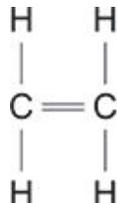


Questions are for both separate science and combined science students unless indicated in the question

Q1.

This question is about addition reactions.

The figure below shows the displayed structural formula of ethene.



- (a) Complete the sentence.

When bromine water is added to ethene, the bromine water changes from orange to

_____.

(1)

Chlorine reacts with ethene.

- (b) What is used to identify chlorine?

Tick (✓) **one** box.

A lighted splint

Damp litmus paper

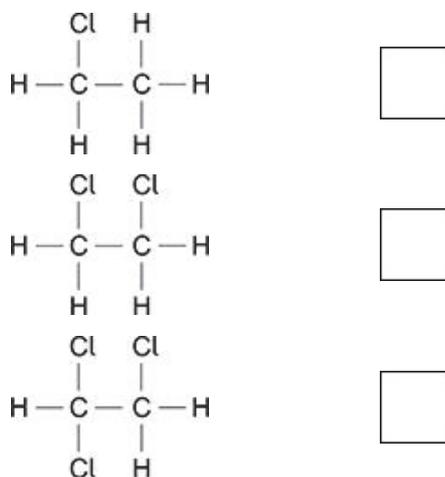
Limewater

(1)

- (c) Which of the following shows the displayed structural formula of the compound produced when chlorine reacts with ethene? (**chemistry only**)

Use the figure above.

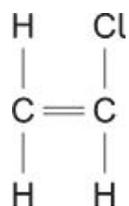
Tick (✓) **one** box.



(1)

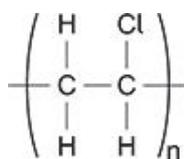
- (d) Chloroethene can be used to produce a polymer called poly(chloroethene).

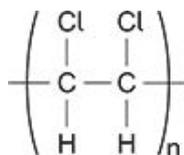
The displayed structural formula of chloroethene is

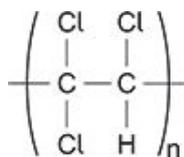


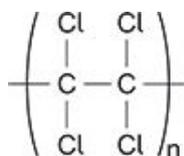
Which represents the structure of poly(chloroethene)? **(chemistry only)**

Tick (✓) **one** box.









(1)

Ethene can be used to produce another polymer called poly(ethene).

The table below shows information about poly(chloroethene) and poly(ethene).

	Poly(chloroethene)	Poly(ethene)
Density in g/cm ³	1.5	0.9
Temperature at which polymer completely melts in °C	260	120

- (e) Determine the simplest whole number ratio of the density of poly(chloroethene) : density of poly(ethene).

Simplest whole number ratio = _____ : _____

(3)

- (f) Poly(ethene) **and** poly(chloroethene) can both be used to make pipes.

Suggest why neither polymer is suitable for pipes carrying steam at a temperature of 300 °C.

Use the table above.

(1)

- (g) Poly(ethene) and paper can both be used to make shopping bags.

Poly(ethene) is produced from crude oil. Paper is produced from trees.

Suggest **one** reason why paper is more sustainable than poly(ethene) for making shopping bags.

(1)

(Total 9 marks)

Q2.

This question is about oxygen.

Scientists think that there was little or no oxygen in the Earth's early atmosphere.

- (a) Which planet today has an atmosphere that is similar to the Earth's early atmosphere?

Tick (✓) **one** box.

Jupiter	<input type="checkbox"/>
Mars	<input type="checkbox"/>
Neptune	<input type="checkbox"/>
Saturn	<input type="checkbox"/>

(1)

- (b) Which is the approximate percentage of oxygen in the Earth's atmosphere today?

Tick (✓) **one** box.

20%	<input type="checkbox"/>
50%	<input type="checkbox"/>
80%	<input type="checkbox"/>
100%	<input type="checkbox"/>

(1)

- (c) Which **two** of the following increased the percentage of oxygen in the Earth's atmosphere?

Tick (✓) **two** boxes.

Active volcanoes emitted gases

Algae and plants evolved

Animals evolved

Carbonate sediments formed in oceans

Photosynthesis took place

(2)

(d) Some scientists think that 1100 million years ago the Earth's atmosphere contained:

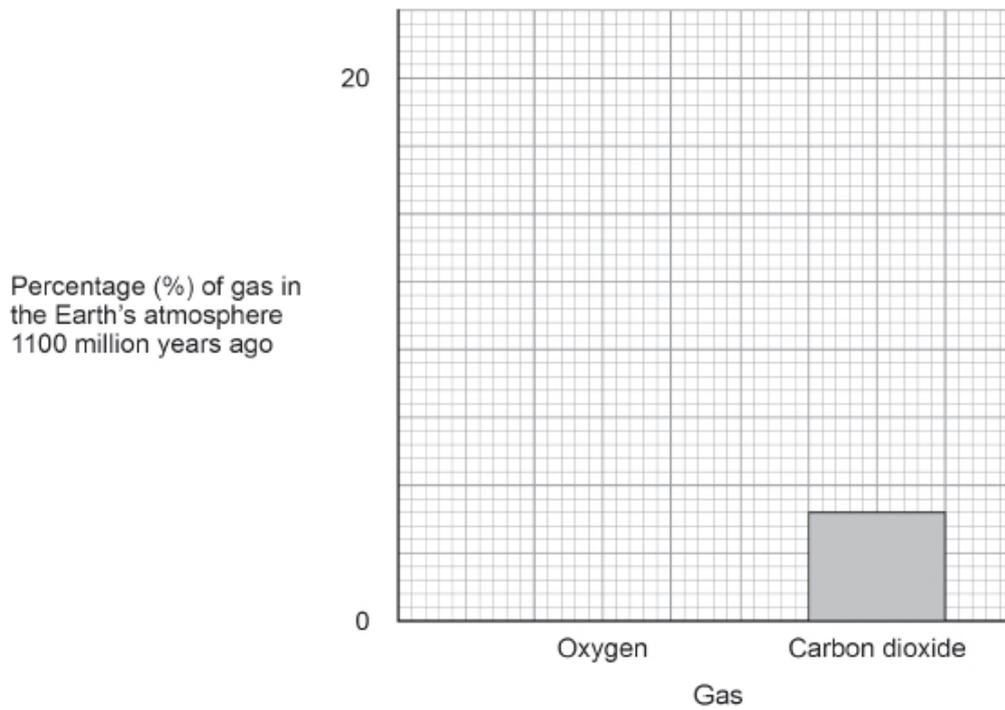
- 16% oxygen
- 4% carbon dioxide.

Complete **Figure 1**.

You should:

- complete the y-axis scale
- plot the percentage of oxygen in the Earth's atmosphere 1100 million years ago.

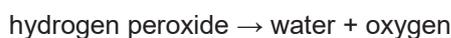
Figure 1



(2)

Oxygen is produced when manganese dioxide is added to hydrogen peroxide solution.

The equation for the reaction is:

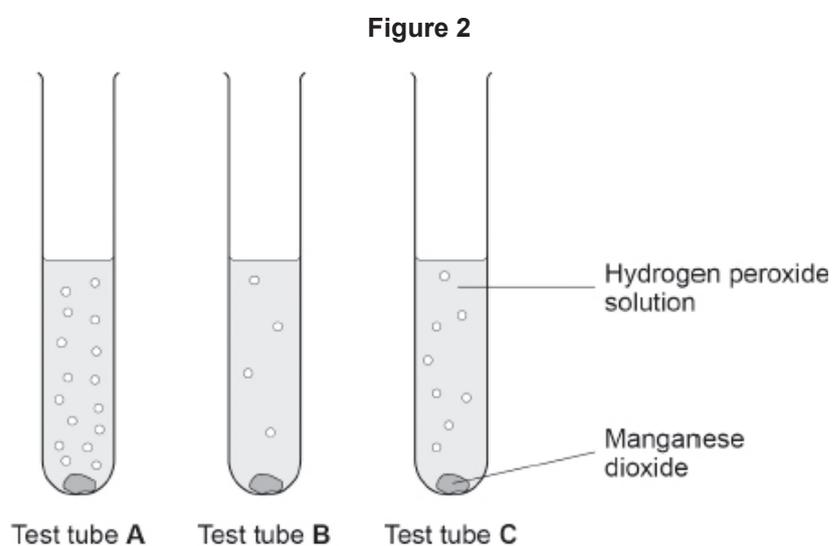


A student investigated the effect of changing the temperature on the decomposition of hydrogen peroxide.

This is the method used.

1. Add 5 cm³ of hydrogen peroxide solution to three test tubes labelled **A**, **B** and **C**.
2. Place each test tube in a water bath at a different temperature.
3. Add 0.2 g of manganese dioxide to each test tube.

Figure 2 shows the results.



(e) Which test tube contained hydrogen peroxide solution at the highest temperature?

Tick (✓) **one** box.

Test tube **A**

Test tube **B**

Test tube **C**

(1)

- (f) The student tested the gas produced.

What is used to prove that the gas is oxygen?

Tick (✓) **one** box.

A glowing splint

Bromine water

Damp litmus paper

(1)

- (g) Manganese dioxide does not appear in the chemical equation for this reaction.

Which is a correct statement about manganese dioxide in this reaction?

Tick (✓) **one** box.

Manganese dioxide increases the activation energy in this reaction.

Manganese dioxide is a catalyst in this reaction.

Manganese dioxide is used up during this reaction.

Manganese dioxide reduces the rate of this reaction.

(1)

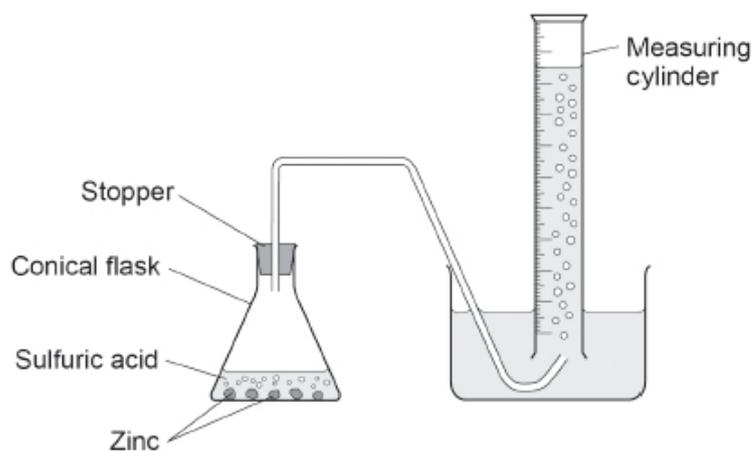
(Total 9 marks)

Q3.

A student investigated the rate of the reaction between zinc and sulfuric acid.

Hydrogen gas is produced during this reaction.

The figure below shows the apparatus.



This is the method used.

1. Add 50 cm³ of sulfuric acid to a conical flask.
 2. Add 2.0 g of zinc to the conical flask.
 3. Quickly put a stopper in the conical flask and start a timer.
 4. Measure the time taken to collect 20 cm³ of gas.
 5. Repeat steps 1 to 4 three more times.
- (a) Suggest why the stopper must be put in the conical flask as quickly as possible in **step 3**.

(1)

- (b) The student calculated the rate of the reaction for each trial.

The table below shows the results of the calculations.

	Trial 1	Trial 2	Trial 3	Trial 4
Rate of reaction in cm ³ /s	0.78	0.81	0.68	0.81

Determine the mean time taken to collect 20 cm³ of gas.

Do **not** include any anomalous results.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas collected}}{\text{mean time taken}}$$

Mean time taken = _____ s

(5)

- (c) The student changed the investigation so that the mean time taken to collect 20 cm³ of gas was greater.

Which **two** changes would increase the mean time taken to collect 20 cm³ of gas?

Tick (✓) **two** boxes.

Use a catalyst

Use a larger conical flask

Use a lower temperature

Use smaller pieces of zinc

Use sulfuric acid of a lower concentration

(2)

- (d) Hydrogen gas is produced during this reaction.

Describe the test for hydrogen gas.

Give the result of the test.

Test _____

Result _____

(2)

(Total 10 marks)