

Rates of reactions

Chemical reactions also work at different rates.



Very slow chemical reaction – limestone reacts very slowly with rainwater to form these stalactites.



Fast chemical reaction – oxygen reacts with the chemicals in the plants.



Very rapid chemical reaction – lots of gas, lots of heat, very quickly.

Some chemical reactions are very fast eg. explosions. Other chemical reactions eg. limestone, ripening of fruit can take days or even months.

In industry the rate of chemical reaction is very important to be able to make a substance very quickly.

Rate- is a measure of the change taking place in a single unit of time such as a second or minute.

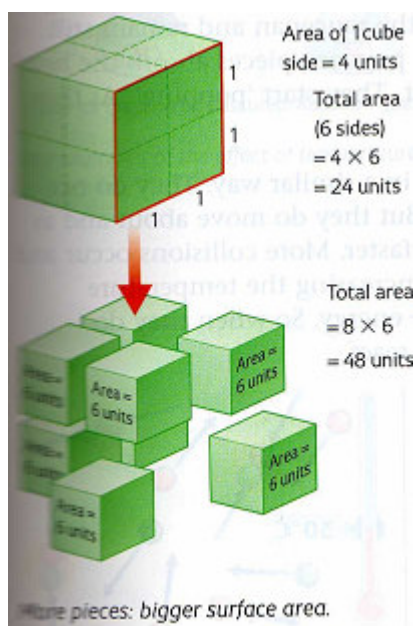
Changing the rate: 1/ AREA

2/ CONCENTRATION

3/ TEMPERATURE

4/ CATALYST

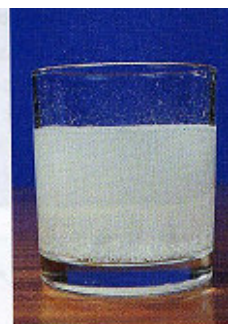
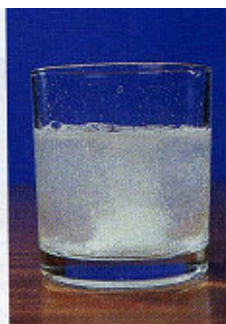
1/ AREA



When a solid is broken down into smaller pieces, more particles are exposed and can collide. More reactions can take place and so the rate of reaction will increase.



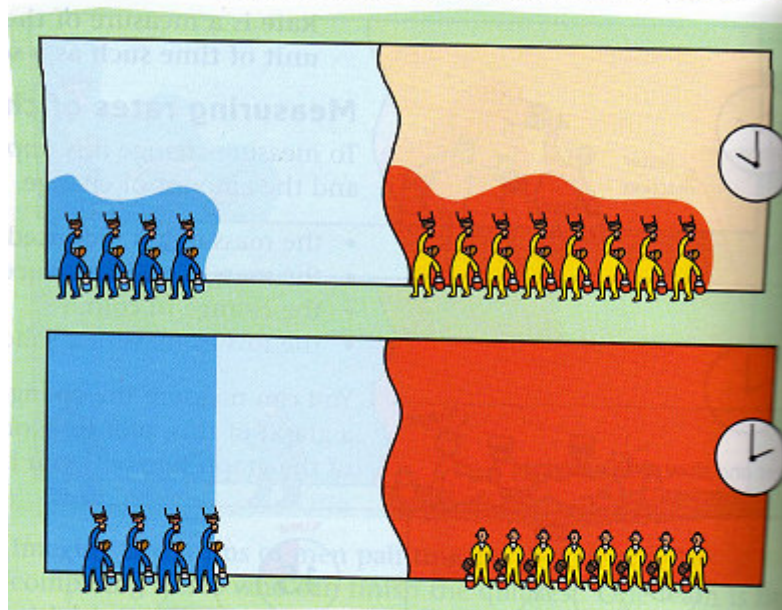
Small, thin chips fry faster than big fat ones.



A tablet broken into pieces dissolves faster than a whole tablet.

B/ CONCENTRATION

How concentration changes the rate of reaction



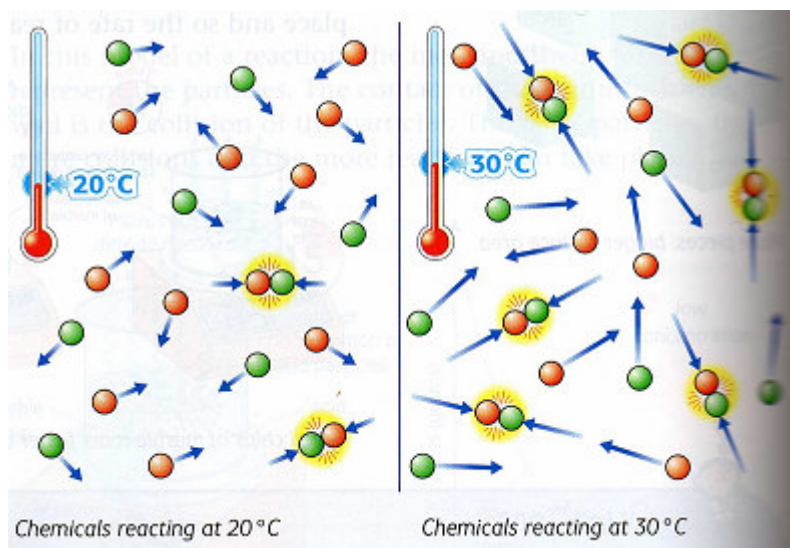
Imagine painters painting a wall. With four men painting there are four paintbrushes putting paint on the wall. While with eight men in the team, there are eight paintbrushes – twice as many brushes making contact with the wall. The concentration of painters is greater with eight men and so the wall is painted faster.

In this model of a reaction, the men and their paintbrushes represent the particles. The contact of the paintbrush with the wall is the collision of the particles. The more particles, the more collisions and the more reactions can take place.

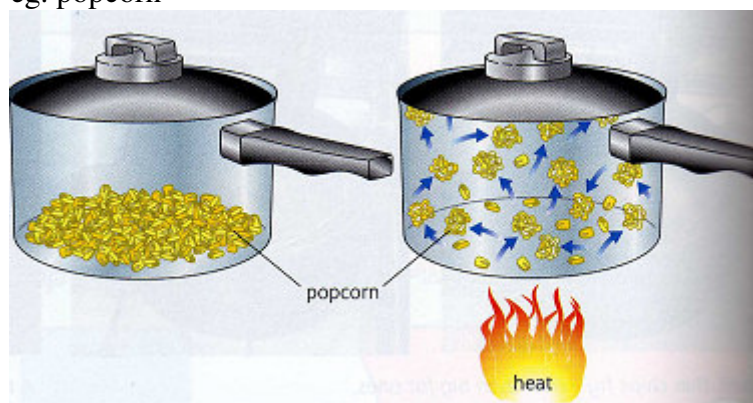
C/ TEMPERATURE

When the temperature of a reaction is increased the particles are given more energy. When they have more energy, they move about much faster.

How temperature affects rate



eg. popcorn



Imagine a saucepan of popcorn. When cold, the pieces of popcorn cover the bottom of the saucepan and remain still. Heat up the saucepan and the popcorn pieces absorb the heat energy and start moving about. They start 'popping' as they move about they collide a lot.



Why do you think food lasts much longer in a fridge, especially during hot weather?

D/ CATALYST

Catalysts- are materials that are used to help chemical reactions take place more quickly.

Our bodies contain catalysts. These are called ***enzymes or biological catalyst***.

Enzymes are used in biological reactions like photosynthesis, respiration and digestion.

Catalysts are used in the manufacture of beer, yoghurt, fruit juices, cheese.



Enzymes are used to make all of these.

What do yoghurt, penicillin, soy sauce, wine, beer, bread, and cheese have in common? They have all been produced by the action of enzymes. They are products of **biotechnology**.

Biotechnology is the use of natural processes for the industrial production of material. Enzymes are involved in many of the processes.

Enzymes

Enzymes are found in all living things. They are biological catalysts. All are proteins. They work by lowering the energy needed to break and make bonds in a chemical reaction and speeding up the reaction. At the end of the reaction they are unchanged.

However, they can be badly affected by temperature and some chemical conditions such as acidity/alkalinity.

Enzymes in your body

Your mouth produces saliva which contains the enzyme amylase. Teeth reduce food to small pieces. This helps to speed up the reaction by increasing the surface area. The six salivary glands produce the saliva. It helps to lubricate dry food and surround the food with enzyme. Amylase works best at temperatures close to 37 °C and in alkaline conditions near pH 7.5. It breaks down starch into sugars.

Once food gets into the stomach the enzyme pepsin works on it. But pepsin works better at temperatures close to 40 °C and in acid conditions of pH 2.