cross (☒) in the box next to your answer.

(1)

	X	Y	Z
☐ **A**	oxygen	nitrogen	ot gases
☐ **B**	other gases	oxygen	nitrogen
☐ **C**	oxygen	other gases	nitrogen
☐ **D**	nitrogen	other gases	oxygen

(b) (i) The percentage of oxygen in the atmosphere has increased since the Earth's earliest atmosphere.

Describe the process that has caused this change.

(2)

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(ii) Describe a test to show a gas is oxygen.

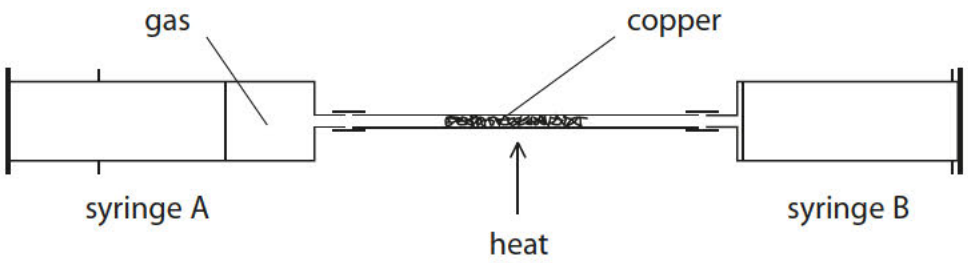
(2)

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(c) This apparatus is used to find the volume of oxygen in 100 cm^3 of air.



When heated, copper reacts with oxygen in the air to form copper oxide.

Syringe A contains 100 cm^3 of air, syringe B contains no air.
The hard glass tube contains excess copper.
The copper is heated strongly and the air is passed backwards and forwards over the copper until no more copper reacts.
The apparatus is then left to cool.

(i) State why an excess of copper must be used.

(1)

.....

.....

.....

(ii) Explain how this experiment can be used to find the volume of oxygen in 100 cm^3 of air.

(2)

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(Total for Question 2 = 8 marks)

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(i) The percentage of carbon dioxide in the Earth's atmosphere today is

(1)

☐ **A** greater than 5%

☐ **B** 4%

☐ **C** 3%

☐ **D** less than 0.5%

(ii) The percentage of carbon dioxide in the Earth's atmosphere today is less than that in the Earth's earliest atmosphere.
Explain what has caused the percentage of carbon dioxide to decrease.

(2)

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(iii) Carbon dioxide and other gases in the atmosphere help to keep the Earth warm.
State how these gases keep the Earth warm.

(1)

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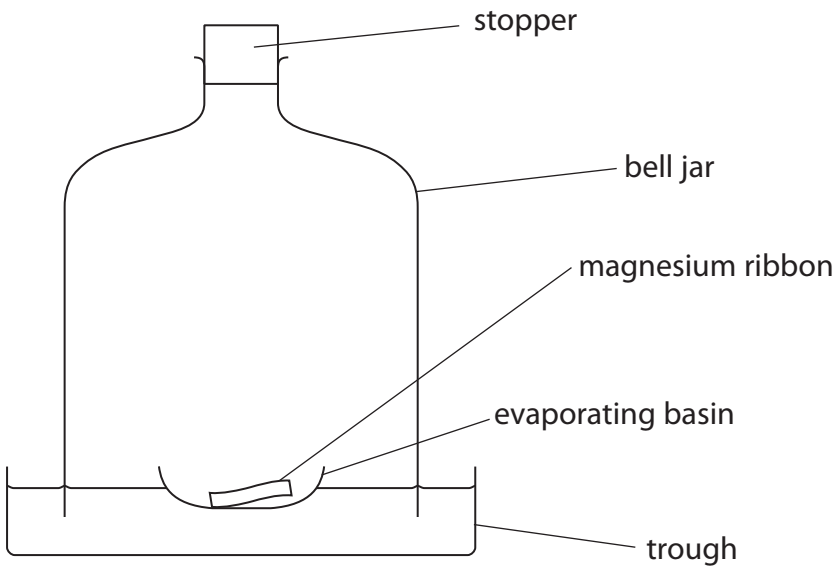
(b) Describe the test to show that a gas is oxygen.

(2)

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.....

(c) Magnesium reacts with oxygen to form magnesium oxide.
An excess of magnesium ribbon was placed in an evaporating basin that was floated on water in a trough.
The magnesium ribbon was lit.
A bell jar was placed over the evaporating basin and the stopper inserted to seal the experiment.



When the magnesium flame went out, there was some magnesium left in the basin.
When the apparatus had cooled, the water in the bell jar had risen.

(i) Explain why the water level had risen.

(2)

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(ii) At the start of the experiment, the volume of the air in the bell jar was 1000 cm^3.
Assume that 21% of the air by volume is oxygen.
Calculate the volume of gas that was present in the bell jar at the end of the experiment.

(2)

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.....

.....

volume of gas = ... cm^3

(d) Metal oxides react with acids to produce salts and water.
Dilute sulfuric acid was added to magnesium oxide.
State the name of the salt formed.

(1)

.....

(Total for Question 3 = 11 marks)

4 Scientists believe that, about 4500 million years ago, the Earth was very much hotter than it is now.
The atmosphere then was very different from that on Earth today.

(a) Explain why it is difficult to be precise about the composition of the Earth's early atmosphere.

(2)

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(b) As the Earth cooled, oceans formed.

How did this affect the composition of the atmosphere?

(1)

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.....

(c) The first plants appeared about 400 million years ago.

Explain how the growth of these plants affected the composition of the atmosphere.

(2)

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(d) What is the current approximate percentage of carbon dioxide in the Earth's atmosphere?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** 0.04

☐ **B** 1.0

☐ **C** 4.0

☐ **D** 10

(e) The amount of carbon dioxide in the Earth's atmosphere has been rising over the past fifty years, mainly caused by an increase in the quantity of fossil fuels that have been burned.

State another cause of increasing amounts of carbon dioxide in the atmosphere.

(1)

.....

.....

(Total for Question 4 = 7 marks)

5 This question is about changes to the Earth's atmosphere.

(a) Which of the following is a correct statement about the relative amounts of carbon dioxide and oxygen in the Earth's early atmosphere?

(1)

- ☐ **A** large amount of carbon dioxide and large amount of oxygen
- ☐ **B** large amount of carbon dioxide and small amount of oxygen
- ☐ **C** small amount of carbon dioxide and large amount of oxygen
- ☐ **D** small amount of carbon dioxide and small amount of oxygen

(b) Several processes change the composition of the Earth's atmosphere.

Describe how the composition of the atmosphere is affected by burning fossil fuels.

(2)

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(c) The graphs in Figure 1 and Figure 2 show the concentration of carbon dioxide in the atmosphere and the mean global temperature between 1960 and 2000.

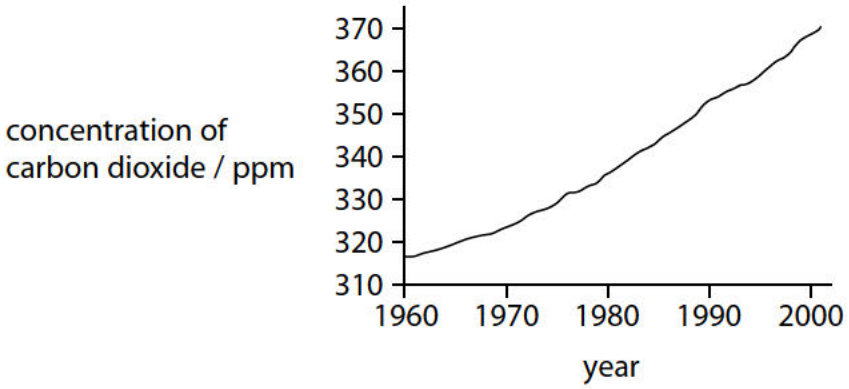


Figure 1

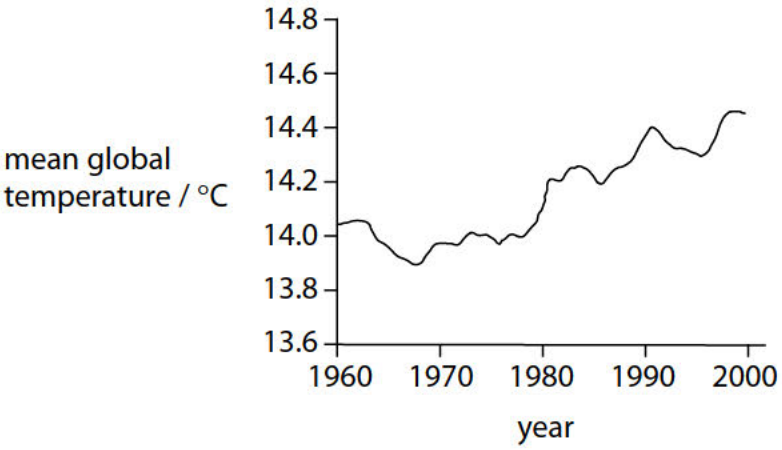


Figure 2

Explain whether these graphs provide evidence that an increase in carbon dioxide is causing the Earth's temperature to rise.

(2)

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(d) Which of these pairs of gases are both greenhouse gases?

(1)

☒ **A** nitrogen and methane

☒ **B** nitrogen and oxygen

☒ **C** oxygen and water vapour

☒ **D** water vapour and methane

(Total for Question 5 = 6 marks)

6 A student used the internet to find information about the percentages of different gases in the Earth's early atmosphere.
She was surprised to find the information given on two websites was very different.

The information from the two websites is shown in the table.

website 1		website 2	
gas	**percentage gas in atmosphere (%)**	**gas**	**percentage gas in atmosphere (%)**
hydrogen	60	carbon dioxide	92.2
water vapour	20	nitrogen	5.1
carbon dioxide	10	sulfur dioxide	2.3
hydrogen sulfide	6	hydrogen sulfide	0.2
nitrogen	3	ammonia	0.1
methane	1	methane	0.1

(a) One of the gases in the table is present in a much larger amount in today's atmosphere.

State the name of this gas.

(1)

.....

(b) A gas not named in the table makes up about 21% of today's atmosphere.

State the name of this gas.

(1)

.....

(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

The amount of carbon dioxide in the early atmosphere was reduced by

(1)

- ☐ **A** animals breathing
- ☐ **B** volcanic activity
- ☐ **C** deforestation
- ☐ **D** the gas dissolving in oceans

(d) The information given on two websites is very different.

Explain why it is difficult to be certain about the composition of the Earth's early atmosphere.

(2)

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(e) In an experiment to find the percentage of oxygen in the air, some copper was heated in 50.0 cm^3 of dry air.

All of the oxygen in this sample of air reacted to form copper oxide.

After the reaction, the volume of gas remaining was 41cm^3.

(i) Calculate the percentage of oxygen in this sample of air.

(2)

% oxygen = ...

(ii) The word equation for the reaction is

copper + oxygen → copper oxide

Balance the equation for this reaction by putting numbers in the spaces provided.

(1)

.....Cu + O_2 → .....CuO

(Total for Question 6 = 8 marks)