Atmosphere 1

Name: _____

Class: _____

Date: _____

Time: **67 minutes**

Marks: **62 marks**

Comments:

1. Screenwash is a mixture designed to keep car windscreens clean.

The components in screenwash include glycerol, methanol and water.

(a) Screenwash is made by mixing the components in carefully measured quantities so that the product has the required properties.

What name is given to this type of mixture?

Tick (✓) **one** box.

Catalyst ☐

Formulation ☐

Polymer ☐

(1)

(b) Glycerol has the formula $C_3H_8O_3$

How many atoms are there in one molecule of glycerol?

Tick (✓) **one** box.

3 ☐ 8 ☐ 11 ☐ 14 ☐

(1)

(c) Incomplete combustion happens when glycerol burns in limited oxygen.

Incomplete combustion produces carbon monoxide gas.

Why can the production of carbon monoxide gas be a problem?

Tick (✓) **one** box.

Carbon monoxide is a greenhouse gas. ☐

Carbon monoxide is a toxic gas. ☐

Carbon monoxide is an acidic gas. ☐

(1)

(d) Complete combustion happens when methanol (CH_4O) burns in excess oxygen.

Balance the equation for the reaction.

$$2\ CH_4O + 3\ O_2 \rightarrow \_\_\_\_\_\ CO_2 + 4\ H_2O$$

(1)

Methanol can be produced by the reaction of carbon dioxide with hydrogen.

(e) Describe the test for hydrogen gas.

Give the result of the test.

Test _____

_____

Result _____

_____

(2)

(f) Carbon dioxide is a greenhouse gas.

An increase in greenhouse gases in the atmosphere has led to an increase in average global temperature.

The increase in average global temperature has caused global climate change.

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

1 _____

_____

2 _____

_____

(2)

Anhydrous cobalt chloride can be used to test for water.

The word equation for the reaction is:

anhydrous cobalt chloride (blue) + water ⇌ hydrated cobalt chloride (pink)

(g) Suggest **one** observation that could be made when water is added to anhydrous cobalt chloride.

_____

_____

(1)

(h) The reaction between anhydrous cobalt chloride and water is exothermic.

What type of reaction is the reverse reaction?

_____

(1)

(Total 10 marks)

2. The proportions of most gases in the Earth's atmosphere have not changed much for the past 200 million years.

(a) About one-fifth of the atmosphere is oxygen.

Describe the test for oxygen gas.

Give the result of the test.

Test _____

_____

Result _____

_____

(2)

(b) The table below shows the percentages of some gases in the Earth's early atmosphere and in the Earth's atmosphere today.

	Percentage (%) of gas in the atmosphere	
Gas	**Earth's early atmosphere**	**Earth's atmosphere today**
Carbon dioxide	95	0.04
Nitrogen	3	78.0
Oxygen	Less than 1	21.0

Explain how the percentages of gases have changed from Earth's early atmosphere to Earth's atmosphere today.

You should refer to all three gases in the table above.

(6)

(c) Methane is a greenhouse gas.

Give **two** ways to reduce methane emissions into the atmosphere.

1 _____

_____

2 _____

_____

(2)

The percentage of sulfur dioxide in the Earth's atmosphere increased between 1850 and 1980.

(d) Describe how sulfur dioxide emissions are produced.

_____

_____

_____

_____

(2)

(e) Give **one** harmful effect of sulfur dioxide emissions.

_____

_____

(1)

(f) Suggest **one** reason why the percentage of sulfur dioxide in the Earth's atmosphere has decreased since 1980.

_____

_____

(1)

(Total 14 marks)

3. The Earth's atmosphere has changed during the last 4.6 billion years.

(a) What is the approximate percentage of nitrogen and of oxygen in the Earth's atmosphere today?

Draw **one** line from each gas to the percentage of that gas.

Gas	Percentage (%) of gas
Nitrogen	20
	40
Oxygen	60
	80

(2)

(b) The approximate percentage of carbon dioxide in the Earth's early atmosphere was 95%.

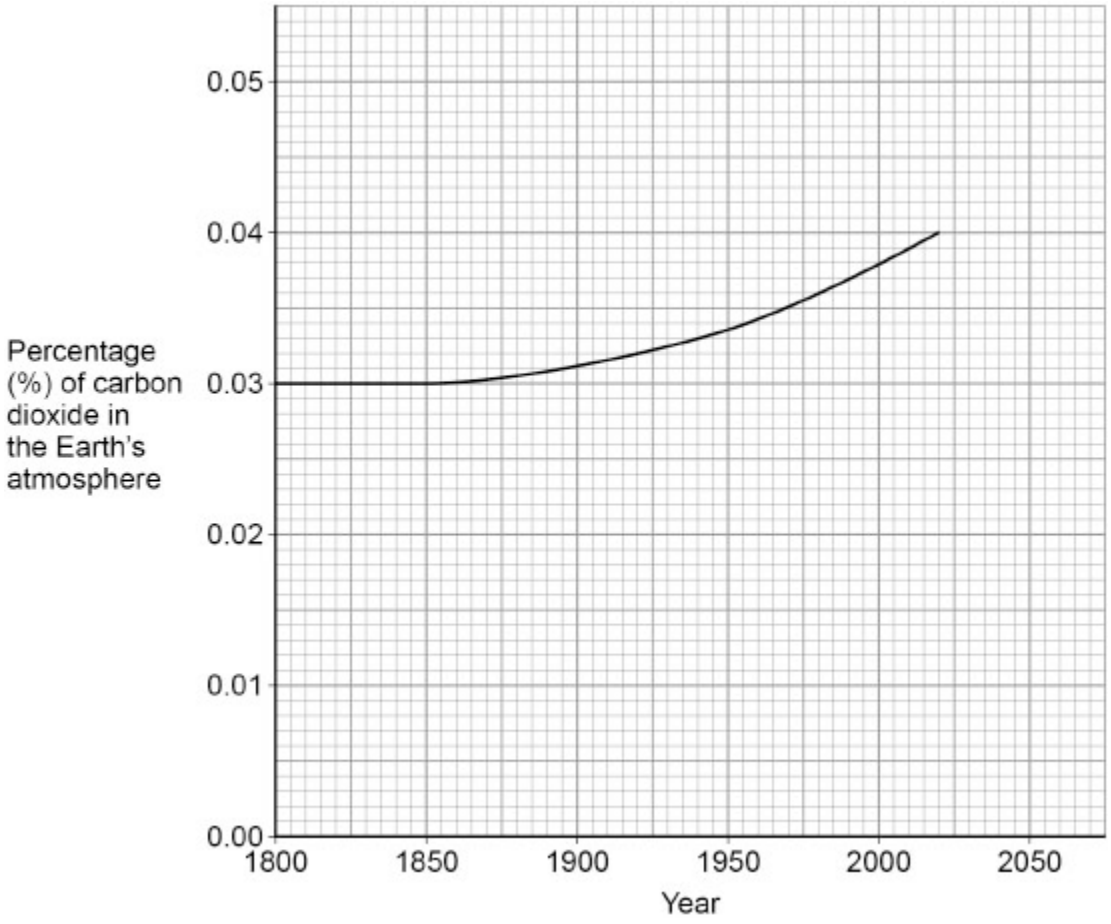
Which are **two** reasons why the percentage of carbon dioxide has **decreased** since the Earth's early atmosphere?

Tick (✓) **two** boxes.

- Combustion of fuels ☐
- Deforestation ☐
- Dissolving in oceans ☐
- Photosynthesis ☐
- Respiration ☐

(2)

(c) The figure below shows the change in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.



Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Use data from the figure above.

(3)

Carbon dioxide is a greenhouse gas.

(d) Which of the following is also a greenhouse gas?

Tick (✓) **one** box.

Argon ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

(1)

(e) Which of the following is an environmental problem caused by greenhouse gases?

Tick (✓) **one** box.

Acid rain ☐

Climate change ☐

Global dimming ☐

(1)

(f) Calculate the relative formula mass (M_r) of carbon dioxide (CO_2).

Relative atomic masses (A_r): C = 12 O = 16

_____

_____

_____

Relative formula mass of carbon dioxide = _____

(2)

(Total 11 marks)

4. The Earth's atmosphere is always changing.

(a) Gases in the Earth's early atmosphere caused changes on the Earth.

Draw **one** line from each change to the gas that caused the change.

Change	Gas that caused the change
	Ammonia
Oceans formed	Carbon dioxide
	Nitrogen
Sedimentary rocks formed	Oxygen
	Water vapour

(2)

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

Gas	**Percentage of gas in atmosphere (%)**	
	Earth	Mars
Argon	0.90	1.9
Carbon dioxide	0.04	95
Nitrogen	78	2.6
Oxygen	21	0.20

(b) Which gas has the highest percentage in the Earth's atmosphere?

_____

(1)

(c) Calculate how many times more carbon dioxide there is in the atmosphere of Mars than in the atmosphere of Earth.

Use the table above.

Give your answer in standard form.

_____

_____

_____

_____

_____

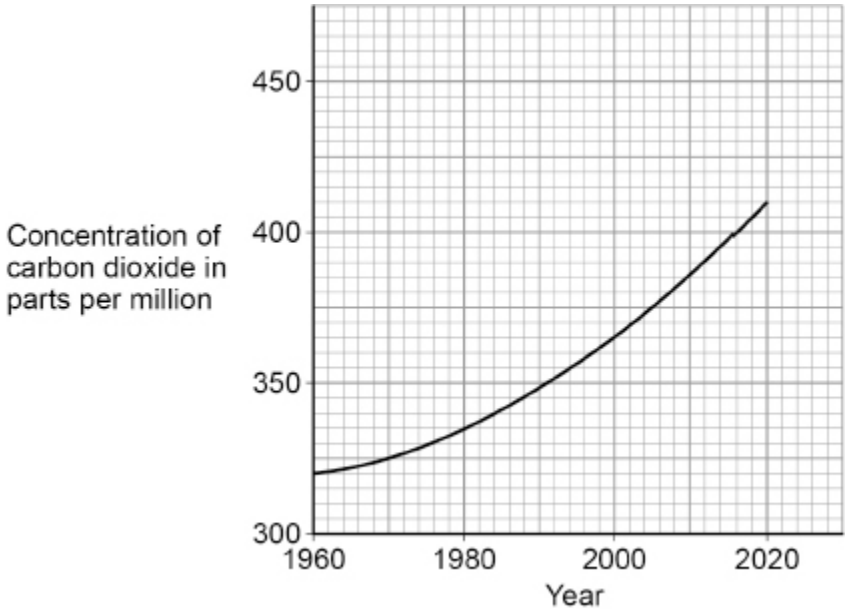
Number of times more carbon dioxide (in standard form) = _____

(3)

Carbon dioxide is a greenhouse gas.

(d) **Figure 1** shows the concentration of carbon dioxide in the Earth's atmosphere from 1960 to 2020.

Figure 1



How has the concentration of carbon dioxide in the Earth's atmosphere changed from 1960 to 2020?

Tick (✓) **one** box.

Decreased ☐

Stayed the same ☐

Increased ☐

(1)

(e) Cars emit carbon dioxide.

A car emits 17.2 kg of carbon dioxide on a journey.

There are four people in the car.

Calculate the mass of carbon dioxide emitted per person.

_____

_____

_____

Mass of carbon dioxide = _____ kg

(2)

(f) Planting trees helps to reduce climate change, because trees use carbon dioxide from the Earth's atmosphere.

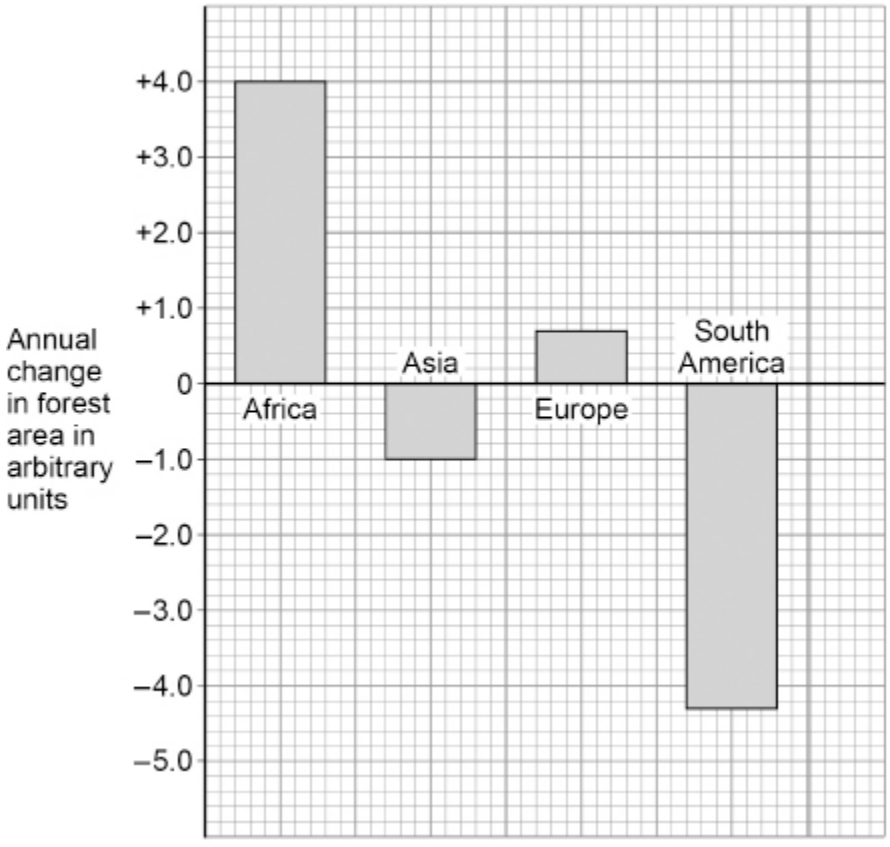
Name the process in trees which uses carbon dioxide.

_____

(1)

(g) **Figure 2** shows the annual change in forest area in four different parts of the world.

Figure 2



Give **two** conclusions about the annual change in forest area.

1 _____

_____

2 _____

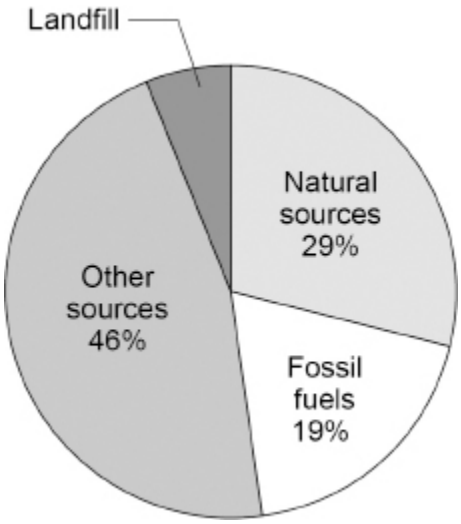
_____

(2)

(h) Methane is a greenhouse gas.

Figure 3 shows sources of methane emissions.

Figure 3



Determine the percentage (%) of methane emissions from landfill.

_____

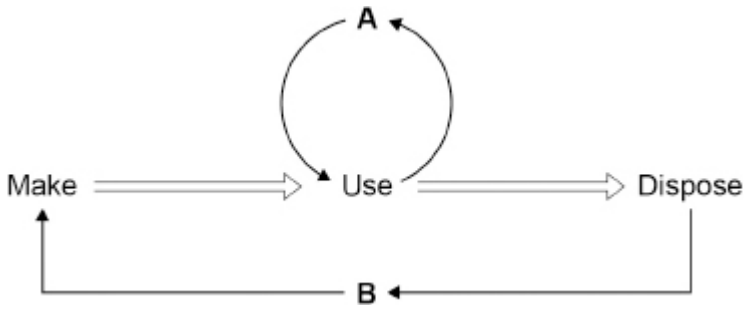
_____

Percentage = _____ %

(1)

(i) **Figure 4** shows two ways (**A** and **B**) of preventing used items going to landfill.

Figure 4



Name **A** and **B**.

Choose answers from the box.

recycle	reduce	release	reuse	reverse

A _____

B _____

(2)

(Total 15 marks)

5. Some fractions of crude oil are processed to produce fuel for transport.

(a) Describe how crude oil was formed.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Transport is a source of atmospheric pollutants.

(b) Suggest how sulfur dioxide can be produced by transport.

_____

_____

_____

_____

(2)

(c) Give **two** problems caused by sulfur dioxide as an atmospheric pollutant.

1 _____

_____

2 _____

_____

(2)

(d) Describe how carbon monoxide can be produced by transport.

_____

_____

_____

_____

(2)

(e) Catalytic converters are fitted to car exhausts to reduce the amount of pollution from cars.

Carbon monoxide and nitrogen dioxide (NO_2) react in a catalytic converter.

Nitrogen and carbon dioxide are produced.

Write a balanced equation for the reaction.

_____ + _____ → _____ + _____

(2)

(Total 12 marks)

1.

(a) formulation

1

(b) 14

1

(c) carbon monoxide is a toxic gas

1

(d) $2\ CH_4O + 3\ O_2 \rightarrow 2CO_2 + 4\ H_2O$

allow multiples

1

(e) (test)
add a burning splint

*do **not** accept glowing splint*

1

(result)
(hydrogen burns with) a pop sound

MP2 is dependent on MP1 being awarded

1

(f) any **two** from:

- melting ice caps
- rising sea levels
- more flooding
- extremes of weather

  allow increase in frequency of storms
- increase in droughts

  allow desertification
- increase in wildfires
- loss of habitats
- reduction in biodiversity
- change in migration patterns

*ignore global warming do **not** accept acid rain*

*do **not** accept global dimming*

*do **not** accept deforestation*

*do **not** accept natural disasters*

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

2

(g) colour change (from blue to pink)

1

(h) endothermic

allow (thermal) decomposition

1

[10]

2.

(a) (test)
glowing splint

*do **not** accept burning / lit splint*

1

(result)
relights

allow glows more brightly

MP2 is dependent upon MP1 being awarded

1

(b) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5-6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3-4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1-2

No relevant content

0

Indicative content

- **the percentage of carbon dioxide has decreased**
  - (because) carbon dioxide dissolved in the oceans
  - forming sediments
  - (because) algae / plants
  - photosynthesised
  - by the formation of sedimentary rocks
  - by the formation of fossil fuels
- **the percentage of nitrogen has increased**
  - (because) volcanic activity produced nitrogen
  - denitrifying bacteria released nitrogen
- **the percentage of oxygen has increased**
  - (because) algae / plants
  - photosynthesised

For **Level 3** answers must include each of the gases with an explanation for different gases

(c) any **two** from:

- reduce livestock farming

  allow reduction of specific animals / product
- reduce the number of rice / paddy fields

  allow reduce area of wetlands
- reduce the amount of rubbish going to landfill

  allow recycle more (so less rubbish to landfill)
- use methane from landfill as an energy source
- reduce fossil fuel use
- reduce the destruction of peat bogs

2

(d) fossil fuels (containing sulfur) are burnt

allow fuels containing sulfur are burnt

1

sulfur reacts with oxygen (to produce sulfur dioxide)

1

(e) any **one** from:

- respiratory problems
- acid rain

  allow immediate consequence of acid rain

1

(f) any **one** from:

- less use of fossil fuels (containing sulfur)

  allow any named fossil fuel

  allow less use of fuels containing sulfur

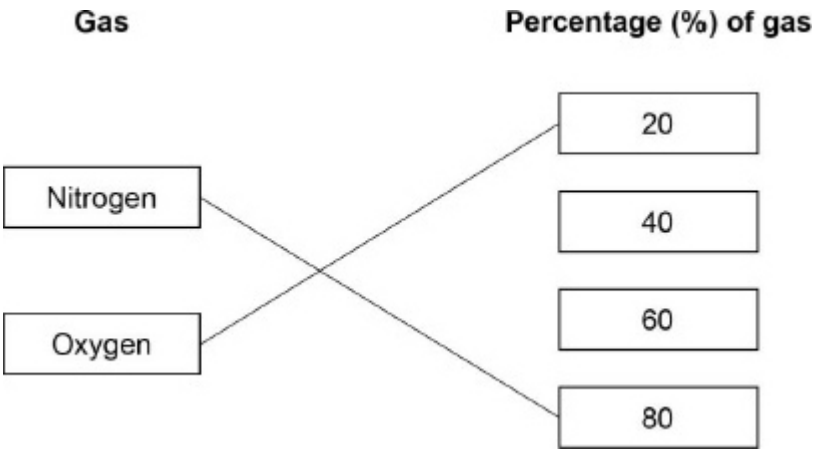
  allow increased use of renewable energy

  allow increased use of electric vehicles
- sulfur is removed from fossil fuels (before burning)
- sulfur dioxide is removed from waste gases (after burning)
- new legislation / regulations (since 1980)

1

[14]

3. (a)



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

2

(b) dissolving in oceans

1

photosynthesis

1

(c) (from 1800 carbon dioxide percentage is) constant

1

until 1850

allow a value in the range 1850 to 1865

1

(then) increases (to 2020)

1

(d) methane

1

(e) climate change

1

(f) (M_r =)
12 + (2 × 16)

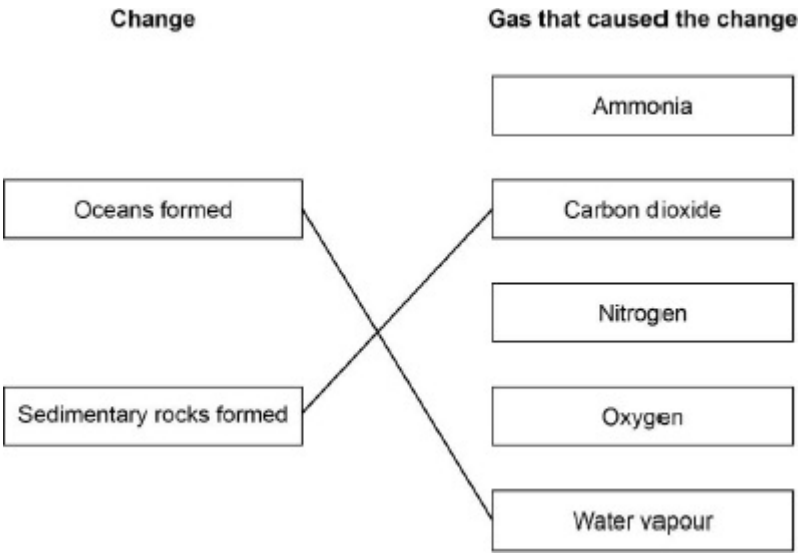
1

= 44

1

[11]

4. (a)



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

2

(b) nitrogen

1

(c) (number of times more =)

$$\frac{95}{0.04}$$

1

= 2375

1

= 2.375×10^3

allow a correctly calculated answer in standard form from an incorrect calculation which uses values given in the table

1

(d) increased

1

(e) (mass CO_2 =)

$$\frac{17.2}{4}$$

1

= 4.3 (kg)

1

(f) photosynthesis

1

(g) any **two** from:
(forest area)
- increases in Africa
- increases in Europe
- decreases in South America
- decreases in Asia

2

(h) 6 (%)

1

(i) (**A**) reuse

1

(**B**) recycle

1

[15]

5. (a) plankton (died)

allow (remains of) ancient biomass

1

and were buried (in mud)

allow and were buried (by sediments)

1

and were compressed

1

over millions of years

1

(b) (some) fuels contain sulfur

allow a named fossil fuel for fuels

1

(which) reacts with oxygen to produce sulfur dioxide

1

(c) acid rain

allow a specific effect of acid rain

1

respiratory problems (in humans)

allow named respiratory problem eg asthma

1

(d) fuels are burnt

allow a named fossil fuel for fuels

1

in insufficient / limited oxygen

allow (carbon monoxide is) produced by incomplete combustion

1

(e) $4\ CO + 2\ NO_2 \rightarrow N_2 + 4\ CO_2$

*allow for **1** mark*

$CO + NO_2 \rightarrow N_2 + CO_2$ with no / incorrect balancing numbers

2

[12]