

Atmosphere 3

Name: _____

Class: _____

Date: _____

Time: **75 minutes**

Marks: **68 marks**

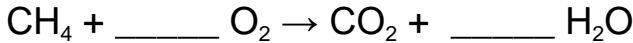
Comments:

1.

The combustion of fuels is a source of atmospheric pollutants.

(a) Methane is a fuel.

Balance the equation for the combustion of methane.



(1)

(b) Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

The table below shows properties of petrol and of diesel.

| | Petrol | Diesel |
|--|---------------|---------------|
| Range of number of carbon atoms in a hydrocarbon molecule | 4 to 12 | 12 to 20 |
| Range of boiling points in °C | 40 to 205 | 250 to 350 |

Compare the properties of petrol and diesel.

Use the table above.

(2)

(c) The gases released when a fuel is burned in car engines may include:

- oxides of nitrogen
- carbon monoxide
- water vapour.

Which chemical element do all these gases contain?

Tick (✓) **one** box.

Carbon

Hydrogen

Nitrogen

Oxygen

(1)

(d) When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

(1)

(e) When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

(1)

(f) Carbon monoxide may be produced when diesel burns.

Give **one** reason why carbon monoxide is difficult to detect.

(1)

(g) Explain why water vapour and **not** liquid water is produced when diesel burns.

(2)

(h) Sulfur is a common impurity in diesel.

Explain why this causes an environmental problem.

(3)

(Total 12 marks)

2.

An increase of greenhouse gases in the Earth's atmosphere is causing global warming.

Global warming is causing global climate change.

(a) Give **one** effect of global climate change.

(1)

(b) Explain how greenhouse gases cause global warming.

(4)

(c) Explain how planting trees reduces global warming.

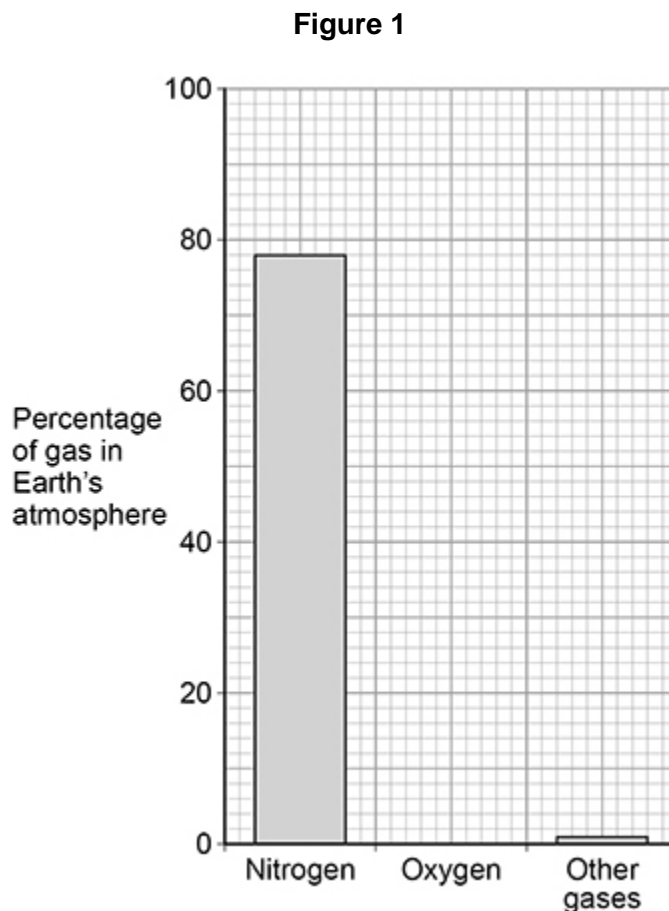
(3)

(Total 8 marks)

3. This question is about the Earth's atmosphere.

(a) The Earth's atmosphere contains 21% oxygen.

Draw the bar for oxygen on **Figure 1**.



(1)

(b) What is used to test for oxygen gas?

Tick (✓) **one** box.

A burning splint

A glowing splint

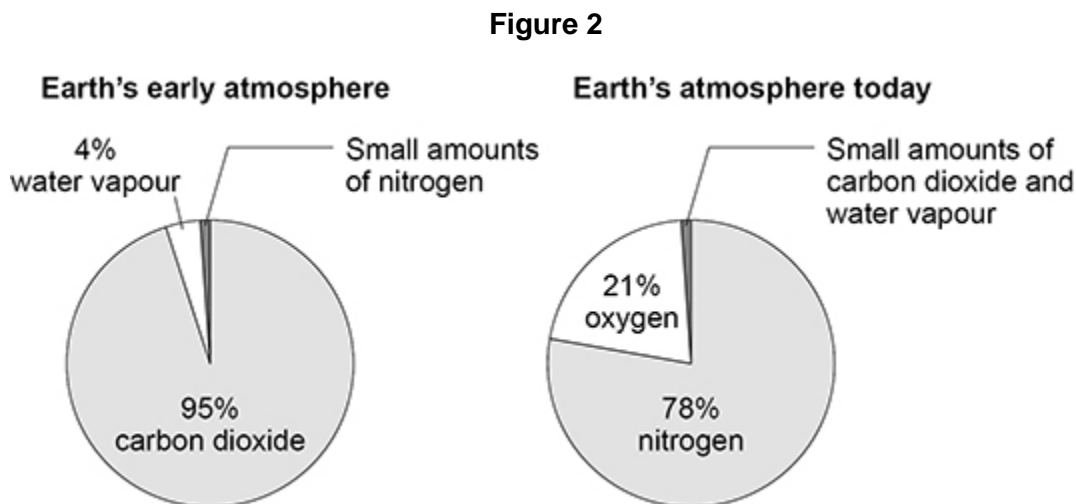
Damp litmus paper

Limewater

(1)

The Earth's early atmosphere was very different from the Earth's atmosphere today.

Figure 2 shows the composition of the Earth's early atmosphere and of the Earth's atmosphere today.



- (c) The percentages of nitrogen and oxygen in the Earth's atmosphere today are different from the Earth's early atmosphere.

Complete the sentences.

Choose answers from the box.

Use **Figure 2**.

Each answer can be used once, more than once or not at all.

| | | |
|------------------|------------------|------------------------|
| decreased | increased | stayed the same |
|------------------|------------------|------------------------|

Since the Earth's early atmosphere, the percentage of nitrogen in the Earth's atmosphere has _____.

Since the Earth's early atmosphere, the percentage of oxygen in the Earth's atmosphere has _____.

(2)

(d) The Earth's atmosphere today contains a small amount of carbon dioxide.

Why has the percentage of carbon dioxide decreased since the Earth's early atmosphere?

Tick (✓) **two** boxes.

Dissolved in oceans

Formation of sedimentary rocks

Industrialisation

Respiration

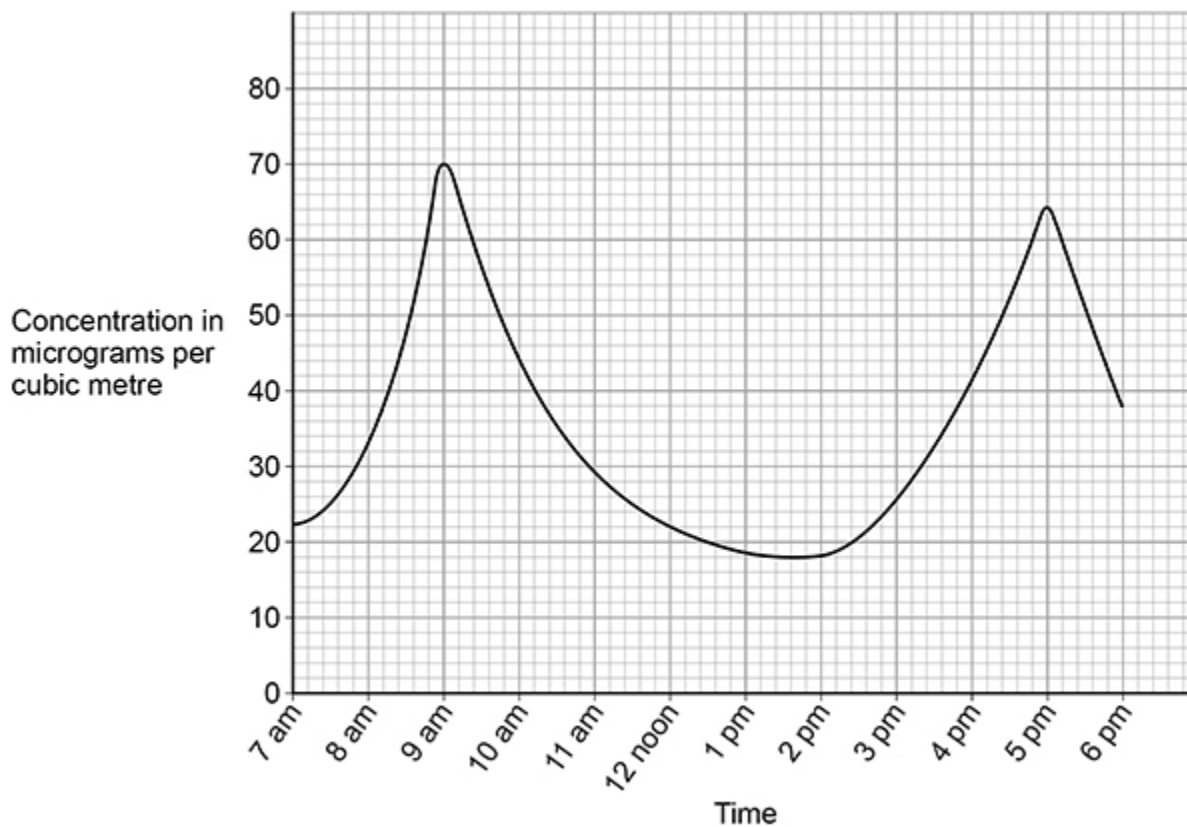
Volcanic activity

(2)

Oxides of nitrogen are produced when nitrogen reacts with oxygen in car engines.

Figure 3 shows the concentration of oxides of nitrogen in the atmosphere during one day in a city.

Figure 3



(e) Which **two times** have the highest concentrations of oxides of nitrogen in the atmosphere?

- 1. _____
- 2. _____

(2)

(f) Suggest why there are the highest concentrations of oxides of nitrogen at these times.

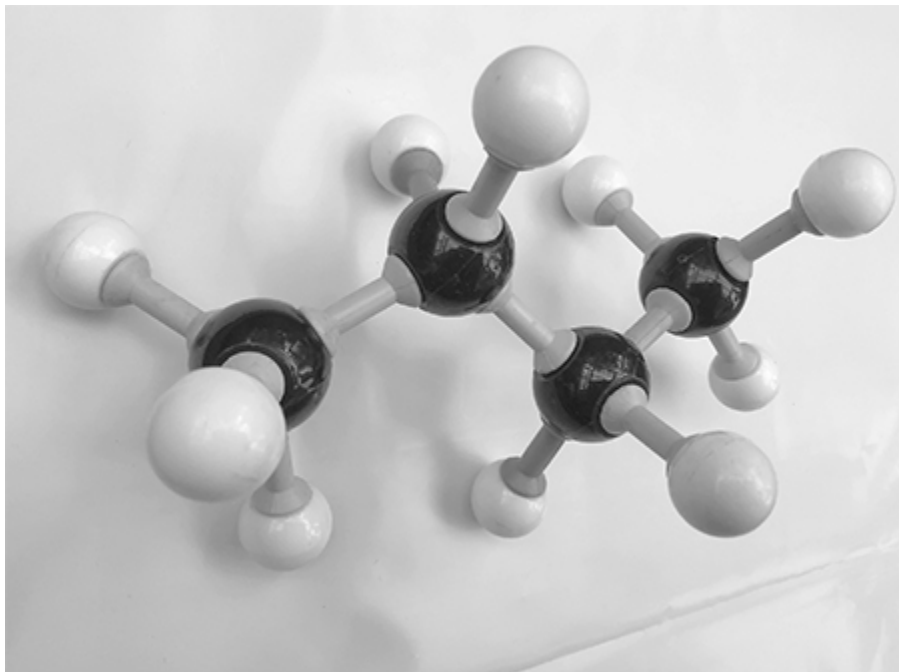
(1)

(Total 9 marks)

4.

This question is about hydrocarbons and the uses of hydrocarbons.

(a) The figure below shows a model of an alkane.



What is the name of the alkane in the figure above?

(1)

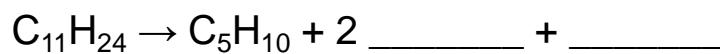
(b) What is a hydrocarbon?

(1)

Large hydrocarbon molecules are cracked.

(c) When C₁₁H₂₄ is cracked, three products are formed.

Complete the equation for the reaction.



(2)

(d) Explain why **one** of the products of cracking is in high demand.

(2)

5.

An increase in greenhouse gases in the Earth's atmosphere causes an increase in global temperature.

(a) An increase in global temperature is a major cause of climate change.

Give **two** effects of global climate change.

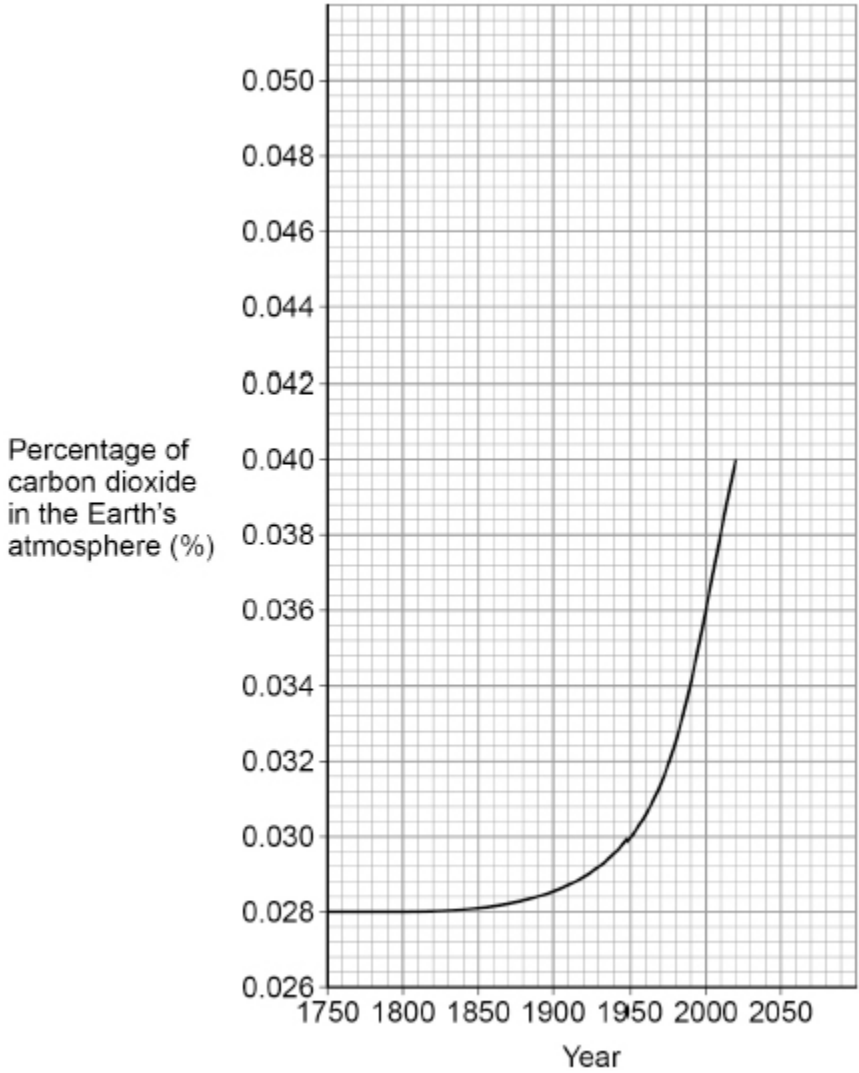
1 _____

2 _____

(2)

Carbon dioxide is a greenhouse gas.

The graph below shows the percentage of carbon dioxide in the Earth's atmosphere from 1750.



- (b) Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1750 to 2000.

Use the graph above.

(2)

- (c) Determine the change in the percentage of carbon dioxide in the Earth's atmosphere from 1950 to 2000.

Use the graph above.

Percentage of carbon dioxide in 1950 _____

Percentage of carbon dioxide in 2000 _____

Change in percentage of carbon dioxide = _____ %

(2)

- (d) Give **one** reason why the percentage of carbon dioxide in the atmosphere is changing.

(1)

- (e) Predict the percentage of carbon dioxide in the Earth's atmosphere in 2050.

You should extend the graph line on the graph above.

Percentage of carbon dioxide in 2050 = _____ %

(2)

(Total 9 marks)

6.

Cars cause atmospheric pollution.

Some car emissions contain nitrogen dioxide.

The table below shows the concentration of nitrogen dioxide in the air in three different areas for 1 week.

| Concentration of nitrogen dioxide in the air in arbitrary units | | | |
|--|-------------|-------------|----------|
| Day | City centre | Countryside | Motorway |
| Monday | 35 | 8 | 22 |
| Tuesday | 37 | 8 | 23 |
| Wednesday | 37 | 8 | 23 |
| Thursday | 34 | 8 | 23 |
| Friday | 37 | 8 | 23 |
| Saturday | 29 | 7 | 20 |
| Sunday | 22 | 6 | 17 |

(a) Which column of data has the greatest range?

Tick (✓) **one** box.

| | |
|-------------|--------------------------|
| City centre | <input type="checkbox"/> |
| Countryside | <input type="checkbox"/> |
| Motorway | <input type="checkbox"/> |

(1)

(b) Explain why the concentration of nitrogen dioxide in the air is lower on Sunday.

(2)

- (c) Calculate the mean value for the concentration of nitrogen dioxide in the air in the city centre for the days from Monday to Friday.

Use the table above.

Mean value for concentration of nitrogen dioxide = _____ arbitrary units

(2)

Nitrogen dioxide is removed from car emissions by catalytic converters.

- (d) Which **two** of the following are correct statements about catalysts?

Tick (✓) **two** boxes.

Catalysts are included in the chemical equation for a reaction.

Catalysts are **not** used up in a reaction.

Catalysts decrease the surface area of the reactants.

Catalysts increase the concentration of the reactants.

Catalysts lower the activation energy of a reaction.

(2)

- (e) The catalyst in catalytic converters contains platinum.

Platinum is an unreactive metal obtained from the Earth's crust.

Complete the sentence.

Choose the answer from the box.

| | | |
|------------------------|--------------------|---------------------------|
| finite resource | formulation | renewable resource |
|------------------------|--------------------|---------------------------|

Platinum is a _____.

(1)

(f) Emissions from cars that burn fossil fuels contain carbon dioxide.

What is used to test for carbon dioxide?

Tick (✓) **one** box.

Burning splint

Glowing splint

Limewater

(1)

(Total 9 marks)

7.

This question is about the atmospheres of Earth and Mars.

(a) Earth's early atmosphere may have been like the atmosphere of Mars today.

Why are scientists **not** certain about the percentage of gases in the Earth's early atmosphere?

(1)

(b) What was formed from the water vapour in the Earth's early atmosphere?

Tick (✓) **one** box.

Crude oil

Limestone

Natural gas

Oceans

(1)

(c) The Earth's atmosphere today consists mainly of nitrogen and oxygen.

Draw **one** line from each gas to what produced the gas.

| Gas | What produced the gas |
|------------|------------------------------|
| | Algae |
| Nitrogen | Animals |
| | Fossils |
| Oxygen | Oceans |
| | Volcanoes |

(2)

The table below shows the percentage of some gases in the atmospheres of Earth and Mars.

| Gas | Percentage of gas in atmosphere (%) | |
|----------------|--|-------------|
| | Earth | Mars |
| Argon | 0.9 | 1.9 |
| Carbon dioxide | 0.04 | 95 |
| Nitrogen | 78 | 2.6 |
| Oxygen | 21 | 0.2 |

(d) Why are animals **not** able to live on Mars?

Tick (✓) **one** box.

The atmosphere of Mars does not contain enough argon.

The atmosphere of Mars does not contain enough nitrogen.

The atmosphere of Mars does not contain enough oxygen.

(1)

(e) There is more carbon dioxide on Mars than on Earth.

Which **other** gas is found in larger quantities on Mars than on Earth?

(1)

(f) Calculate how many times more nitrogen than oxygen there is in the atmosphere of Earth.

Use the table above.

Give your answer to 2 significant figures.

Number of times more nitrogen than oxygen (2 significant figures) = _____

(3)

(Total 9 marks)

Mark schemes

1.

(a) $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$ 1

(b) hydrocarbon molecules in petrol have fewer carbon atoms than those in diesel 1

petrol has a lower boiling point (range) than diesel 1

allow converse throughout

allow petrol is more flammable than diesel

allow petrol is less viscous than diesel

(c) oxygen 1

(d) air
allow the atmosphere
allow from volcanoes 1

(e) global dimming 1

(f) (carbon monoxide is) colourless
or
(carbon monoxide is) odourless
ignore clear 1

(g) (diesel) burns at a high temperature
or
(diesel) burns at a temperature greater than 100 °C 1

(which is) above the boiling point of water 1

- (h) sulfur dioxide (is produced when diesel is burnt) 1
- (which causes) acid rain 1
- (which results in)
any **one** from:
- damage to buildings / statues / bridges
 - damage to trees / plants
 - damage to aquatic life
 - acidification of lakes / rivers / soil
 - respiratory problems
- allow (which affects) asthma*

1
[12]

2.

- (a) any **one** from:
- melting ice
 - rising sea levels
 - flooding
 - extremes of weather
 - loss of habitats
- ignore global warming*
- do **not** accept acid rain*
- do **not** accept global dimming*
- do **not** accept references to ozone*
- (b) (greenhouse gases) allow short wavelength radiation to enter the atmosphere 1
- (which are) absorbed by the earth **and** re-emitted as longer wavelength radiation 1
- (which is) absorbed by (greenhouse gases in) the atmosphere 1
- (this) increases the temperature leading to global warming 1
- allow uv / ultra-violet for short wavelength radiation*
- allow ir / infra-red for long wavelength radiation*
- ignore references to the ozone layer*

- (c) trees use carbon dioxide 1
 (for) photosynthesis 1
 (and) carbon dioxide causes global warming
allow (and) carbon dioxide is a greenhouse gas 1

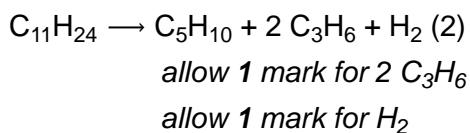
[8]

- 3.** (a) bar drawn to 21% 1
 (b) a glowing splint 1
 (c) (nitrogen) increased 1
 (oxygen) increased 1
 (d) dissolved in oceans 1
 formation of sedimentary rocks 1
 (e) 9 (am) 1
allow 0900
 5 (pm) 1
allow 1700
 (f) more cars / buses / lorries on the roads 1

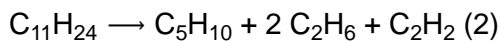
[9]

- 4.** (a) butane 1
 (b) (molecule) made up of carbon and hydrogen (atoms) only 1
 (c) $C_{11}H_{24} \rightarrow C_5H_{10} + 2 C_2H_4 + C_2H_6$
allow 1 mark for 2 C₂H₄
allow 1 mark for C₂H₆

OR



OR



allow 1 mark for 2 C₂H₆

allow 1 mark for C₂H₂

2

(d) C₂H₆ is useful as a fuel

allow smaller molecule so useful as a fuel

1

(because more) flammable (than larger molecules)

1

OR

C₂H₄ / C₃H₆ / C₅H₁₀ is used to make polymers (1)

allow C₂H₄ / C₃H₆ / C₅H₁₀ is used to make plastics

allow C₂H₄ / C₃H₆ / C₅H₁₀ is used to make other chemicals

(because more) reactive (than alkanes) (1)

if a named product is given, allow 1 mark for a correct use and 1 mark for a correct linked reason

(e) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons is given.

5-6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3-4

Level 1: Relevant points are made. They are not logically linked.

1-2

No relevant content

0

Indicative content

- production of plastic uses more hydrocarbons which are from non-renewable crude oil
- production of plastic produces more greenhouse gases in the atmosphere which contributes to global warming
- production of plastic produces more sulfur dioxide which causes acid rain
- production of plastic produces more oxides of nitrogen which cause acid rain and respiratory problems
- disposal of plastic produces more waste which increases landfill
- burning plastic produces fumes which are toxic so cause respiratory problems

- lifetime cost of plastic frames is less
- plastic frames have lower costs for maintaining

- the total energy consumption for plastic frames is greater than for wooden frames

- judgement

[12]

5.

(a) any **two** from:

- global warming
- melting polar ice caps
- rising sea levels
- flooding
- crop failure

or

famine

- extremes of weather
- loss of habitats

*do **not** accept acid rain*

*do **not** accept global dimming*

*do **not** accept references to ozone*

ignore temperature rise

2

(b) constant

allow no change

allow stays same

1

(then) increases

ignore values if given

1

- (c) (1950) 0.030
and
(2000) 0.036 1

$$(0.036 - 0.030) = 0.006 \text{ (\%)}$$

allow correct use of incorrectly determined percentage reading(s)

ignore + or - 1

- (d) any **one** from:
- combustion of fuel
allow any named activity which burns fuel
 - deforestation
 - population increase 1

- (e) extrapolation on graph 1

determine value from extrapolation at 2050

allow a value in the range 0.044 to 0.050

allow a tolerance of $\pm \frac{1}{2}$ a small square 1

[9]

6.

- (a) city centre 1

- (b) less traffic 1
allow fewer lorries / cars

(because) fewer people working

allow (because) no school

allow (because) businesses / factories closed 1

- (c) (mean =) $\frac{35 + 37 + 37 + 34 + 37}{5}$ 1

= 36 (arbitrary units) 1

- (d) catalysts are **not** used up in a reaction 1

catalysts lower the activation energy of a reaction 1

(e) finite resource

1

(f) limewater

1

[9]

7.

(a) any **one** from:

- occurred (4.6) billion years ago
- limited evidence

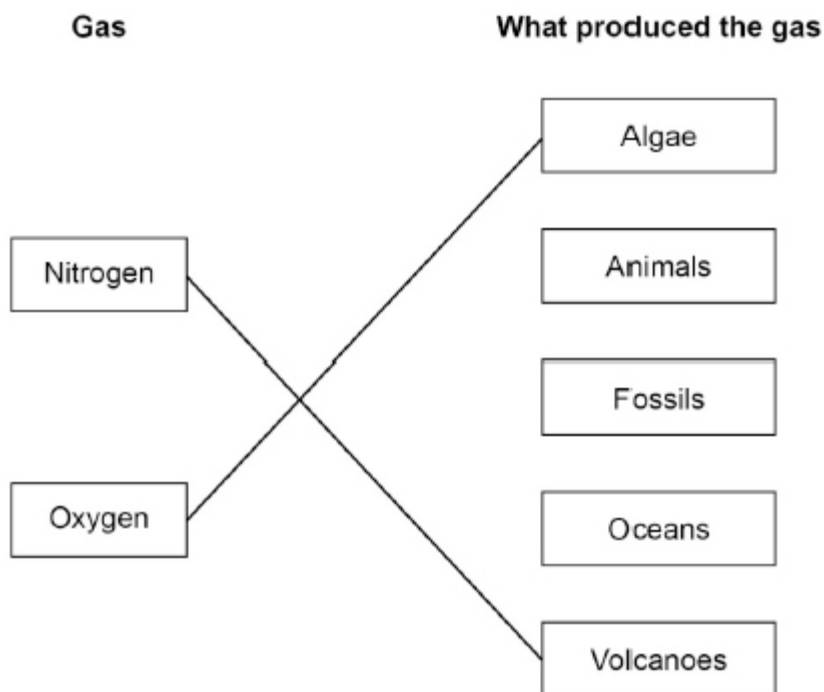
ignore nobody was there ignore no proof

1

(b) oceans

1

(c)



do **not** accept more than one line from a box on the left

1

1

(d) the atmosphere of Mars does not contain enough oxygen

1

(e) argon

allow Ar

1

(f) $\frac{78}{21}$

1

= 3.714

do **not** accept a subsequent step in the calculation

1

= 3.7

allow an answer correctly calculated to 2 significant figures which uses the values in the question

1

[9]