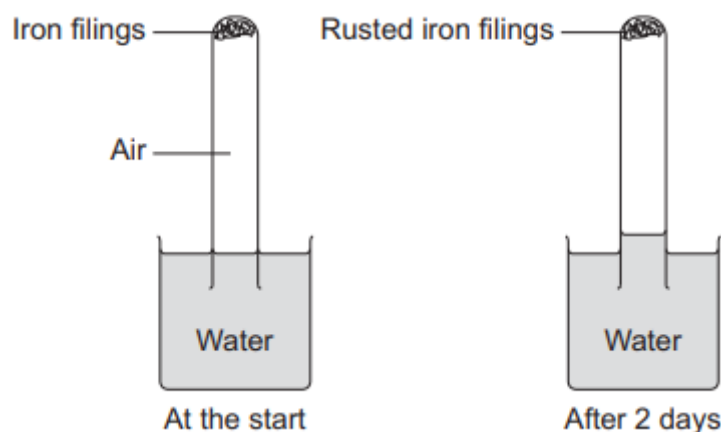


# RATE OF REACTION 3

**Q1.** The experiment below can be used to estimate the percentage of oxygen in the air.

- Damp iron filings are placed into a 150 mm long test tube.
- The test tube is inverted and then placed in a beaker of water.
- The test tube is then left for one week.
- The height of the water in the test tube is measured every day.

Rusting is a reaction between iron, oxygen and water. The water rises up the test tube to replace the oxygen that has reacted.



These are the results of the experiment.

Day	0	1	2	3	4	5	6	7
Height of the water in the test tube in mm	0	9	16	20	23	25	25	25

**(a)** At what height will the water be after another seven days?

- 1 25 mm
- 2 50 mm
- 3 just below the iron filings
- 4 the top of the test tube

(1 mark)

**(b)** In this experiment, the height of the water in the test tube is the dependent variable.

This is because . . .

- 1 it is dependent on an accurate measurement being carried out.

- 2 it changes due to the changes in another variable.
- 3 it is the value that is measured first.
- 4 it is not dependent on any other variable.

(1 mark)

**(c)** A student used the experiment described to find the percentage of oxygen in the air. He was unsure about his result. The student could check the reliability of the results by . . .

- 1 using fewer iron filings.
- 2 using colder water.
- 3 repeating the experiment.
- 4 using already rusted iron filings.

(1 mark)

**(d)** Another student did the experiment with more iron filings in the test tube.

One reason for doing this is because . . .

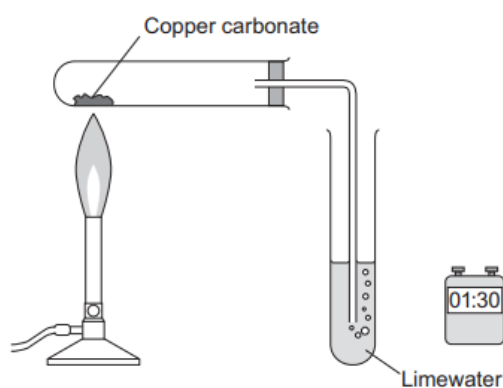
- 1 the reaction would be much slower.
- 2 the volume of oxygen reacting would be much greater.
- 3 there would be less air in the test tube.
- 4 it would confirm that all the oxygen had reacted.

(1 mark)

**Q2.** Carbon dioxide is produced when copper carbonate is heated.

A student investigated heating copper carbonate. The student used the apparatus to measure how long it took for carbon dioxide to be

produced. The student also noted what happened during each minute for three minutes.



(a) The student used changes to the limewater to measure how long it took for carbon dioxide to be produced. Describe how.

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(2 marks)

(b) The student wrote down her observations.

<b>Time interval in minutes</b>	<b>Observations</b>
Between 0 and 1	A slow release of gas bubbles. The limewater did not change. The solid in the test tube was green.
Between 1 and 2	A fast release of gas bubbles. The limewater changed at 1 minute 10 seconds.
Between 2 and 3	No release of gas bubbles. The solid in the test tube was black.

(i) Suggest the reason for the student's observations between 0 and 1 minute.

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(2 marks)

(ii) Explain the student's observations between 1 and 2 minutes.

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(2 marks)

(iii) Explain the student's observations between 2 and 3 minutes.

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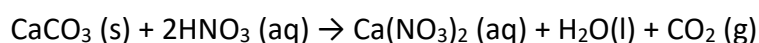
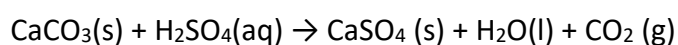
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(2 marks)

**Q3.** Reacting calcium carbonate with sulfuric acid gave different results to nitric acid.

The symbol equations for the reaction of calcium carbonate with sulfuric acid and with nitric acid are shown below.



Describe how the results for sulfuric acid are different and use the symbol equations to explain this difference.

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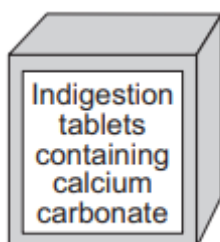
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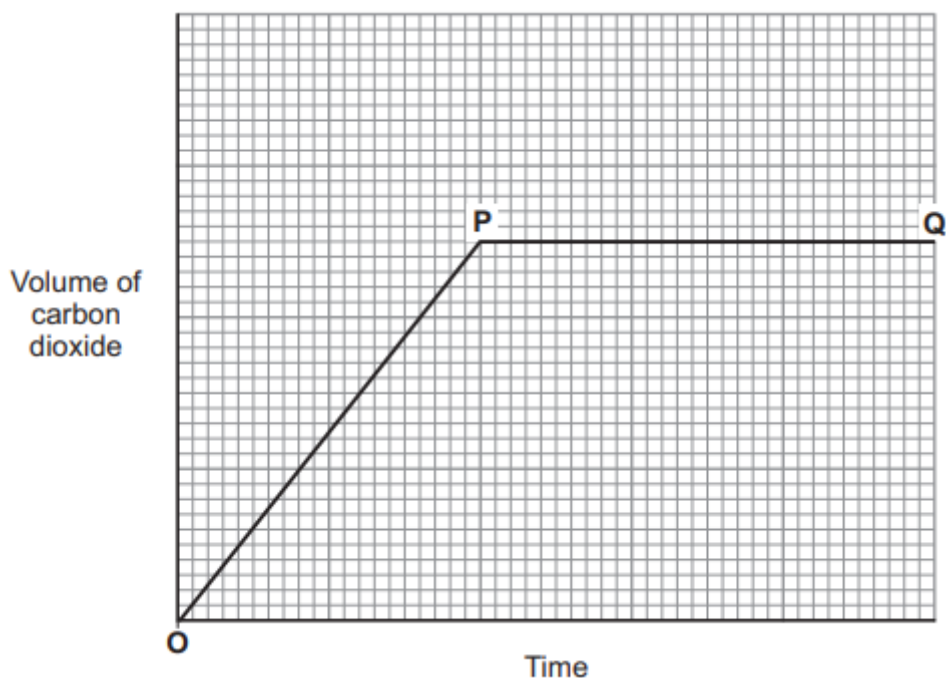
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(3 marks)

**Q4.** Human stomachs contain hydrochloric acid. Stomach ache can be caused by too much acid in the stomach. Indigestion tablets can be used to reduce the amount of acid in the stomach.



The graph shows how the volume of carbon dioxide produced changes with time, after some calcium carbonate is added to hydrochloric acid.



(i) Complete the sentence to explain what happens between O and P.

Between O and P the calcium carbonate and hydrochloric acid \_\_\_\_\_

(1 mark)

(ii) Complete the sentence to explain what happens at P.

At P the calcium carbonate and hydrochloric acid \_\_\_\_\_ because

\_\_\_\_\_.

(2 marks)

Total marks (18)