You need to know the content of this sheet. 100%

100% Sheet
Rate of Reaction

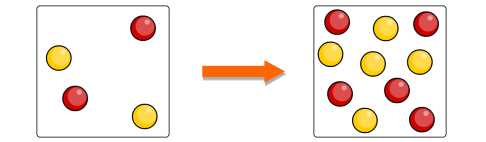
Chemical Reactions involve rearrangement of atoms in substances to form new substances.

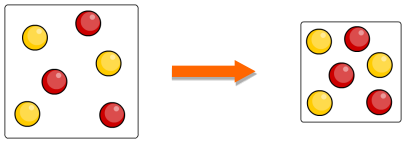
Rate of Reaction and Collision Theory

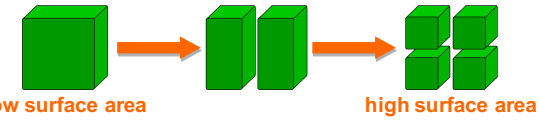
For 2 particles to react they must collide with each other with enough force to overcome activation energy.
The more collisions per second, the greater the rate of reaction

Important point to remember

Increasing the rate of a reaction decreases the time taken to make the product. You DO NOT make more product, you just make it faster. If you look at the left-hand graph showing 2 rates, the amount of product made (height of graph) is the same.

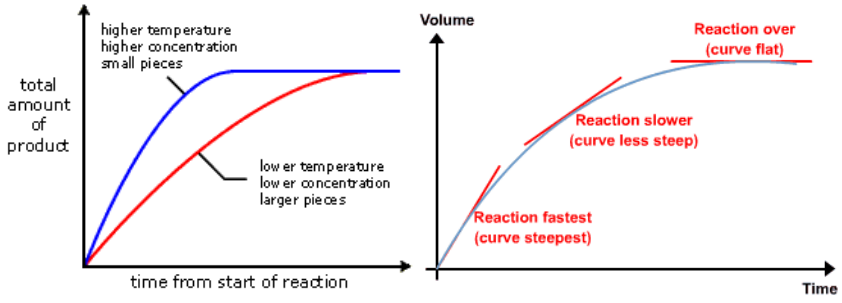




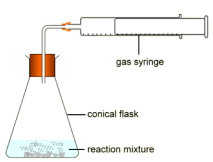


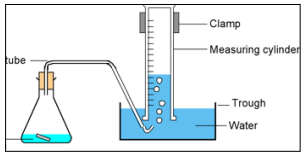
	Full explanation
Increased Temperature	Higher temperatures give the particles more energy. They move quicker and have more collisions. The collisions have more force so there is more change of a reaction
Increased Concentration	More particles are moving in the same space so there is more chance of a collision
Increased Pressure	The same number of particles are moving in a small space so more chance of a collision
Increased Surface Area	There are more surfaces for the particles to collide with so the reaction will be faster

- **activation energy –** The amount of energy needed to start a reaction.
- **catalyst –** A substance that increases the rate of a chemical reaction without being used up.
- **concentration –** The number of molecules of a substance in a given volume.
- **enzyme –** A biological catalyst.



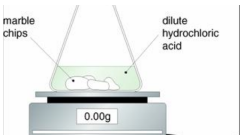
Measuring gas produced in a reaction.

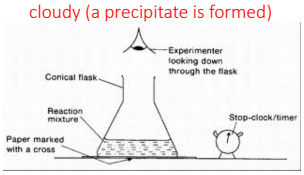




Measuring time taken for a solution to tur cloudy (a precipitate is formed)

Measuring change in mass





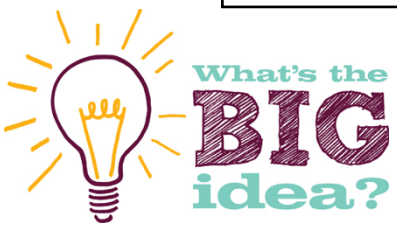
You must be able to describe (equipment and measurements), explain (why it works) and evaluate (advantages AND disadvantages) experiments to measure rates

Think about what you will measure and what equipment will help you do this.

- Measuring gas produced – a gas syringe is more accurate but more expensive than gas collected over water with a measuring cylinder
- Instead of measuring gas produced you could measure gas lost by measuring a decrease in mass
- If a solid is produced you could measure time taken to go cloudy by observing when you can no longer see through the flask

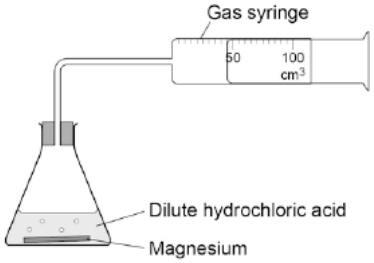
You need to apply your knowledge

100% Sheet
Rate of Reaction



Chemical Reactions involve rearrangement of atoms in substances to form new substances.

A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid.
The student used the apparatus shown in **Figure 1** to collect the gas produced.



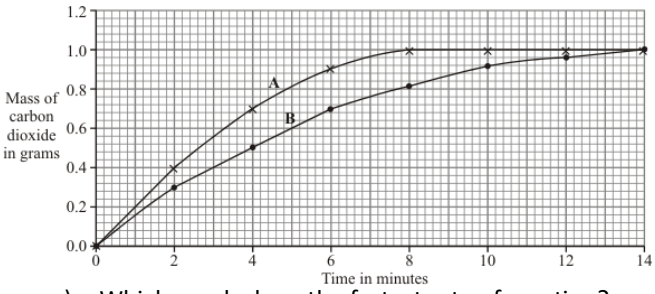
Outline a plan to investigate how the rate of this reaction changed when the concentration of the hydrochloric acid was changed.

- Describe how you would do the investigation and the measurements you would make.
- Describe how you would make it a fair test.

You do **not** need to write about safety precautions. (6)

Marble is a rock that contains mainly calcium carbonate. This reacts with hydrochloric acid.
calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

The rate of this reaction was followed by measuring the mass of carbon dioxide formed



a) Which graph show the fastest rate of reaction?

b) Explain which graph shows the experiment done at;

a. highest temperature

b. Lower concentration of acid

c) Describe how could you accurately determine the rate of reaction at 4 minutes

d) Why is the final mass of carbon dioxide the same?

Define a catalyst and explain how it works