BGE Science

Home is where the science begins

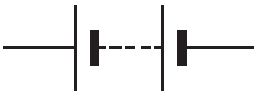
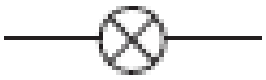
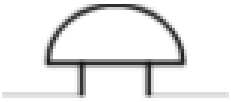
Revision Notes

Electricity

Electricity is very important to our everyday lives. We use it for cooking, storing food, communication, and transport. Therefore, understanding how to use it and how to stay safe is important.

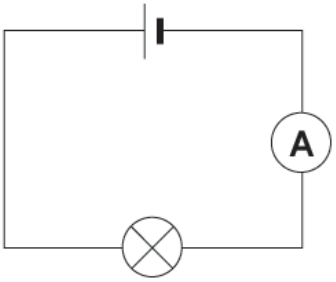
Circuit Symbols

Scientists use symbols to represent each component in a circuit. A diagram can be drawn to show how all of the components are connected.

Component	*Symbol*	*Role within a circuit*
Cell		Source of electrical energy
Battery		Source of electrical energy
Wire		Carries current around the circuit connecting the components
Switch		Allows the current to one part of the circuit to be switched on or off
Bulb		Changes electrical energy into light energy
Bell		Changes electrical energy into sound energy
Motor		Changes electrical energy into kinetic (movement) energy

How to draw a circuit diagram

- Draw the circuit symbols first
- Use a ruler to draw the wires and connect the components
- Make sure there are no breaks in the circuit



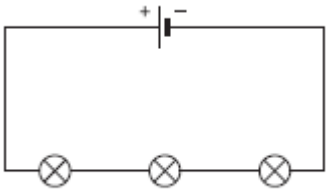
Current

Current is the flow of electrons (electricity) in a circuit. The unit for current is Amps (amperes) which has the symbol A. It is measured using an ammeter set up in series to allow the current to flow through it.

Series Circuit

In a series circuit, all the components are connected one after the other, in a big loop. This means the current will pass through all the different components, one after the other, without any branches.

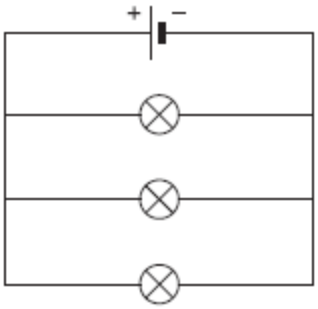
- If one bulb breaks, all the others go off
- *The current is the same everywhere*
- If you add in more bulbs, the bulbs will be dimmer because it harder for the electricity to get through



Parallel Circuits

In parallel circuits, the components are connected on different branches of the wire. This means the current can only pass through all the components if you follow all the branches.

- If one bulb breaks, the bulbs on the other branches stay on
- *The current splits when it comes to a branch. The current in all the branches adds up to the current in the main part of the circuit.*
- If you add in more bulbs the brightness of each bulb stays the same

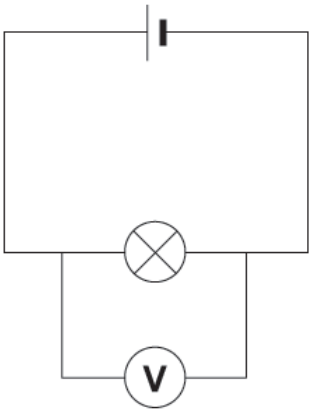


Advantages of parallel circuits

- When more bulbs are added in parallel the brightness of each bulb remains the same. The bulbs do not get dimmer like they do in a series circuit.
- Each bulb can be switched on and off on its own. In a series circuit, all the bulbs are either on or off.
- When one bulb blows, all the other bulbs stay lit. In a series circuit if one bulb blows, all the other would go out too.
- Every component in the circuit receives the same voltage. This is the voltage that the supply provides.

Voltage

Voltage is how much energy the electricity has. The unit for voltage is the volt (V) and is measured using a voltmeter. Voltmeters are connected in parallel.



Voltage in series

Voltage splits across each component in a series circuit and adds up to equal the voltage of the supply.

Voltage in parallel

Voltage is the same across each component in a parallel circuit and is the same as the voltage of the supply.

Summary Table	Current	Voltage
Definition	How many electrons flow through a circuit	How much energy the electricity has
Units	Amps (A)	Volts (V)
How is it measured	With an ammeter in series	With a voltmeter in parallel
Series	Same everywhere	Divides across each component
Parallel	Divides across each component	Same everywhere

Resistance

Wires and other electric components in a circuit can slow down the flow of current through them. This is called resistance. Resistance is measured in Ohms **Ω**) using a multimeter.

Electrical Safety

Electricity is a useful form of energy, but it can also be very dangerous.
There are lots of ways in which we can be electrocuted including:

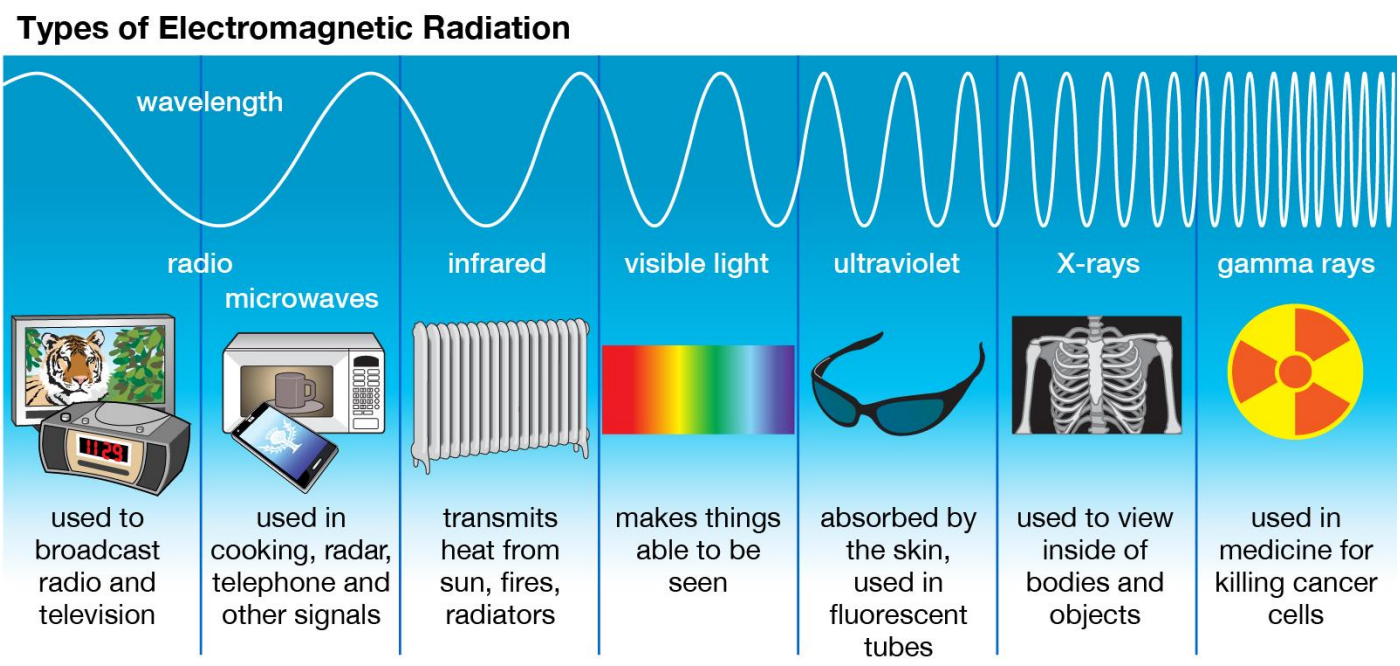
- touching frayed electrical cables
- long or overheating cables
- damaged or incorrectly wired plugs
- allowing water or wet objects to enter plug sockets or touch frayed cables
- pushing metal objects into plug sockets

Useful websites

http://www.bbc.co.uk/bitesize/ks3/science/energy_electricity_forces/electric_current_voltage/revision/1/

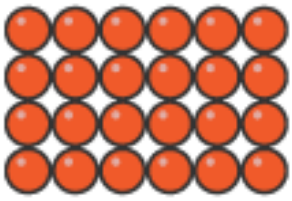
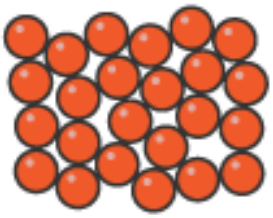
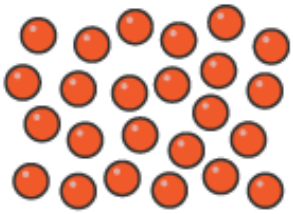
EM Spectrum

The electromagnetic spectrum is a family of waves. The waves transfer energy. They can travel through a vacuum such as in space. Electromagnetic waves travel at 300 000 000 metres per second through a vacuum.

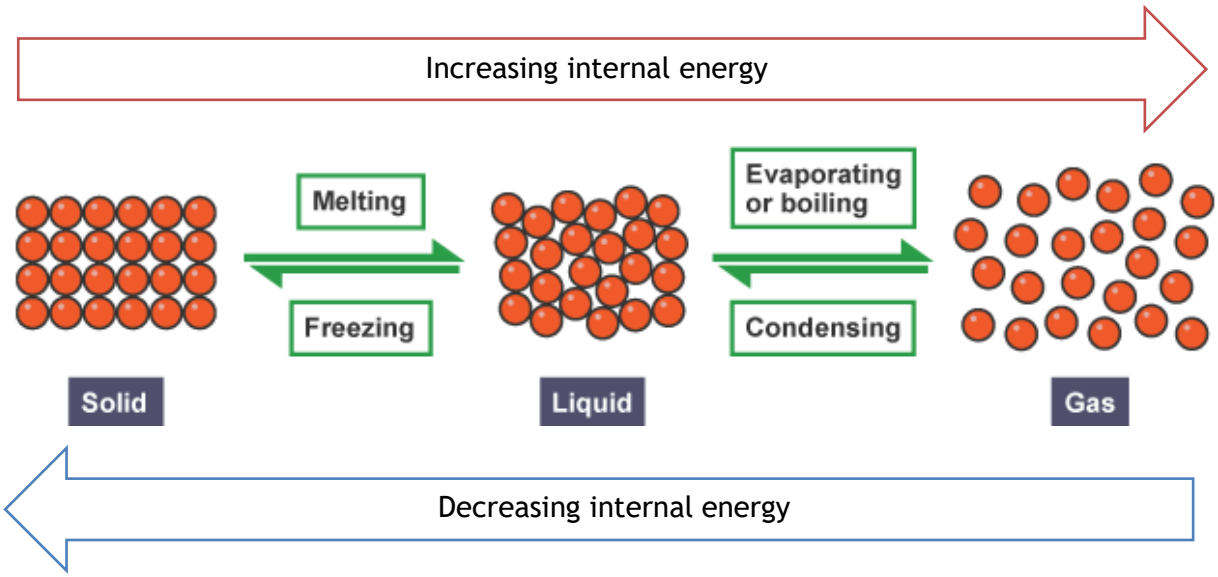


http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/waves/theelectromagneticspectrumrev3.shtml

States of matter

	Solid	Liquid	Gas
Diagram			
Arrangement of particles	Close together Regular pattern	Close together Random arrangement	Far apart Random arrangement
Movement of particles	Vibrate on the spot	Move around each other	Move quickly in all directions
Properties	Cannot change shape Cannot change volume Cannot flow Cannot be squashed	Can change shape Cannot change volume Can flow Cannot be squashed	Can change shape Can change volume Can flow Can be squashed

Changing states of matter



When a substance is heated, its internal energy increases:

- The particles move about more
- The bonds between particles break and the spacing between the particles increases
- This causes a solid to melt into a liquid or a liquid to evaporate into a gas

When a substance is cooled, its internal energy decreases

- The particles move about less
- The spacing between the particles decreases and bonds form between particles
- This causes a gas to condense into a liquid or a liquid to freeze into a solid

Useful websites

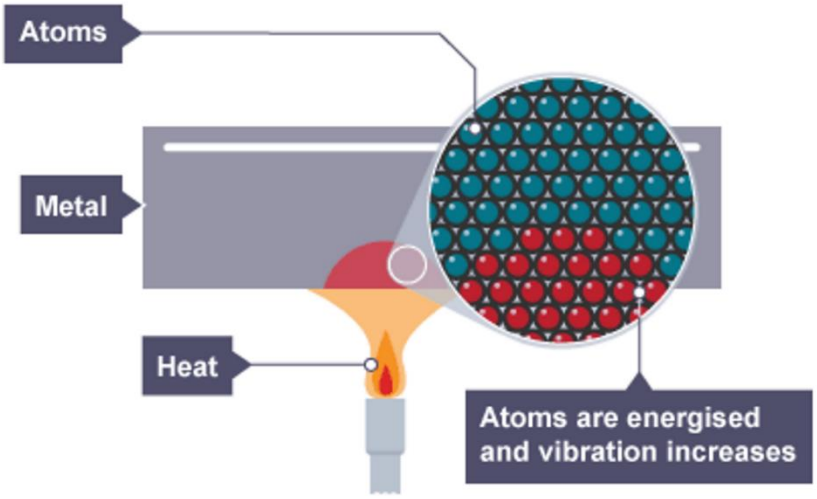
http://www.bbc.co.uk/bitesize/ks2/science/materials/changing_states/read/1/
http://www.bbc.co.uk/education/guides/zc9q7ty/revision/4

Heat and Temperature

Heat is a form of energy. It is measured in Joules (j). Temperature is a measure of how hot or cold something is. It is measured in degrees Celsius (°C). A large bowl of porridge at 30 °C has more energy than a small bowl of porridge at 30 °C because it has more matter and stores more energy.

Conduction

- When a solid is heated, its particles gain internal energy and move around more.
- The particles bump into nearby particles and make them vibrate more.
- This transfers internal energy through the substance by conduction from the hot end to the cold end.

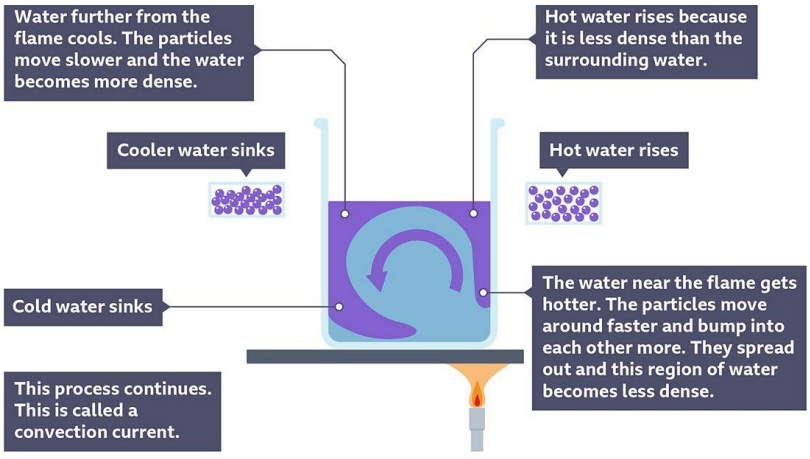


Conductors and Insulators

- Materials that let heat travel through them are called conductors e.g. metals
- Materials that do not let heat travel through them are called insulators e.g. rubber and plastic

Convection

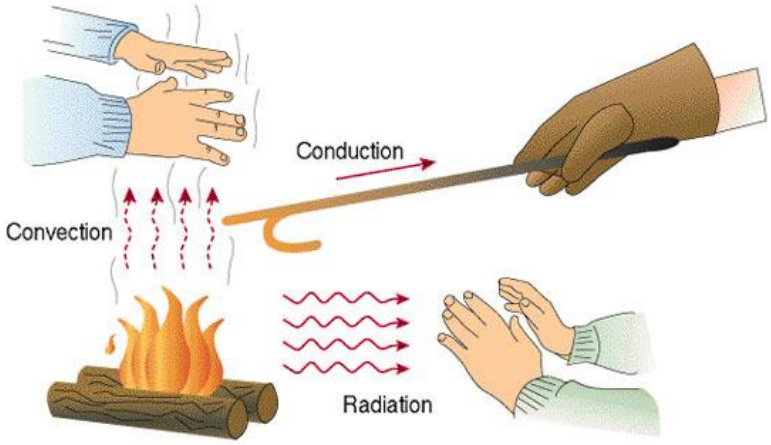
- When a liquid is heated it expands.
- The warm fluid is less dense and begins to rise.
- When it reaches the top, it cools and contracts.
- The cooler fluid is more dense and begins to fall.
- This is known as a convection current.



Infrared Radiation

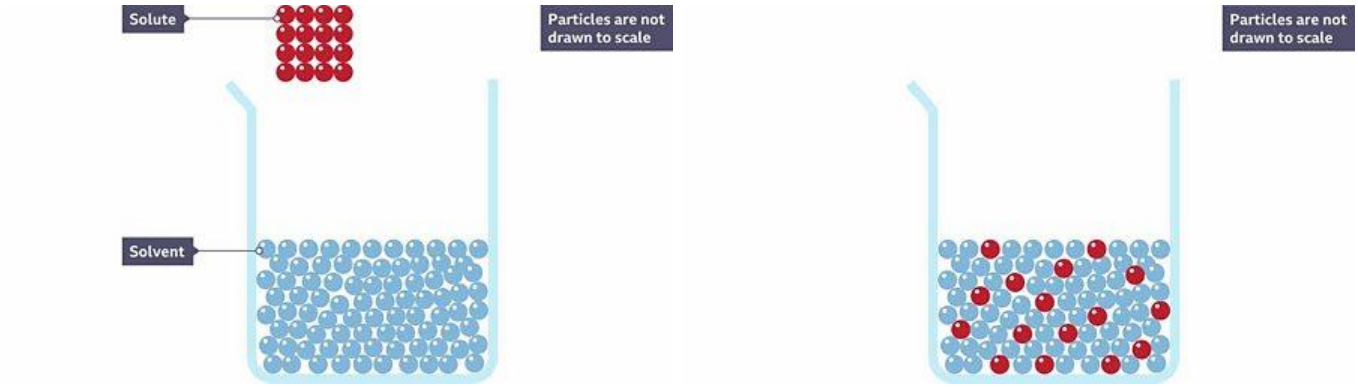
- All objects transfer heat energy by infrared radiation.
- The hotter an object is, the more infrared radiation it gives off.
- Infrared radiation is part of the electromagnetic spectrum and energy travels as waves and does not involve particles.

- This means that thermal energy transfer by radiation can even work in vacuums.



Useful Websites
https://www.bbc.co.uk/bitesize/guides/zr7j382/revision/1
https://www.bbc.co.uk/bitesize/clips/zsqb9j6

Solubility
- A solid is soluble when it can dissolve in a liquid called a solvent.
- A solid is insoluble when it cannot dissolve in a liquid called a solvent.



- The solubility of a substance can be affected by factors such as :-
  - temperature
    - Increasing temperature increases solubility
  - particle size
    - Decreasing particle size increases solubility
  - volume of solvent
    - the greater the volume of solvent, the greater the solubility of a solid
  - type of solvent

Useful websites
https://www.bbc.co.uk/bitesize/guides/zc9q7ty/revision/6

Signs of a chemical reaction
A chemical reaction is a process in which one or more substances react together to from new products. Chemical reactions happen every day, all around us. There are 4 main signs that a chemical reaction has taken place.
- A solid (precipitate) forms
- A colour change happens
- An energy change occurs

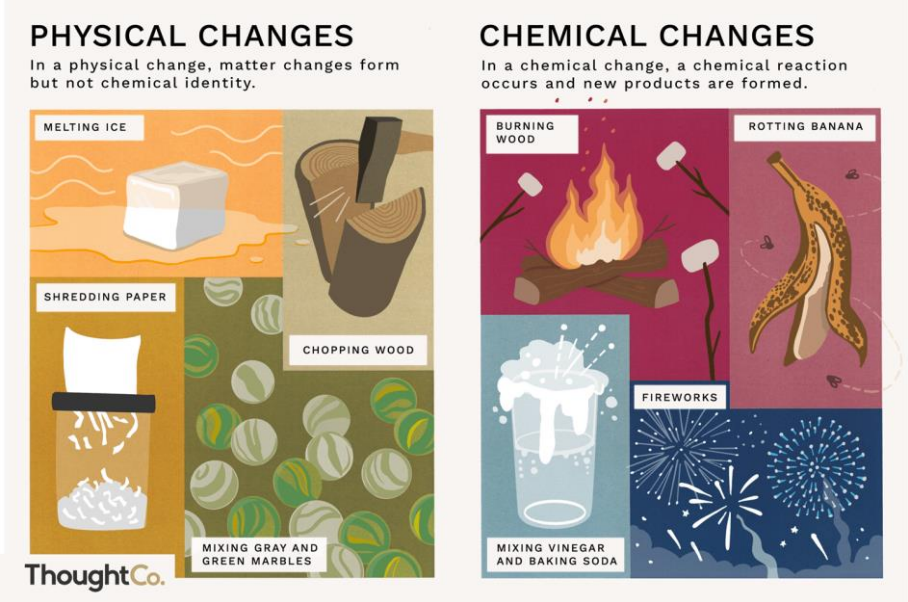
- A gas is produced

All chemical reactions involve the production of a new substance.

Chemical reaction or physical change?

Sometimes, a physical change can look like a chemical reaction but there are some main differences.

- Chemical reactions produce new substances and are not easily reversed
    - For example, baking a cake
- Physical changes involve changing the state of matter of a substance and can be easily reversed
    - For example, melting ice or boiling water



Changing the rate of a chemical reaction

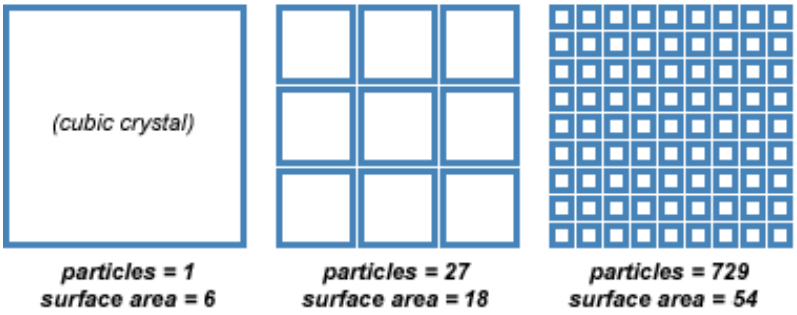
The rate of a reaction is how quickly the product is made. The rate of a reaction can be affected by 4 different factors.

- Particle size
- Temperature
- *Concentration*
- *Addition of a catalyst*

Particle size

As the particle size decrease, the rate of reaction increases.

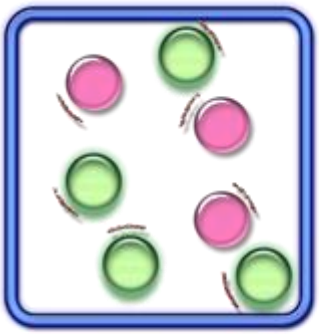
This is because as the particle size decreases, the surface area increases. The greater the surface area the more chance particle have of bumping into each other. The more particles bump off each other, the more reactions take place.



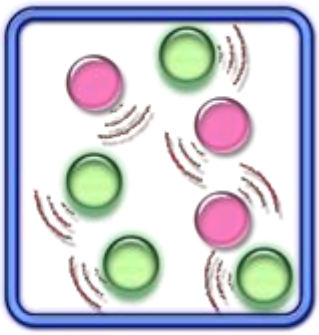
Temperature

As the temperature increases, the rate of reaction increases.

This is because temperature is a measure of the kinetic energy of particles. As the temperature increases, the particles gain energy and move faster. The faster the particle move, the more likely they are to bump into each other meaning more reactions take place.



Particles have less energy, less frequent and successful collision



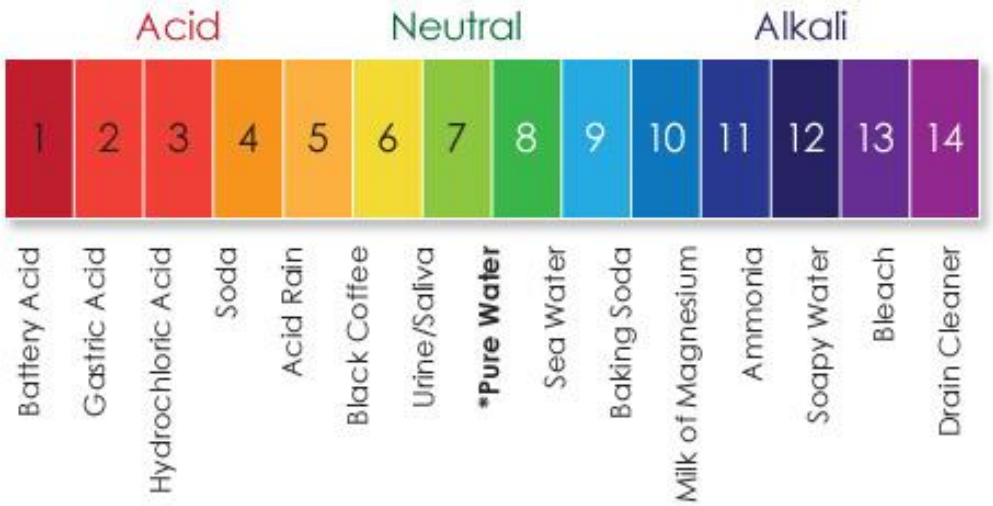
Particles have high energy, more frequent and successful collision

Useful Websites

https://www.bbc.co.uk/bitesize/guides/zfjdd6f/revision/1

Acids and Alkalis

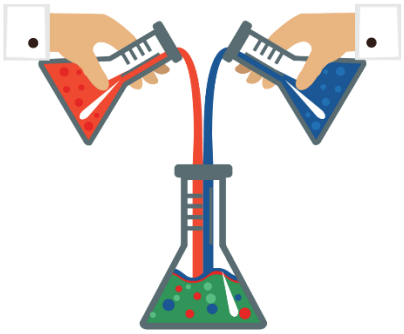
Universal indicator can be used to find out if a substance is an acid, alkali or neutral.



Acids have a pH less than 7. Strong acids are red / orange in colour. Weaker acids are yellow.
Neutral substances have a pH of 7. They are green in colour.
Alkali substances have a pH more than 7. Strong alkalis are a dark purple colour. Weak alkalis are more blue in colour.

Neutralisation

When an acid is added to an alkali, the pH decreases towards neutral. This is called neutralisation.



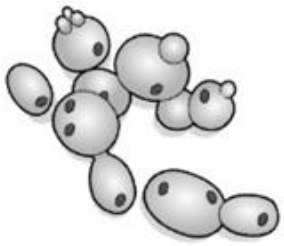
An acid can also be neutralised by an alkali. Indigestion tablets are an example of this type of reaction. The tablet contains an alkali which increase the pH towards neutral.

Useful websites
https://www.bbc.co.uk/education/guides/zqd2mp3/revision
https://www.bbc.co.uk/education/guides/zyn3b9q/revision

Microorganisms
A microorganism is an organism which is too small to be seen with the naked eye.
There are three different types of microorganism – bacteria, viruses and fungi.


Bacterium


Virus


Fungus

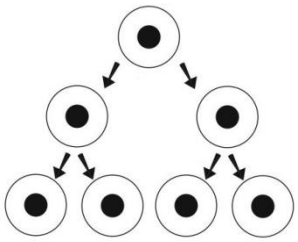
Type of microorganism	*Description*	*Examples*
Viruses	The smallest microorganism. Can only survive within a host cell. Multiply rapidly.	Influenza (Flu), HIV, Measles, Varicella (chickenpox)
Fungus	Organisms which can be multicellular (made up of more than one cell) or unicellular. Can be harmful or beneficial.	Yeast, mushrooms, mould
Bacteria	Unicellular organisms (made up of only one cell) which do not have a nucleus. Multiply rapidly.	E.coli, Streptococcus, C.difficile

Where are microorganisms found?
- Microorganisms are found in most places.
- For example
  - in soil
  - in water
  - in the air
  - on animals
  - on plants.

Growing Microorganisms
Microorganisms, like humans, require essential resources to grow and reproduce.
- Food
- Water

- Warm temperature
- Suitable pH

During the growth of bacteria, each bacterial cell divides to produce two identical cells. Therefore, each time cell division occurs, the number of cells present doubles. The table below shows the number of bacterial cells which would be produced from one original cell after each division.



Number of divisions	*Number of bacterial cells present*
0	1
1	2
2	4
3	8
4	16

Controlling the Growth of Microorganisms

The growth of microorganisms can be controlled using a variety of chemicals such as anti-bacterials and antifungals.

Anti-bacterials can be used to control the growth and spread of bacteria.

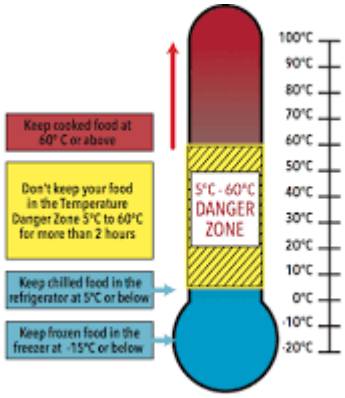
Antifungals can be used to control the growth and spread of fungus and can be used to treat fungal diseases such as athlete's foot.

Effect of Temperature on the Growth of Microorganisms

Microorganisms grow best in warm temperatures between 5°C and 40°C.

At cool temperatures (below 5°C), microorganisms grow very slowly.

If the temperature is too high the microorganisms will die (above 70°C).



Useful Websites

https://www.bbc.co.uk/bitesize/guides/zj6qqp3/revision/1