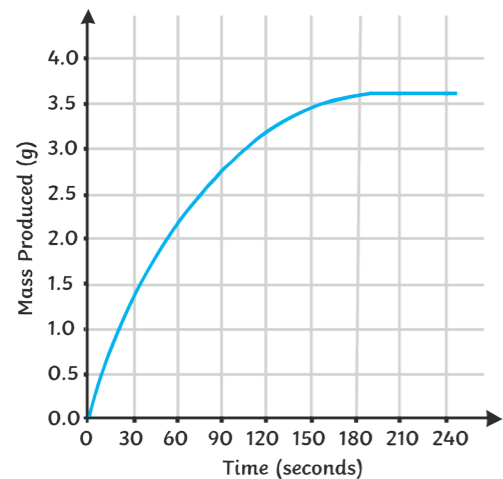


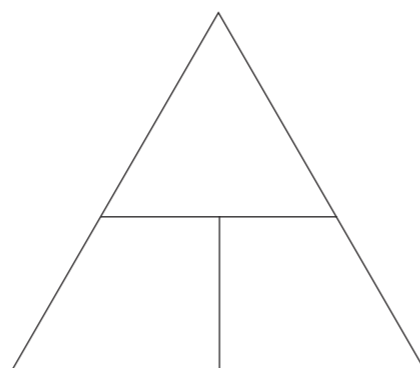
Describe in detail what the rate of reaction graph shows.



Why does it have this shape?

Complete the formula triangle to show the formula for calculating rates of reaction.

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$



Calculate the rate of reaction when:

The amount of product made is 650g and it takes 50 seconds to produce. Show your working out.

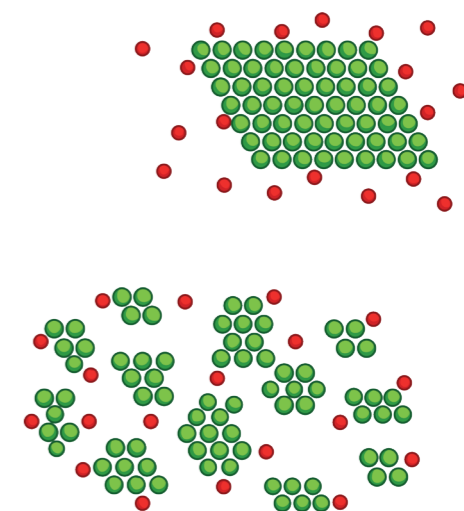
Describe how increasing the surface area of a solid reactant affects the rate of reaction.

Why does this happen?

Write down the definition of a catalyst.

How do catalysts work?

Discuss, in terms of collision theory, what happens to particles when they are heated.



Describe how sodium thiosulfate can react with HCl in a practical. Write it step by step.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

Explain what happens when a reaction is in equilibrium.

Why can reactions only reach equilibrium in a closed system?

What does this symbol show?



What is Le Chatelier's Principle?

Give an example of a condition that could be changed.

When concentration increases explain why rate of reaction increases. Use diagrams to help you explain.



**a** Describe how marble chips and hydrochloric acid can react to produce carbon dioxide. Write it step by step.

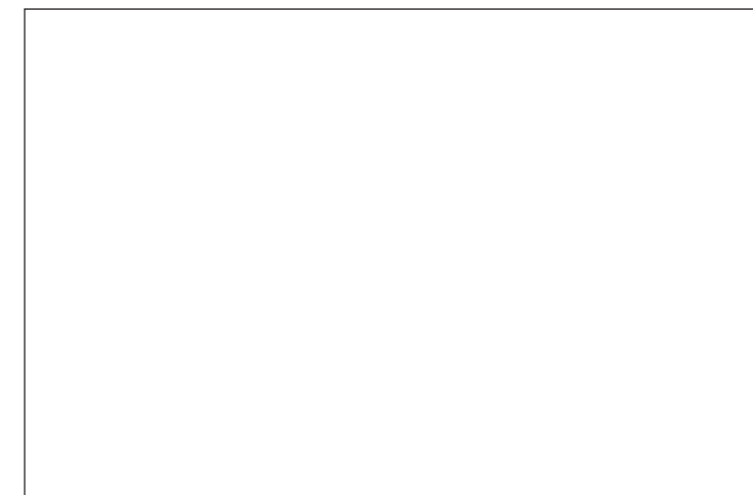
1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_
5. \_\_\_\_\_  
\_\_\_\_\_
6. \_\_\_\_\_  
\_\_\_\_\_

**d** Draw a graph of the following results. Add a curve of best fit.

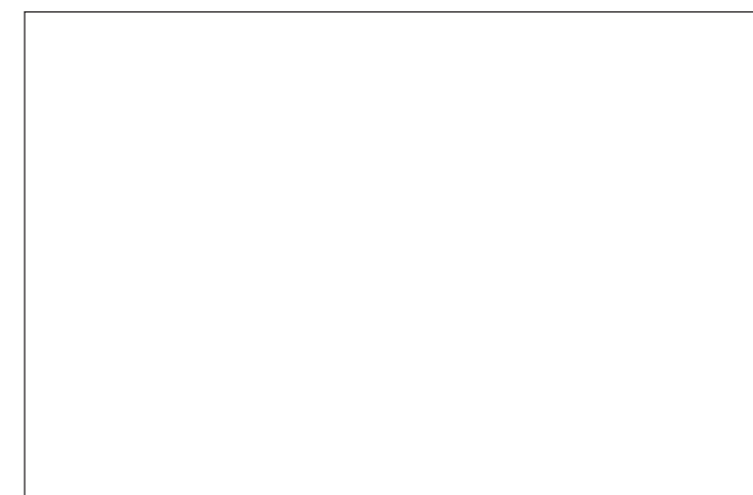
Time	Volume of gas
0	0
10	11
20	16
30	19
40	21



**f** Sketch a graph to show a slow reaction.



Sketch a graph to show a quick reaction.



**b** How can a balance be used to measure the amount of gas being produced? Choose the correct answer.

1. The quicker the mass lost, the quicker the reaction.
2. The slower the mass lost the quicker the reaction.
3. The quicker the mass is gained the quicker the reaction.

Why would you add a tangent to the graph?

\_\_\_\_\_

\_\_\_\_\_

What does the steepness of the tangent show?

\_\_\_\_\_

\_\_\_\_\_

**c** I am feeling confident in the following topics...

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

I need to work on the following topics...

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**e** How can a graph be used to calculate the mean reaction rate?

Answer the question using the information:

- Work out when the reaction finished;
- Work out how much product formed;
- Divide by the time taken to finish.

The line goes flat at 70s and 80cm<sup>3</sup> of gas was produced.

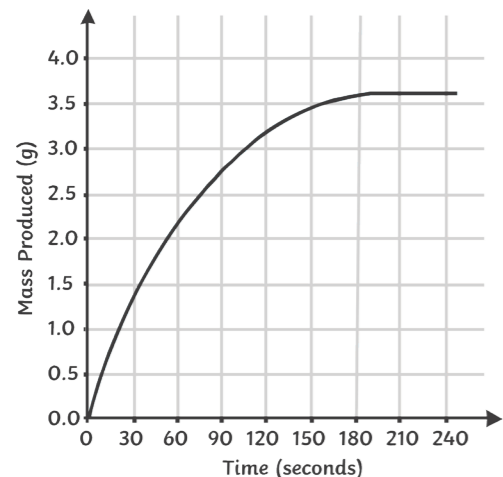
Mean rate = \_\_\_\_\_

**g** Find the mean rate of reaction between these 2 points:

At 30s, 20cm<sup>3</sup> of product had been produced and at 60s, 75cm<sup>3</sup> had been produced.

Mean rate = \_\_\_\_\_

Describe in detail what the rate of reaction graph shows. **a**



The rate of reaction goes quickly to start with and then starts to level off.

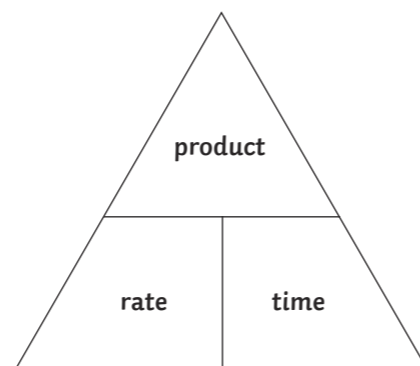
Why does it have this shape?  
There are more products and less reactants so less reactions occur so the graph starts to level off.

Describe how sodium thiosulfate can react with HCl in a practical. Write it step by step. **b**

1. Add sodium thiosulfate solution to a flask.
2. Place flask on a black cross.
3. Add HCl.
4. Time how long it takes for the cross to disappear.
5. Record the results.
5. Repeat with different concentration.

Complete the formula triangle to show the formula for calculating rates of reaction. **c**

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$



Calculate the rate of reaction when:

The amount of product made is 650g and it takes 50 seconds to produce. Show your working out.

$$\text{Mean Rate} = 650\text{g}/50\text{s}$$

$$\text{Mean rate} = 13\text{g/s}$$

Explain what happens when a reaction is in equilibrium. **d**  
When the forwards reaction is equal to the backwards reaction.

Why can reactions only reach equilibrium in a closed system?

None of the reactants or products can escape.

Describe how increasing the surface area of a solid reactant affects the rate of reaction. **e**

The rate of reaction is quicker.

Why does this happen?  
There is more surface area for the reactants to react with so the reaction occurs quicker.

Write down the definition of a catalyst. **f**

A catalyst speeds up the rate of a reaction without being used up.

How do catalysts work?  
They provide a surface area for the reactants to bind to.



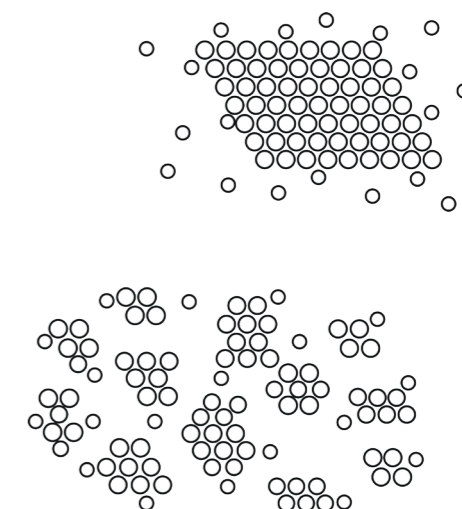
What does this symbol show?  
A reaction going forwards and backwards. (reversible reaction) **g**

What is Le Chatelier's Principle? **h**

If the conditions are changed in a reversible reaction then the system will counteract that change.

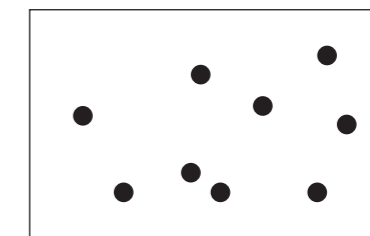
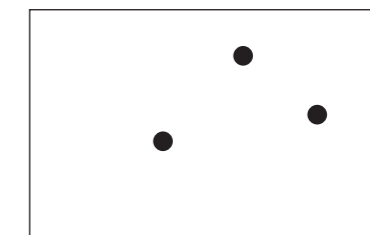
e.g. temperature, pressure, concentration.

Discuss, in terms of collision theory, what happens to particles when they are heated. **i**



When particles are heated they have more kinetic energy. Particles move around more and more collisions occur.

When concentration increases explain why rate of reaction increases. Use diagrams to help you explain. **j**



There are more particles in the same volume, so collisions are more frequent.

Describe how marble chips and hydrochloric acid can react to produce carbon dioxide. Write it step by step. a

1. Measure out the HCl.
2. Pour into a conical flask.
3. Measure out the marble chips.
4. Add to the flask and add the bung and delivery tube.
5. Start the stop watch.
6. Gas is collected in the gas syringe, measure every 10s and write down the results.

How can a balance be used to measure the amount of gas being produced? Choose the correct answer. b

1. The quicker the mass lost, the quicker the reaction.
2. The slower the mass lost the quicker the reaction.
3. The quicker the mass is gained the quicker the reaction.

I am feeling confident in the following topics... c

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I need to work on the following topics...

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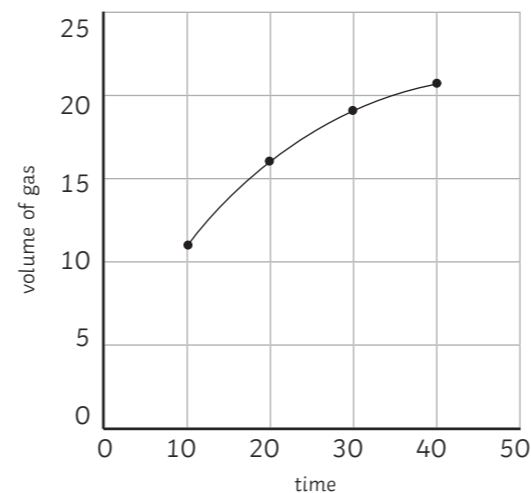
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Draw a graph of the following results. Add a curve of best fit. d

Time	Volume of gas
0	0
10	11
20	16
30	19
40	21



Why would you add a tangent to the graph?

To see how the reaction rate changes.

What does the steepness of the tangent show?

How fast the rate of reaction is. The steeper it is, the faster the rate of reaction.

How can a graph be used to calculate the mean reaction rate? e

Answer the question using the information:

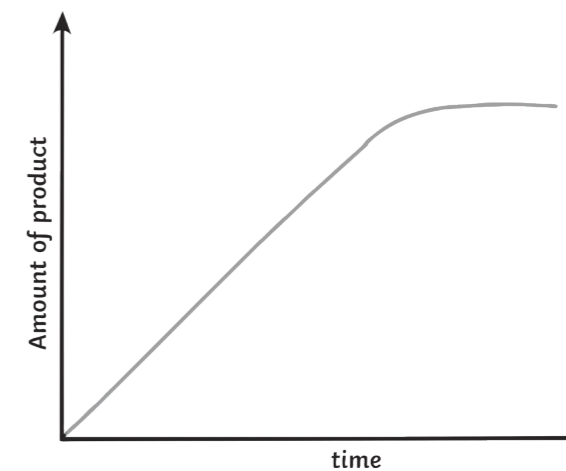
- Work out when the reaction finished;
- Work out how much product formed;
- Divide by the time taken to finish.

The line goes flat at 70s and 80cm<sup>3</sup> of gas was produced.

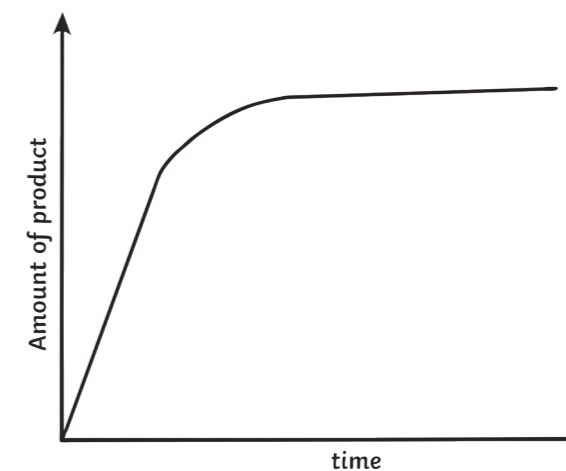
Mean rate =  $80/70$

Mean rate =  $1.14 \text{ cm}^3/\text{s}$

Sketch a graph to show a slow reaction. f



Sketch a graph to show a quick reaction.



Find the mean rate of reaction between these 2 points: g

At 30s, 20cm<sup>3</sup> of product had been produced and at 60s, 75cm<sup>3</sup> had been produced.

$$75 - 20 = 55\text{cm}^3$$

$$60 - 30 = 30\text{s}$$

$$\text{Mean rate} = 55/30 = 1.8 \text{ cm}^3/\text{s}$$