Overview of the KS3 Science Syllabus

	Part 1 Taught in year 7 or year 7/8*		Part 2 Taught in year 8 or year 8/9*	
Forces	Speed	Gravity	Contact forces	Pressure
Electromagnets	Voltage and resistance	Current	Electromagnets	Magnetism
Energy	Energy costs	Energy transfer	Work	Heating and cooling
Waves	Sound	Light	Wave effects	Wave properties
Matter	Particle model	Separating mixtures	Periodic table	Elements
Reactions	Metals and non-metals	Acids and alkalis	Chemical energy	Types of reaction
Earth	Earth structure	Universe	Climate	Earth resources
Organisms	Movement	Cells	Breathing	Digestion
Ecosystem	Interdependence	Plant reproduction	Respiration	Photosynthesis
Genes	Variation	Human reproduction	Evolution	Inheritance

Year 7 Science Student Curriculum Map			Week	Module covered
Biology	**Chemistry**	**Physics**	1	H + Starting science
			2	H + Starting science
			3	H + Starting science
H – Organisms - Movement and cells	**E - Matter- Particles and Separating substances**	**A – Forces – Speed and Gravity**	4	H + Starting science
			5	H + Starting science
Observing cells	The particle Model	Balanced and Unbalanced forces	6 9/10	Formal Assessment 1 – H + Starting sci
Plant and animal cells	States of matter	Speed	7	H + Starting science
Specialised cells	Changes of state	Distance / Time graphs	8	H + Starting science
Movement of substances	Diffusion	Gravity, mass and Weight	9	H + Starting science
Organisation	Gas Pressure	**C- Energy – Energy cost and Energy transfer**	10	C + E + J
The Skeleton	Particles	Food and fuels	11	C + E + J
Movement of joints	Pure substances and mixtures	Non- renewable energy	12	C + E + J
Muscles	Solubility	Renewable energy	13	C + E + J
J – Genes – Variation and Human reproduction	Filtration	Energy and Power	14	C + E + J
	Distillation	Energy stores	15	C + E + J
Variation	Chromatography	Dissipation of energy	16	E + J + A
Continuous Variation RP		Calculating efficiency	17	E+ J+ A
Adapting to Change	**F – Reactants – Acid and alkalis and Metals**	**B- Electromagnets – Voltage, resistance and Current**	18	E+ J+ A
Adolescence	Elements	Potential Difference	19	E+ J+ A
Reproductive systems	Metal reactions	Resistance	20 29/1	Formal Assessment 2 H, G, E
Fertilisation and Implantation	Displacement reactions	Series and Parallel	21	E+J+A
Development of a fetus	Chemical Reactions	Current	22	D+ F +B
Menstrual Cycle	Acids and Alkalis	Charging up	23	D+ F +B
	Indicators and pH	**D – Waves – Sound and Light**	24	D+ F +B
I – Ecosystems Interdependence and Plant Reproduction	Neutralisation	Sounds waves	25	D+ F +B
	Making salts	Loudness and Amplitude	26	D+ F +B
Food Chains and webs		Frequency and Pitch	27	D+ F +B
Ecosystems		The Ear and Hearing	28	I + F + B
Competition		Light	29	I + F + B
Flowers and Pollination		Reflection and refraction	30 29/4	Formal Assessment 3 A, D, J
Seed Dispersal		The Eye and Vision	31	I + F + B
		Colour	32	B +I
			33	B +I
FA1	**FA2**	**FA3**	34	B +I
			35	B +I
			36	B +I
			37	B +I
			38 1/7	Setting Assessment 4
			39	B +I

FORCES A Speed Gravity

All Saints Catholic High School Science

Keywords

Speed: How much distance is covered in how much time.

Average speed: The overall distance travelled divided by overall time for a journey.

Relative motion: Different observers judge speeds differently if they are in motion too, so an object's speed is relative to the observer's speed.

Acceleration: How quickly speed increases or decreases.

Keywords

Weight: The force of gravity on an object (N).

Non-contact force: One that acts without direct contact.

Mass: The amount of stuff in an object (kg).

Gravitational field strength, g: The force from gravity on 1 kg (N/kg).

Field: The area where other objects feel a gravitational force.

Speed

The speed of an object tells you how fast or slow it is moving. You can find the average speed of an object if you know the distance it has travelled and the time taken to travel that distance.

The equation is:

Speed(m/s) = Distance(m) ÷ Time(s)

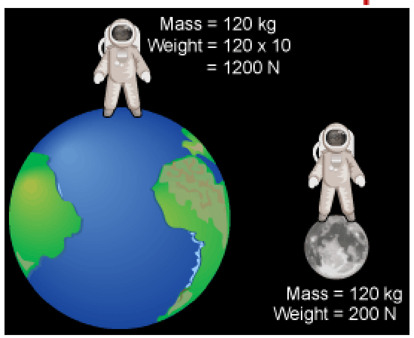
$$V = \frac{S}{t}$$

E.g. A car travels 100m in 20s. Calculate the speed of the car.

Speed = Distance ÷ Time

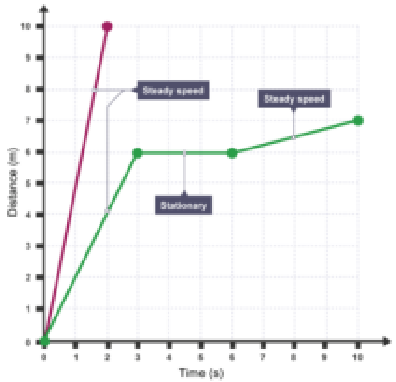
Speed = 100m ÷ 20s

Speed = 5m/s



Distance Time Graphs

A distance time graph is a useful way to represent the motion of an object. It shows ho the distance move from a starting point changes over time.



If the line is horizontal, the object is stationary (because the distance stays the same).
If the line is a straight diagonal, the object is moving at a constant speed.

The steeper the line, the greater the gradient and the greater the speed.

E.g. Calculate the speed of the green line for the first 3s.

Speed = Distance ÷ Time

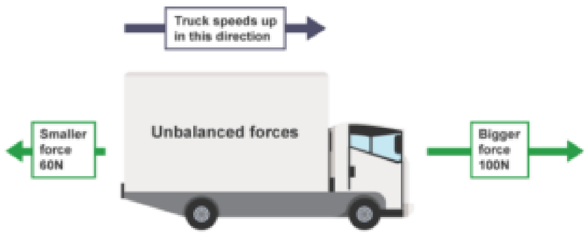
Speed = 6m ÷ 3s

Speed = 2m/s

Unbalanced Forces

If more than one force act along a straight line, the resultant force can be found by adding (acting in the same direction) or subtracting (acting in opposite direction) them.

100 – 60 = 40 N (to the right)



Contact & Non-Contact Forces

All forces between objects are either:

Contact Forces – The objects are physically touching

Non-Contact Forces – The objects are physically separated.

Contact: Friction, Air Resistance, Tension, Normal Contact

Non-Contact: Gravitational, Electrostatic, Magnetic

Acceleration:

Acceleration is the rate of change of velocity. It is the amount that velocity changes per unit time.

$$\text{Acceleration} = \frac{\text{Change in Velocity}}{\text{Time Taken}}$$

Metres per second (m/s)

Metres per second squared (m/s^2)

Seconds (s)

$$a = \frac{v - u}{t}$$

Change in velocity = final speed – initial speed

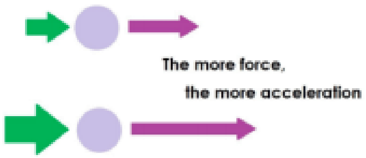
Newton's First Law

An object has a constant velocity unless acted on by a resultant force

Thrust = Drag. Zero resultant force and the plane moves at a constant velocity.

Newton's Second Law

The acceleration of an object is proportional to the resultant force acting on the object, and inversely proportional to the mass of the object.



F = ma

F is Force in N

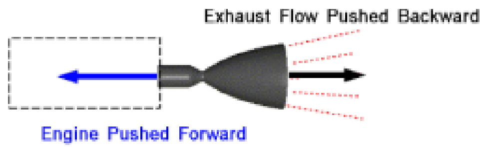
m is mass in Kg

a is acceleration in m/s^2.

Newton's Third Law

Wherever two objects interact, the forces they exert on each other are equal and opposite.

Rocket Engine Thrust



For every action, there is an equal and opposite re-action.

FORCES A Pressure Contact Forces

All Saints Catholic High School Science

Keywords

Equilibrium: State of an object when opposing forces are balanced.

Deformation: Changing shape due to a force.

Linear relationship: When two variables are graphed and show a straight line which goes through the origin, and they can be called directly proportional.

Newton: Unit for measuring forces (N).

Resultant force: Single force which can replace all the forces acting on an object and have the same effect.

Friction: Force opposing motion which is caused by the interaction of surfaces moving over one another. It is called 'drag' if one is a fluid.

Tension: Force extending or pulling apart.

Compression: Force squashing or pushing together.

Contact force: One that acts by direct contact.

Keywords

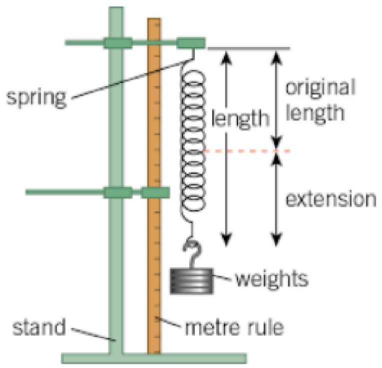
Fluid: A substance with no fixed shape, a gas or a liquid.

Pressure: The ratio of force to surface area, in N/m², and how it causes stresses in solids.

Upthrust: The upward force that a liquid or gas exerts on a body floating in it.

Atmospheric pressure: The pressure caused by the weight of the air above a surface.

Hooke's Law Practical



Aim: To investigate how adding mass to a spring affects the springs extension.

Method:

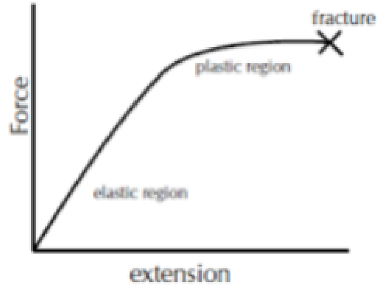
1. Set up the equipment as shown in the diagram.
2. Add 10g mass to the holder and record the spring length.
3. Add another 10g and record the new spring length.
4. Take away the previous spring length from the new length to calculate extension.
5. Repeat by adding 100g masses until 100g is reached.

Independent Variable: Mass added (g)
Dependent Variable: Extension (mm/cm)
Controlled Variable: Spring and Slotted Mass

The extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that the limit of proportionality is not exceeded.

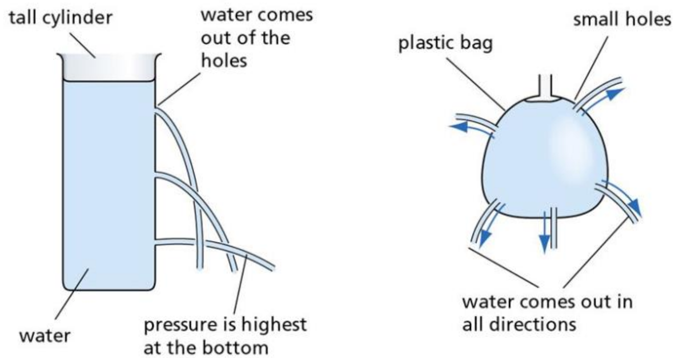
$F = k\,e$

- force, F, in newton's, N
- spring constant, k, in newton's per metre, N/m
- extension, e, in metres, m



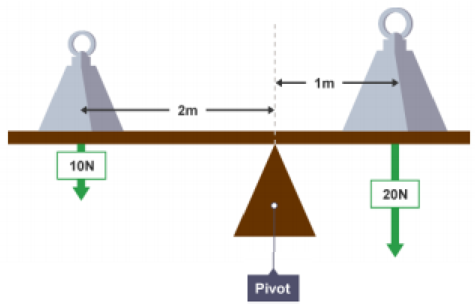
Pressure in liquids

Pressure increases with depth | **Pressure acts in all directions**



To calculate moments, you need two things:
The distance from the pivot that the force is applied and the size of the force applied.

moment (Nm) = force (N) x distance (m)



Moment on the left:
moment = force (N) x distance (m)
moment = 10N x 2
Moment = 20Nm

Moment on the right:
moment = force (N) x distance (m)
moment = 20N x 1
Moment = 20Nm

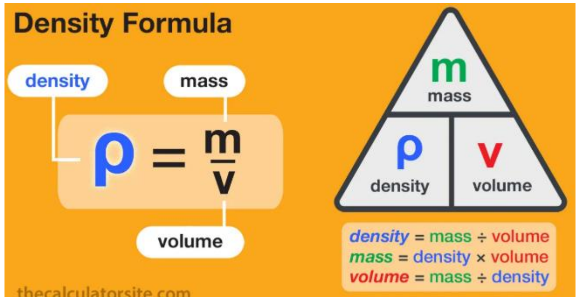
Notice that the two moments in the example above are equal and opposite. They are both 20Nm but the left are acting in an anti-clockwise direction, whilst the right side is acting in a clockwise direction. This is why the beam is balanced.

Contact & Non-Contact Forces

All forces between objects are either:
Contact Forces – The objects are physically touching
Non-Contact Forces – The objects are physically separated.

Contact: Friction, Air Resistance, Tension, Normal Contact

Non-Contact: Gravitational, Electrostatic, Magnetic



ELECTROMAGNETS B Voltage and resistance Current

Keywords

Negatively charged: An object that has gained electrons as a result of the charging process.

Positively charged: An object that has lost electrons as a result of the charging process.

Electrons: Tiny particles which are part of atoms and carry a negative charge.

Charged up: When materials are rubbed together, electrons move from one surface to the other.

Electrostatic force: Non-contact force between two charged objects.

Current: Flow of electric charge, in amperes (A).

In series: If components in a circuit are on the same loop.

In parallel: If some components are on separate loops.

Field: The area where other objects feel an electrostatic force.

Keywords

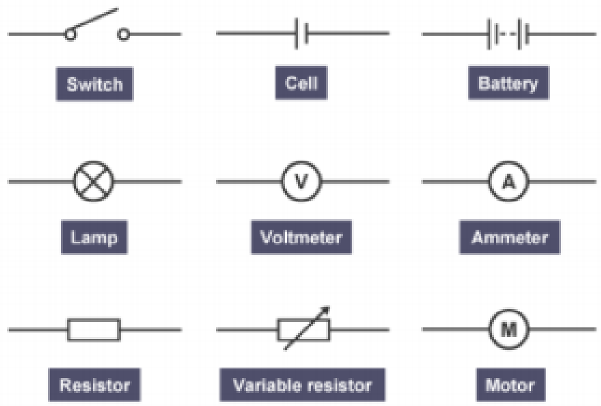
Potential difference (voltage): The amount of energy shifted from the battery to the moving charge, or from the charge to circuit components, in volts (V).

Resistance: A property of a component, making it difficult for charge to pass through, in ohms (Ω).

Electrical conductor: A material that allows current to flow through it easily, and has a low resistance.

Electrical insulator: A material that does not allow current to flow easily, and has a high resistance.

Circuit Symbols



Electric Charge

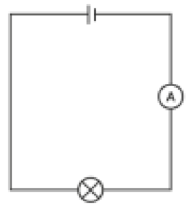
Some particles carry an electric charge. In electric wires these particles are called electrons. An electric current is a flow of charge, and in a wire this will be a flow of electrons.

For an electric current to flow we need:

- Something to transfer the energy to the electrons, such as a cell, battery or power pack.
- A complete path for the electrons to flow through (a complete circuit).

Current

Current is measured in amperes (A). 20A is a bigger current that 10A. An ammeter is used to measure the current. The ammeter must be connected in series.



Equations To Remember

Current

$$\text{Current} = \frac{\text{Charge}}{\text{time}} \qquad I = \frac{Q}{t}$$

Current in Amps (A), Charge in Coulombs (C), Time in Seconds (s).

Potential Difference:

Potential Difference = Current x Resistance

V = I x R

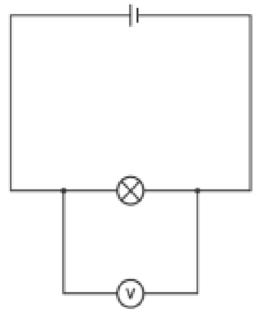
Potential difference in Volts (V), Resistance in Ohms (**Ω**), Current in Amps (A)

Potential Difference

Potential difference is a measure of the difference in energy between two parts of a circuit. The bigger the difference in energy, the bigger the potential difference.

Potential difference is measured in volts. A 230V is a bigger potential difference than 12V.

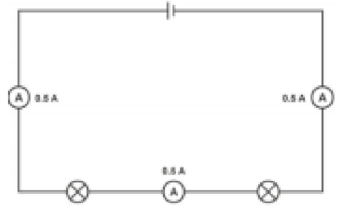
A voltmeter is used to measure the potential difference, and must be in parallel.



Series Circuit

In series circuits:

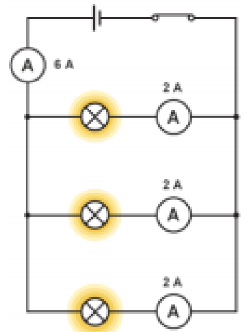
- You get several components one after another.
- If a component breaks, the circuit is broken and all the other components stop working.
- The current is the same everywhere in a series circuit no matter where you put the ammeter – it will give the same reading.



Parallel Circuit

In parallel circuits:

- Different components are connected on different braches.
- If a component breaks, the components on the different braches keep working.
- Unlike series, the lamps stay bright If you add more lamps in parallel.
- Current is shared between the components.

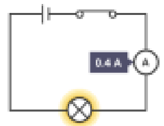


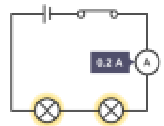
Resistance

The wires and other components in a circuit reduce the flow of charge through them – this is resistance.

The resistance increases when you add more components in series.

The resistance of two lamps is greater than the resistance of one lamp, so less current will flow through them.





ELECTROMAGNETS B Electromagnets Magnetism

Keywords

Electromagnet: A non-permanent magnet turned on and off by controlling the current through it.

Solenoid: Wire wound into a tight coil, part of an electromagnet.

Core: Soft iron metal which the solenoid is wrapped around.

Keywords

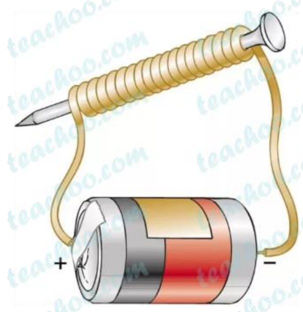
Magnetic force: Non-contact force from a magnet on a magnetic material.

Permanent magnet: An object that is magnetic all of the time.

Magnetic poles: The ends of a magnetic field, called north-seeking (N) and south-seeking poles (S).

Temporary Magnet Vs Permanent Magnet

Temporary Magnet

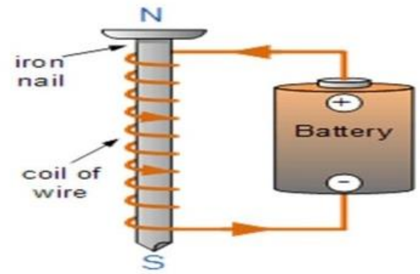


Electromagnet

Permanent Magnet

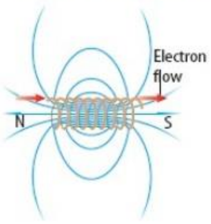
Bar magnet

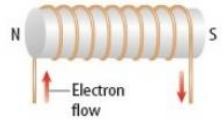
Electromagnetism



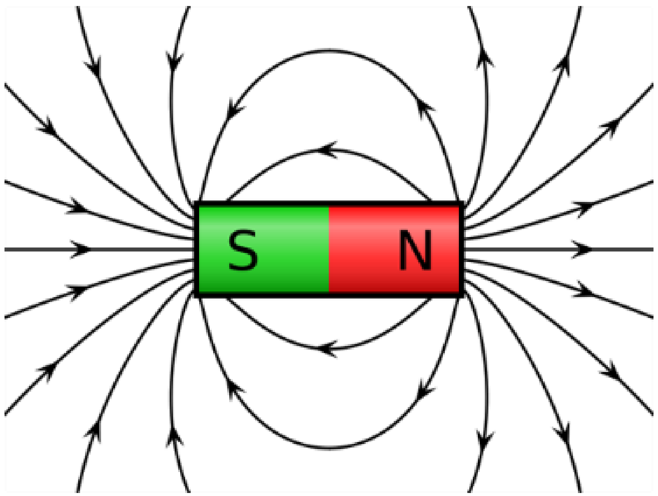
What is an electromagnet?

When an electric current is passed through a coil of wire wrapped around a metal core, a very strong magnetic field is produced. This is called an electromagnet.

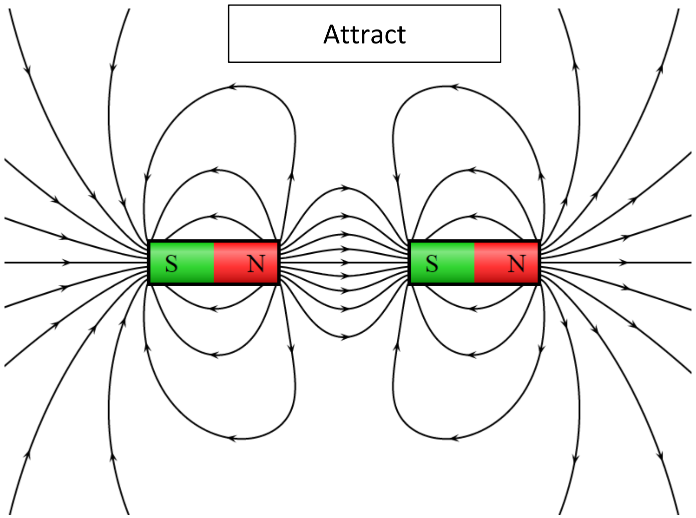




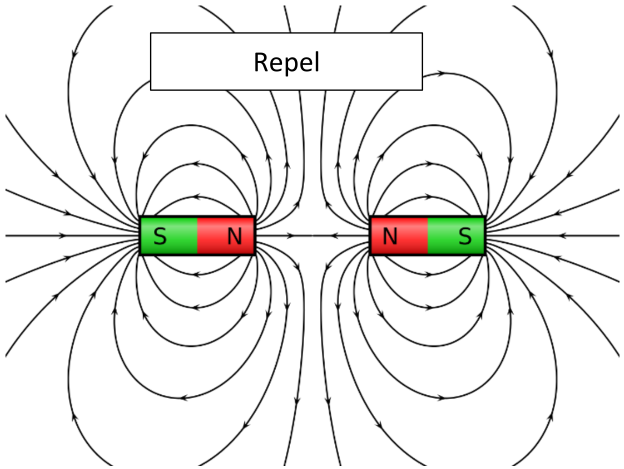
An iron core inserted into the coil becomes a magnet.



Attract



Repel



ENERGY C Energy Costs Energy Transfer

All Saints Catholic High School Science

Keywords

Power: How quickly energy is transferred by a device (watts).

Energy resource: Something with stored energy that can be released in a useful way.

Non-renewable: An energy resource that cannot be replaced and will be used up.

Renewable: An energy resource that can be replaced and will not run out. Examples are solar, wind, waves, geothermal and biomass.

Fossil fuels: Non-renewable energy resources formed from the remains of ancient plants or animals. Examples are coal, crude oil and natural gas.

Keywords

Thermal energy store: Filled when an object is warmed up.

Chemical energy store: Emptied during chemical reactions when energy is transferred to the surroundings.

Kinetic energy store: Filled when an object speeds up.

Gravitational potential energy store: Filled when an object is raised.

Elastic energy store: Filled when a material is stretched or compressed.

Dissipated: Become spread out wastefully.

Type of energy	Description	Type of energy	Description
Kinetic 	The energy in moving objects	**Thermal (Internal)** 	The heat stored in an object
Chemical 	When a substance undergoes a chemical reaction	**Gravitational potential** 	When an object is raised to a height
Magnetic 	When 2 objects attract or repel	**Electrostatic (electrical)** 	Allows an electric current to flow
Elastic potential 	When an object is stretched or squashed	**Nuclear** 	Energy stored in an atom *(not needed till GCSE)*
Light 	*From a bright object (not stored)*	*Sound* 	*From a vibrating object (not stored)*

Calculating Kinetic Energy

$$E_K = \frac{1}{2}mv^2$$

E_K = Kinetic Energy

m = Mass

v = velocity

Calculating GPE

GPE = mass x gravitational field strength x height

- Mass is measured in **kilograms** (kg).
- Gravitational field strength is measured in **newtons per kilogram** (N/kg), usually taken as 10N/kg on Earth.
- Height is measured in **metres** (m).
- GPE is measured in **joules** (J).

Calculating Power

Word Equation	Power	=	Work Done / Time Taken		
Dimensions	P	=	W	/	t
Units	Watt	=	Joule	/	second

Calculating Efficiency.

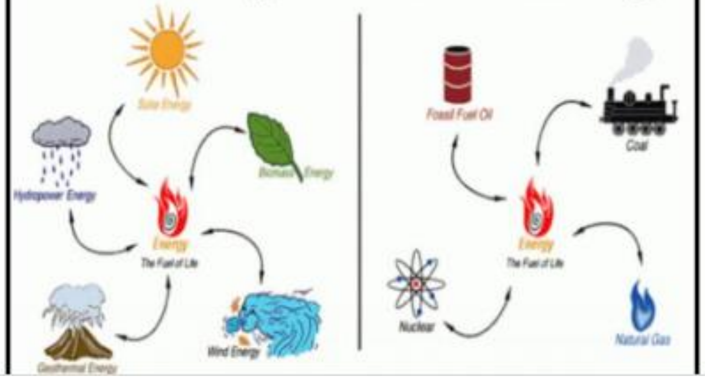
$$\text{Efficiency} = \frac{\text{useful energy out}}{\text{total energy in}} \times 100$$

E.g. Lightbulb

Efficiency = 90 ÷ 100 x 100

Efficiency = 90%

Renewable Energy | Non-Renewable Energy



ENERGY C Work Heating and cooling

Keywords

Work: The transfer of energy when a force moves an object, in joules.

Lever: A type of machine which is a rigid bar that pivots about a point.

Input force: The force you apply to a machine.

Output force: The force that is applied to the object moved by the machine.

Displacement: The distance an object moves from its original position.

Deformation: When an elastic object is stretched or squashed, which requires work.

Keywords

Thermal conductor: Material that allows heat to move quickly through it.

Thermal insulator: Material that only allows heat to travel slowly through it.

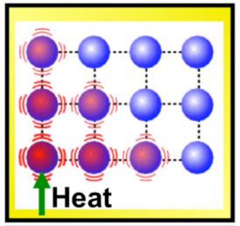
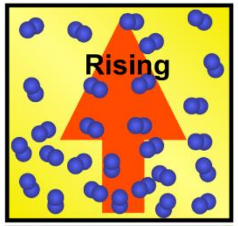
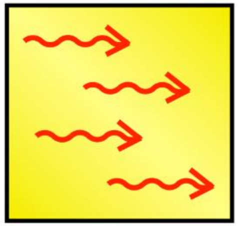
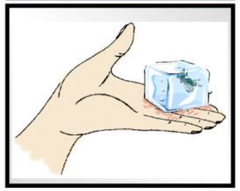
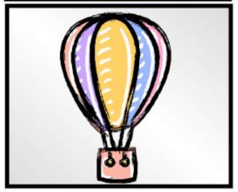
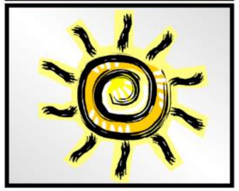
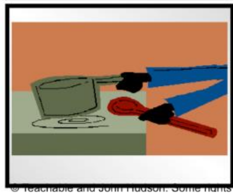
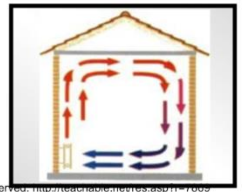
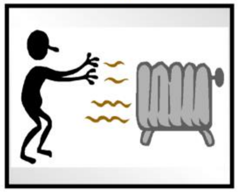
Temperature: A measure of the motion and energy of the particles.

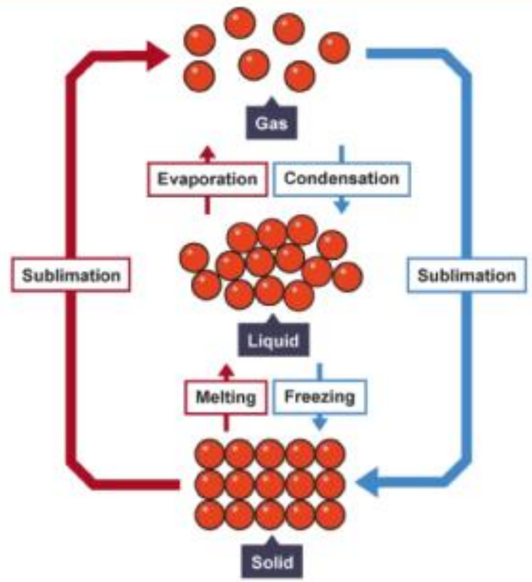
Thermal energy: The quantity of energy stored in a substance due to the vibration of its particles.

Conduction: Transfer of thermal energy by the vibration of particles.

Convection: Transfer of thermal energy when particles in a heated fluid rise.

Radiation: Transfer of thermal energy as a wave.

Conduction	Convection	Radiation
		
Particles with more heat energy vibrate faster. The vibrations pass onto adjacent particles	Particles with more heat energy move faster. Faster moving particles spread out becoming less dense. Less dense material rises	The energy travels in waves. Particles can absorb radiation gaining heat energy
Solids, liquids and gases	Liquids and gases	Can travel through a vacuum
		
		



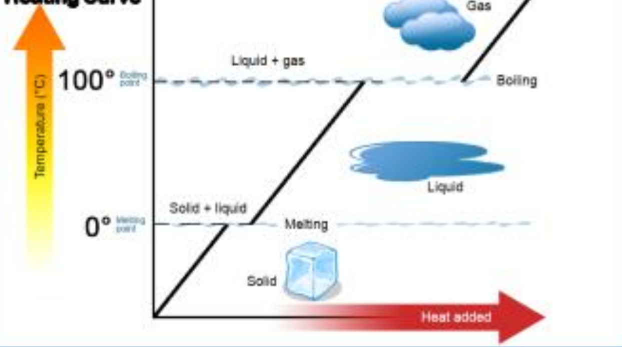
Forces between particles:

Solid: There are strong forces of attraction between the particles in a solid. Therefore, particles can only vibrate in a fixed position.

Liquid: There are weaker forces of attraction between the particles in a liquid. Therefore, the particles are close together, and are able to move around each other.

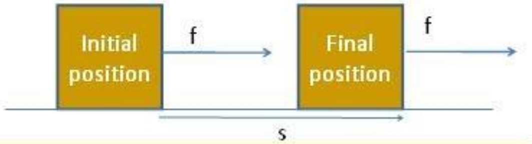
Gas: The forces of attraction between the particles are overcome. Therefore, the particles are far apart and move quickly in all directions.

Heating Curve



Work = Force x Distance moved in the direction of the force

- scalar quantity
- S.I unit : Joule (J)
- Unit: Nm



WAVES D Sound Light

Keywords

Vibration: A back and forth motion that repeats.

Longitudinal wave: Where the direction of vibration is the same as that of the wave.

Volume: How loud or quiet a sound is, in decibels (dB).

Pitch: How low or high a sound is. A low (high) pitch sound has a low (high) frequency.

Amplitude: The maximum amount of vibration, measured from the middle position of the wave, in metres.

Wavelength: Distance between two corresponding points on a wave, in metres.

Frequency: The number of waves produced in one second, in hertz.

Vacuum: A space with no particles of matter in it.

Oscilloscope: Device able to view patterns of sound waves that have been turned into electrical signals.

Absorption: When energy is transferred from sound to a material.

Auditory range: The lowest and highest frequencies that a type of animal can hear.

Echo: Reflection of sound waves from a surface back to the listener.

Keywords

Incident ray: The incoming ray.

Reflected ray: The outgoing ray.

Normal line: From which angles are measured, at right angles to the surface.

Angle of reflection: Between the normal and reflected ray.

Angle of incidence: Between the normal and incident ray.

Refraction: Change in the direction of light going from one material into another.

Absorption: When energy is transferred from light to a material.

Scattering: When light bounces off an object in all directions.

Transparent: A material that allows all light to pass through it.

Translucent: A material that allows some light to pass through it.

Opaque: A material that allows no light to pass through it.

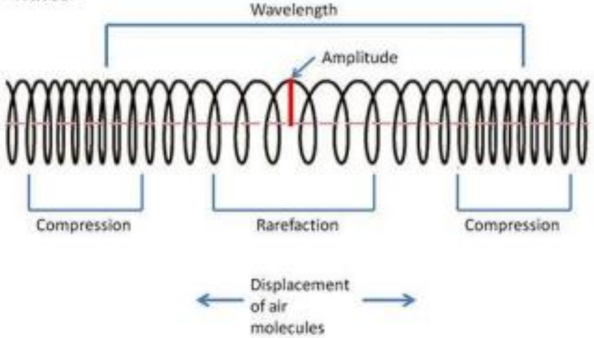
Convex lens: A lens that is thicker in the middle which bends light rays towards each other.

Concave lens: A lens that is thinner in the middle which spreads out light rays.

Retina: Layer at the back of the eye with light detecting cells and where an image is formed.

Longitudinal Waves

In longitudinal waves, the vibrations are parallel to the direction of wave travel. Examples are: Sound Waves, Ultrasound Waves, Seismic P-Waves.



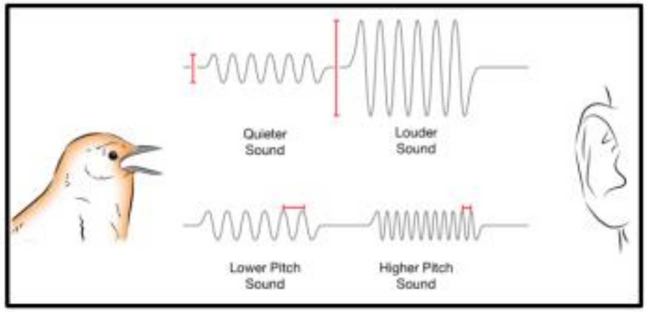
Calculating Wave Speed

$$v = f\lambda$$

v = velocity
f = frequency
λ = wavelength

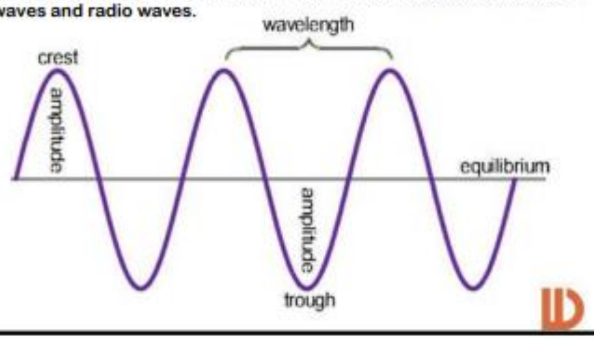
Calculating Speed

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

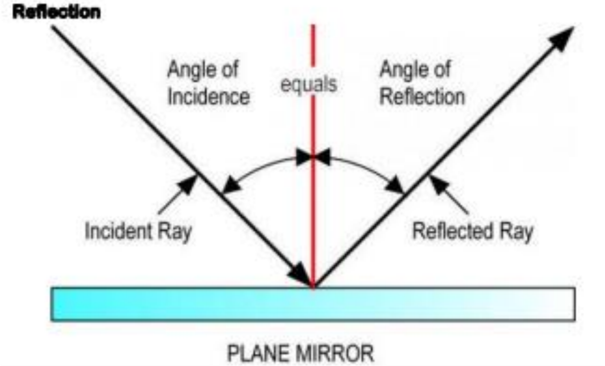


Transverse Waves

In transverse waves, the vibrations are at right angles to the direction of wave travel.
Examples include: Ripples on water, vibrations on a guitar string and a Mexican Wave. Electromagnetic waves such as light waves, micro waves and radio waves.

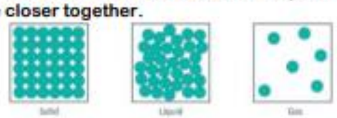


Reflection

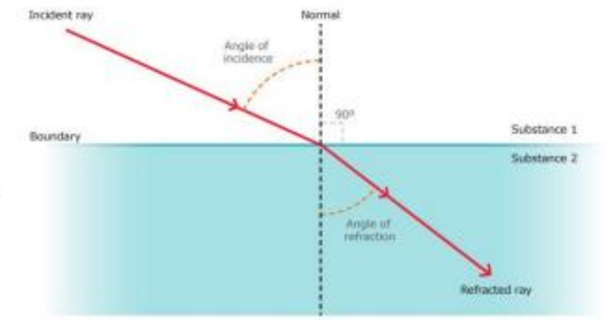


Speed of Light
300,000km/s
Speed of Sound (air)
343m/s

Light can travel through a vacuum but sound cannot. Sound needs a medium to travel through either a solid, liquid or gas. Sound travels fastest in a solid because the particles are closer together.



Refraction



WAVES D Wave Effects Wave Properties

All Saints Catholic High School Science

Keywords

Ultrasound: Sound waves with frequencies higher than the human auditory range.

Ultraviolet (UV): Waves with frequencies higher than light, which human eyes cannot detect.

Microphone: Turns the pressure wave of sound hitting it into an electrical signal.

Loudspeaker: Turns an electrical signal into a pressure wave of sound.

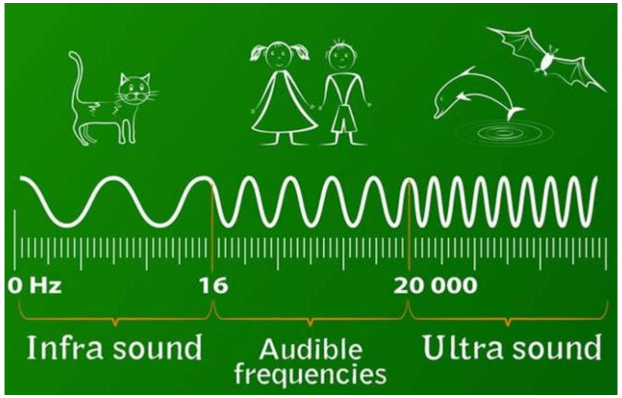
Pressure wave: An example is sound, which has repeating patterns of high-pressure and low-pressure regions.

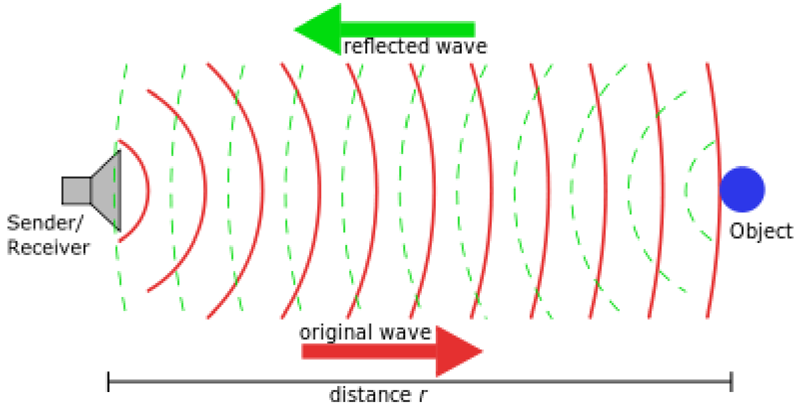
Keywords

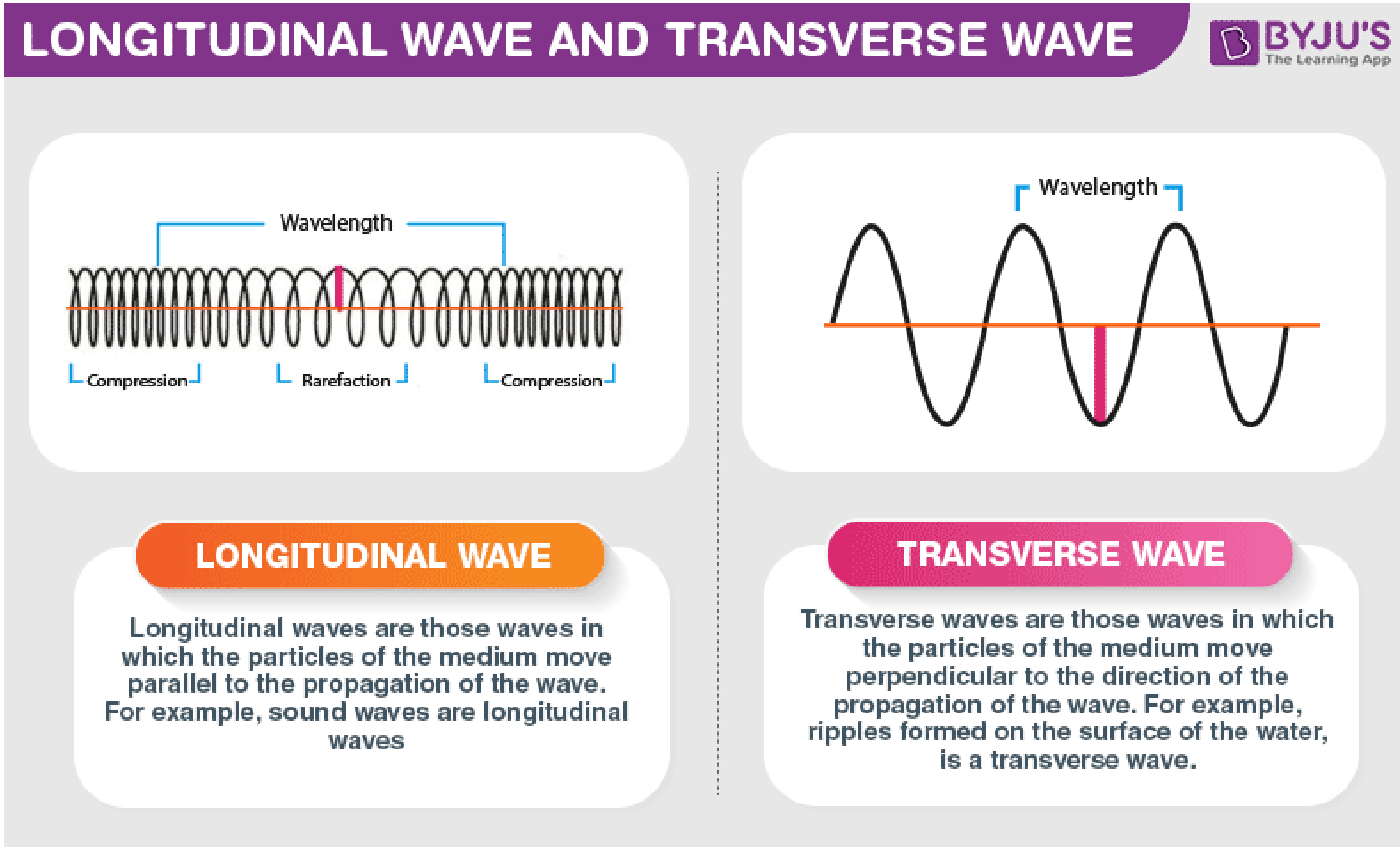
Waves: Vibrations that transport energy from place to place without transporting matter.

Transverse wave: Where the direction of vibration is perpendicular to that of the wave.

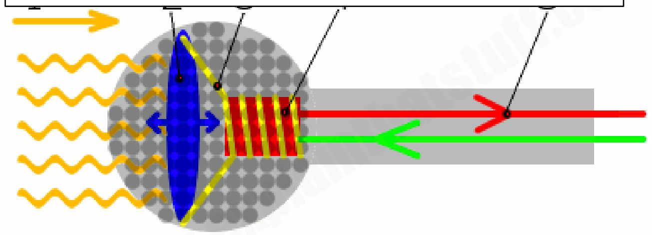
Transmission: Where waves travel through a medium rather than be absorbed or reflected.

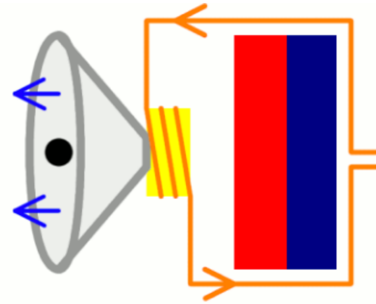






Microphone





Loudspeaker

MATTER E Particle Model Separating Mixtures

All Saints Catholic High School Science

Keywords

Particle: A very tiny object such as an atom or molecule, too small to be seen with a microscope.

Particle model: A way to think about how substances behave in terms of small, moving particles.

Diffusion: The process by which particles in liquids or gases spread out through random movement from a region where there are many particles to one where there are fewer.

Gas pressure: Caused by collisions of particles with the walls of a container.

Density: How much matter there is in a particular volume, or how close the particles are.

Evaporate: Change from liquid to gas at the surface of a liquid, at any temperature.

Boil: Change from liquid to a gas of all the liquid when the temperature reaches boiling point.

Condense: Change of state from gas to liquid when the temperature drops to the boiling point.

Melt: Change from solid to liquid when the temperature rises to the melting point.

Freeze: Change from liquid to a solid when the temperature drops to the melting point.

Sublime: Change from a solid directly into a gas.

Keywords

Solvent: A substance, normally a liquid, that dissolves another substance.

Solute: A substance that can dissolve in a liquid.

Dissolve: When a solute mixes completely with a solvent.

Solution: Mixture formed when a solvent dissolves a solute.

Soluble (insoluble): Property of a substance that will (will not) dissolve in a liquid.

Solubility: Maximum mass of solute that dissolves in a certain volume of solvent.

Pure substance: Single type of material with nothing mixed in.

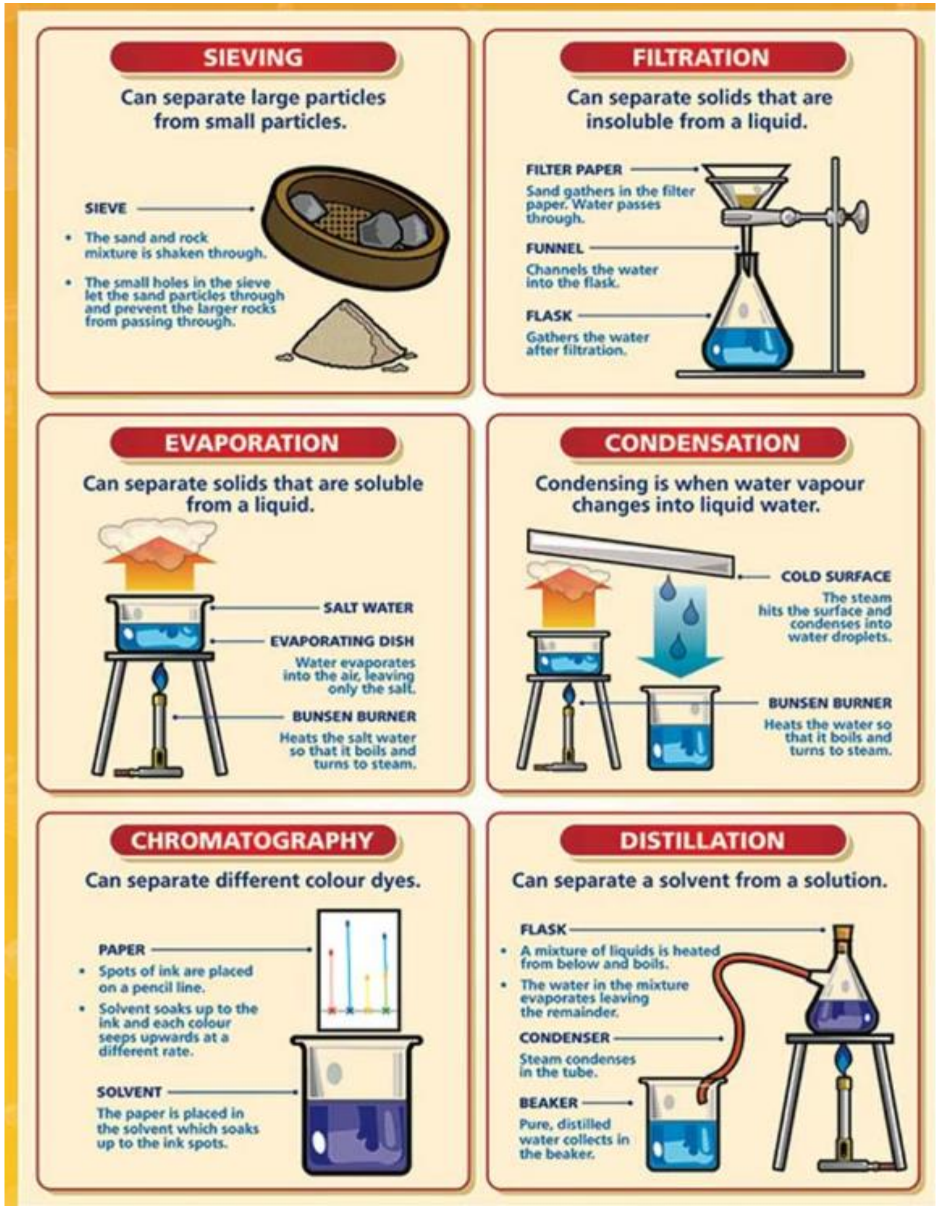
Mixture: Two or more pure substances mixed together, whose properties are different to the individual substances.

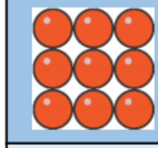
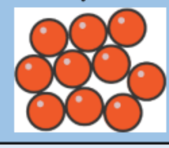
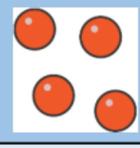
Filtration: Separating substances using a filter to produce a filtrate (solution) and residue.

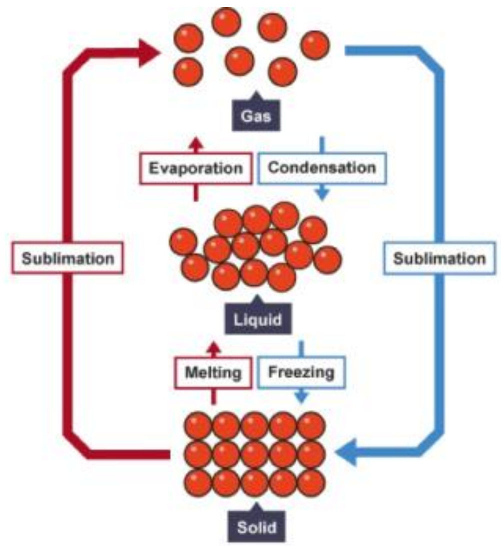
Distillation: Separating substances by boiling and condensing liquids.

Evaporation: A way to separate a solid dissolved in a liquid by the liquid turning into a gas.

Chromatography: Used to separate different coloured substances.



Solid	Liquid	Gas
		
The particles vibrate in a fixed position.	The particles are close together and move around each other.	The particles are far apart and move quickly in all directions.
The particles cannot move from place to place.	The particles are arranged in a random position.	The particles are arranged in a random way.
Particles have a fixed shape and cannot flow.	The particles flow and take the shape of the bottom of their container.	The particles flow and completely fill their container.
The particles cannot be compressed (squashed)	The particles cannot be compressed.	The particles can easily be compressed.



MATTER E Periodic Table and Elements

All Saints Catholic High School Science

Keyword	Definition
Periodic Table	A tabular representation of all known elements in order based on atomic number.
Atomic Number	The number of protons in the nucleus of an atom. Also called the proton number.
Periods	A horizontal row in the periodic table.
Groups	A vertical column in the periodic table containing elements with similar chemical properties.
Element	A substance made of only one type of atom.
Compound	A Substance where two or more elements have chemically joined together.
Mixture	Two or more substances that are not joined together. The substances can be elements, compounds or both.
Reactive	The tendency of a substance to undergo a chemical reaction.

Further Reading:
https://www.bbc.com/bitesize/guides/z3vwxnb/revision/5
https://www.bbc.com/bitesize/guides/z84wjxs/revision/1

The periodic table is arranged in rows called periods and columns called groups. Groups contain elements with similar chemical properties.

Group 1 – Alkali Metals

Group 1 metals are very soft metals which can be cut with a knife. They have very low melting and boiling points and are very reactive compared to other metals. The elements become more reactive as you go down group 1.

When the group 1 metals react in water they produce a metal hydroxide and hydrogen gas.
E.g.
Lithium + Water → Lithium Hydroxide + Hydrogen

Group 2 – Alkali Earth Metals

Group 2 metals are reactive, but less reactive than group 1 elements.
Group 2 metals react with acids to produce a salt and hydrogen. The name of the salt depends on the acid used.
Hydrochloric Acid – Chloride
Sulfuric Acid – Sulfate
Nitric Acid - Nitrate
E.g.
Magnesium + Hydrochloric Acid → Magnesium Chloride + Hydrogen
Magnesium + Sulfuric Acid → Magnesium Sulfate + Hydrogen
Magnesium + Nitric Acid → Magnesium Nitrate + Hydrogen

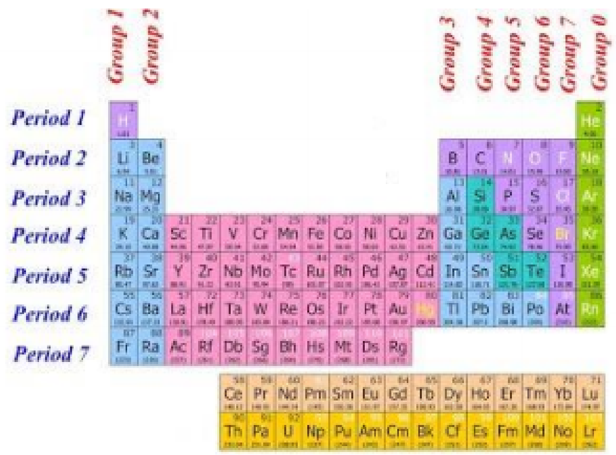
Group 2 metals become more reactive when you go down group 2.

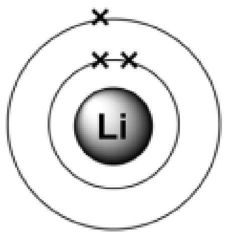
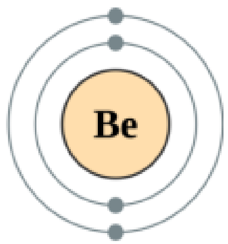
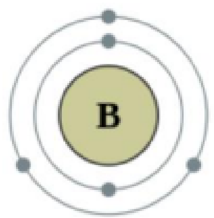
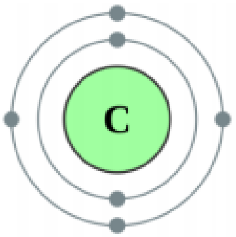
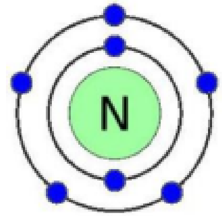
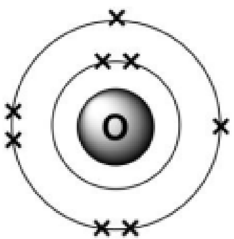
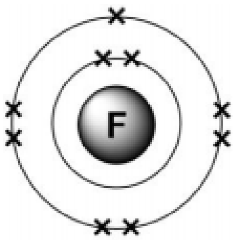
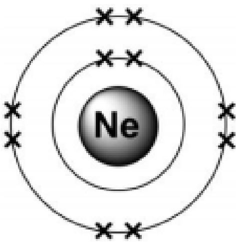
Group 7 – The Halogens

Group 7 elements become less reactive when you move down the group. This can be shown as a displacement reaction.

Group 0 – The Noble Gases

Group 0 elements are not reactive. This is because the atoms have full outer shells.



Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Lithium - Li Sodium - Na Potassium - K	Beryllium – Be Magnesium – Mg Calcium - Ca	Boron – B Aluminium – Al Gallium – Ga	Carbon – C Silicon – Si Germanium – Ge	Nitrogen – N Phosphorus – P Arsenic – As	Oxygen – O Sulfur – S Selenium - S	Fluorine – F Chlorine – Cl Bromine - Br	Helium – He Neon – Ne Argon - Ar
							

Reactions F Metals and non-metals Acids and Alkalis

All Saints Catholic High School Science

Keywords

Metals: Shiny, good conductors of electricity and heat, malleable and ductile, and usually solid at room temperature.

Non-metals: Dull, poor conductors of electricity and heat, brittle and usually solid or gaseous at room temperature.

Displacement: Reaction where a more reactive metal takes the place of a less reactive metal in a compound.

Oxidation: Reaction in which a substance combines with oxygen.

Reactivity: The tendency of a substance to undergo a chemical reaction.

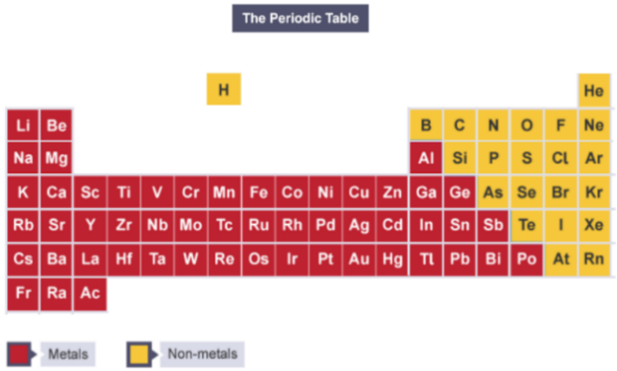
Keywords

pH: Scale of acidity and alkalinity from 0 to 14.

Indicators: Substances used to identify whether unknown solutions are acidic or alkaline.

Base: A substance that neutralises an acid – those that dissolve in water are called alkalis.

Concentration: A measure of the number of particles in a given volume.



Reactivity Series

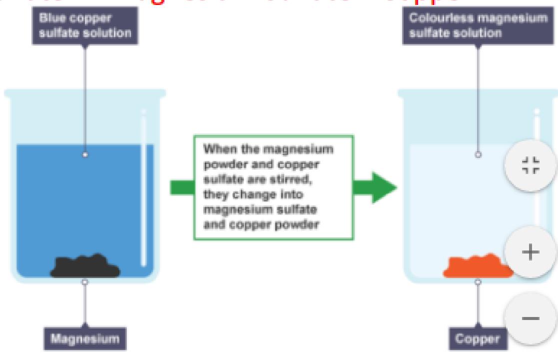
Some metals are very unreactive. This means they don't take part in chemical reactions. For example platinum. Some metals are very reactive and they take part in chemical reactions easily to form new substances.

Displacement Reactions

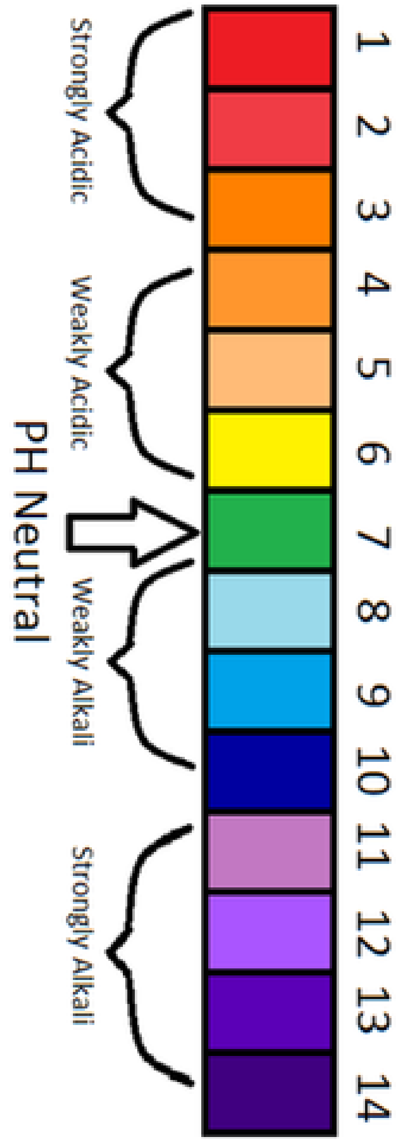
Displacement reactions involve a metal and a compound of a different metal. In displacement reactions, a more reactive metal will displace a less reactive metal from its compound.

Magnesium + Copper Sulfate → Magnesium Sulfate + Copper

Magnesium is more reactive than copper, so it displaces (pushes out) the copper within the compound.



Metals	Non-Metals
Shiny in colour, solids at room temperature (except mercury), high density, strong, malleable, good conductor of heat and electricity.	Dull in colour, can be solids, liquids or gases at room temperature, low density, brittle, poor conductors of heat and electricity.



Reactions F Chemical energy Types of Reaction

Keywords

Catalysts: Substances that speed up chemical reactions but are unchanged at the end.

Exothermic reaction: One in which energy is given out, usually as heat or light.

Endothermic reaction: One in which energy is taken in, usually as heat.

Chemical bond: Force that holds atoms together in molecules.

Keywords

Fuel: Stores energy in a chemical store which it can release as heat.

Chemical reaction: A change in which a new substance is formed.

Physical change: One that changes the physical properties of a substance, but no new substance is formed.

Reactants: Substances that react together, shown before the arrow in an equation.

Products: Substances formed in a chemical reaction, shown after the reaction arrow in an equation.

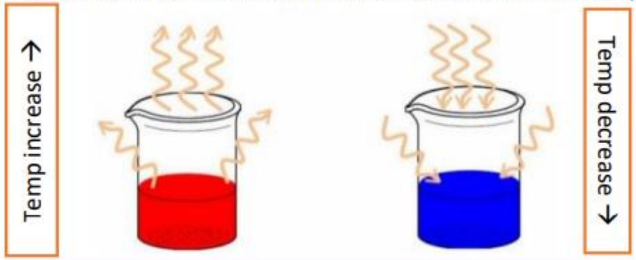
Conserved: When the quantity of something does not change after a process takes place.

Endothermic Reactions

In an endothermic reaction, thermal energy is taken in from the surroundings, therefore there is a temperature decrease. Thermal decomposition is an example.

Exothermic Reactions

In an exothermic reaction, thermal energy is given out to the surroundings, therefore there is a temperature increase. Combustion, oxidation and neutralisation reactions are all examples.



Conservation of Mass

No atoms are created or destroyed in a chemical reaction. Instead, they just joint together in a different way than they were before the reaction, and form products. This means that the total mass of the products in a chemical reaction will be the same as the total mass of the reactants.

Copper + Oxygen → Copper Oxide
10g 0.5g 10.5g

Balancing Equations

A balanced equation gives more information about a chemical reaction because it gives the symbols and formulae of the substances involved.

$Cu + O_2 \rightarrow CuO$

The above equation is not balanced because there is one copper atom on both sides of the arrow, but two oxygen atoms on the left hand side, an only one on the right.
You need to adjust the number of units of some substances until you have equal numbers of atoms on both sides of the arrow. You cannot change formulae of a substance (you can't change the small number).

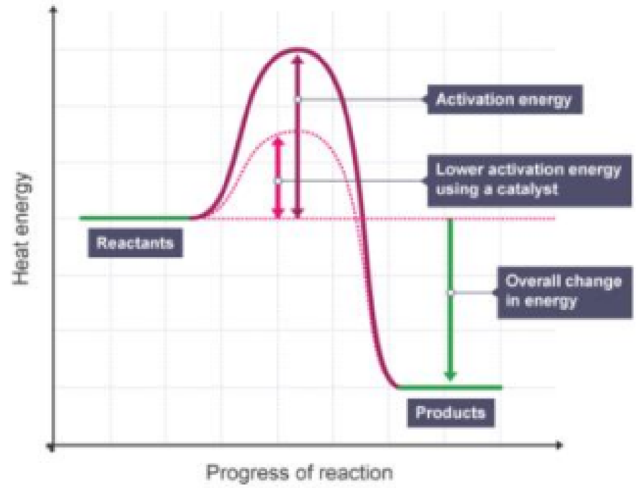
$2Cu + O_2 \rightarrow 2CuO$

Catalysts

A catalyst is a substance that:

- Speeds up the rate of a chemical reaction
- Does not alter the products of the reaction
- Is unchanged chemically and in mass at the end of the reaction.

Catalysts provide an alternative reaction pathway that has a lower activation energy than the uncatalysed reaction.



ORGANISMS H Movement Cells

All Saints Catholic High School Science

Keywords

Joints: Places where bones meet.

Bone marrow: Tissue found inside some bones where new blood cells are made.

Ligaments: Connect bones in joints.

Tendons: Connect muscles to bones.

Cartilage: Smooth tissue found at the end of bones, which reduces friction between them.

Antagonistic muscle pair: Muscles working in unison to create movement.

Keywords

Cell: The unit of a living organism, contains parts to carry out life processes.

Uni-cellular: Living things made up of one cell.

Multi-cellular: Living things made up of many types of cell.

Tissue: Group of cells of one type.

Organ: Group of different tissues working together to carry out a job.

Diffusion: One way for substances to move into and out of cells.

Structural adaptations: Special features to help a cell carry out its functions.

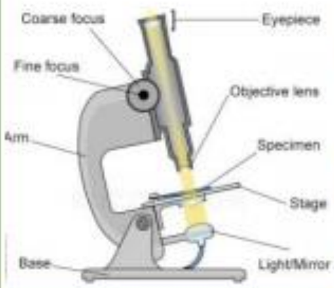
Cell membrane: Surrounds the cell and controls movement of substances in and out.

Nucleus: Contains genetic material (DNA) which controls the cell's activities.

Vacuole: Area in a cell that contains liquid, and can be used by plants to keep the cell rigid and store substances.

Mitochondria: Part of the cell where energy is released from food molecules.

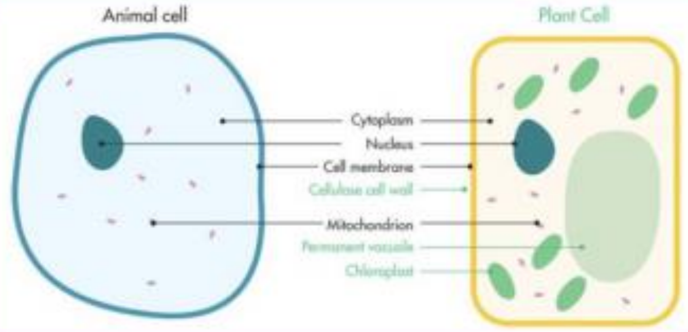
Cell wall: Strengthens the cell. In plant cells it is made of cellulose.

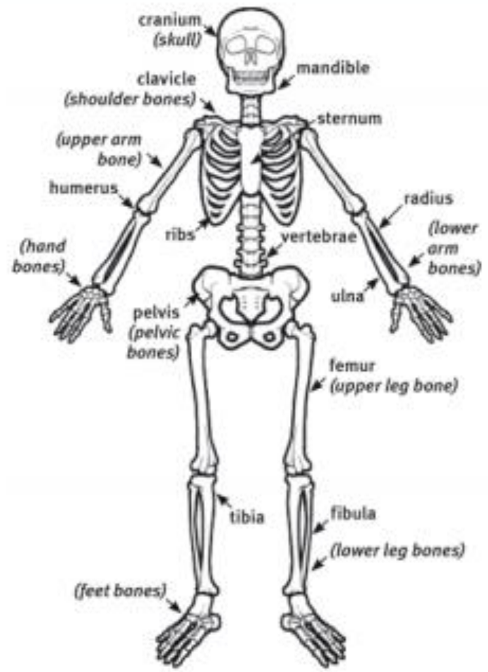


Light Microscope: A device which uses light and a series of lenses to produce a magnified image of an object.

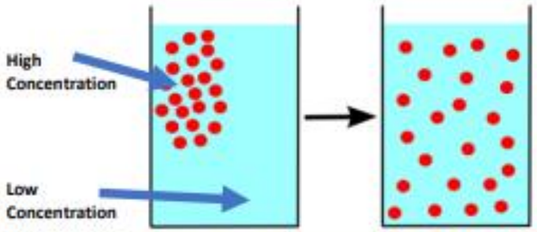
Magnification = How much bigger a sample/object appears under the microscope than it is in real life.

Total magnification = Eyepiece lens x Objective lens

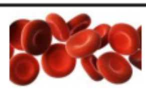
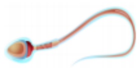
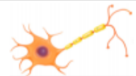




Diffusion: The movement of particles from an area of high concentration to an area of low concentration. Substances diffuse into and out of cells.

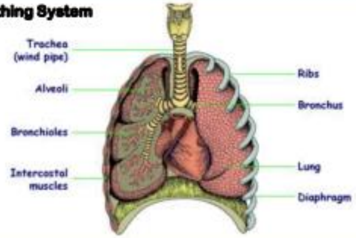


Antagonistic Muscles:
- Muscles work by getting shorter.
- Muscles can only pull and can't push.
- Muscles work in pairs.
- When you raise your forearm, the biceps contract and the triceps relax.
- When you lower your forearm, the biceps relax and the triceps contract.

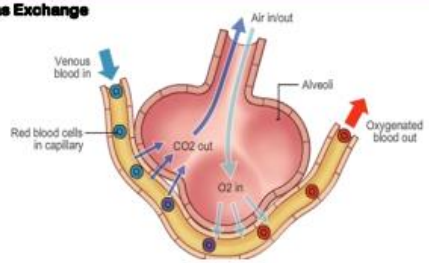
Red Blood Cell	Sperm Cell	Egg Cell	Root Hair Cell	Palisade Cell	Nerve Cell
					
Carries blood around the body. **Adaptations**: No nucleus, large surface area and biconcave shape.	Carries the male genes. **Adaptations**: Tail for swimming, mitochondria for energy, acrosome to break down the egg cell.	Carries the female genes. **Adaptations**: Lots of mitochondria. Outer layer hardens once fertilised.	Take in water from the soil. **Adaptations**: Long & thin; large surface area for maximum water absorption. Thin cell walls.	Production of food for the plant. **Adaptations**: Tall and thin. Lots of chloroplasts to absorb sunlight for photosynthesis.	Carry signals around the body. **Adaptations**: Long axon. Myelin sheath.

ORGANISMS H Breathing Digestion

The Breathing System



Gas Exchange



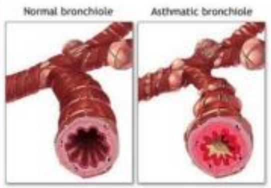
The alveoli are adapted to make gas exchange in the lungs happen easily and efficiently.

- Alveoli give the lungs a large surface area.
- Alveoli have think cells walls (just one cell thick)
- Alveoli are surrounded by lots of blood capillaries.

The gases move by diffusion from where they have a high concentration to a lower concentration.

Oxygen diffuses from the air in the alveoli into the blood.
Carbon dioxide diffuses from the blood into the air in the alveoli.

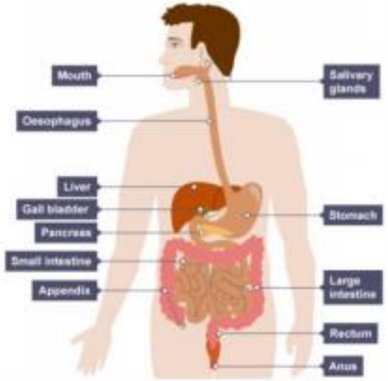
Asthma and Respiration



Air passage for people who are asthmatic become reduced.

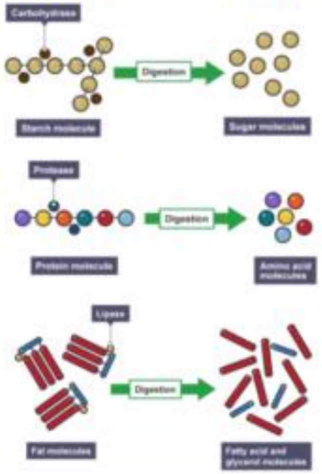
This is why they often struggle during exercise as there is reduced volume of oxygen getting into the blood stream, so rate of respiration is reduced.

The food we eat has to be broken down into other substances that our bodies can use. This is called digestion. Without this process, we could not absorb the food unto our bodies and use it.



Organ	Function
Oesophagus	Also known as the gullet. Connects the mouth to the stomach. Food is pushed down using contractions of muscles.
Liver	Production of bile.
Stomach	Churns and mixes the food with hydrochloric acid and enzymes.
Pancreas	Produces biological catalysts called enzymes which speeds up the digestive reactions.
Small Intestine	Absorption of digested food into the bloodstream, production of enzymes to aid digestion.
Large Intestine	Absorption of excess water.
Rectum	Storage of faeces (undigested material) before excretion.
Anus	Where faeces are excreted (removed from the body).

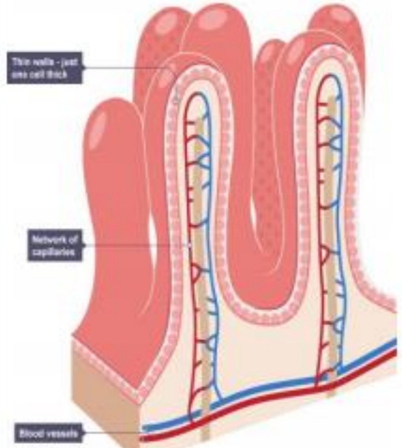
Enzymes are not living things. They are special proteins that can break large molecules into smaller molecules.



Minerals, vitamins and water are already small enough to be absorbed by the body without being broken down, so they're not digested.

Digestive enzymes cannot break down dietary fibre, which is why the body cannot absorb it.

Adaptations of the Small Intestine



The small intestine is adapted for efficient absorption of digested food into the blood stream by:

- Having a very large surface area.
- Surrounded by lots of blood capillaries.
- Thin walls (1 cell thick) for faster absorption.

Keywords

Enzymes: Substances that speed up the chemical reactions of digestion.

Dietary fibre: Parts of plants that cannot be digested, which helps the body eliminate waste.

Carbohydrates: The body's main source of energy. There are two types: simple (sugars) and complex (starch).

Lipids (fats and oils): A source of energy. Found in butter, milk, eggs, nuts.

Protein: Nutrient your body uses to build new tissue for growth and repair. Sources are meat, fish, eggs, dairy products, beans, nuts and seeds.

Stomach: A sac where food is mixed with acidic juices to start the digestion of protein and kill microorganisms.

Small intestine: Upper part of the intestine where digestion is completed and nutrients are absorbed by the blood.

Large intestine: Lower part of the intestine from which water is absorbed and where faeces are formed.

Gut bacteria: Microorganisms that naturally live in the intestine and help food break down.

Keywords

Breathing: The movement of air in and out of the lungs.

Trachea (windpipe): Carries air from the mouth and nose to the lungs.

Bronchi: Two tubes which carry air to the lungs.

Bronchioles: Small tubes in the lung.

Alveoli: Small air sacs found at the end of each bronchiole.

Ribs: Bones which surround the lungs to form the ribcage.

Diaphragm: A sheet of muscle found underneath the lungs.

Lung volume: Measure of the amount of air breathed in or out.

ECOSYSTEMS I Interdependence Plant reproduction

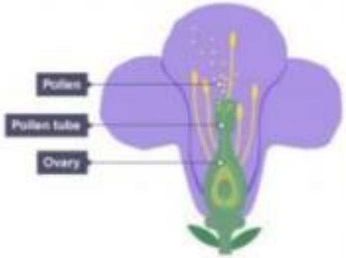
Pollination

During plant reproduction, pollen grains need to move from the anther of one flower to the stigma of another flower. This is called pollination. Pollination can occur by either insects or the wind.


Feature	Insect-pollinated	Wind-pollinated
Petals	Large and brightly-coloured – to attract insects	Small, often dull green or brown – no need to attract insects
Scent and nectar	Usually scented and with nectar – to attract insects	No scent or nectar – no need to attract insects
Number of pollen grains	Moderate - insects transfer pollen grains efficiently	Large amounts – most pollen grains are not transferred to another flower
Pollen grains	Sticky or spiky - sticks to insects well	Smooth and light – easily carried by the wind without clumping together
Anthers	Inside flower, stiff and firmly attached - to brush against insects	Outside flower, loose on long filaments – to release pollen grains easily
Stigma	Inside flower, sticky - pollen grains stick to it when an insect brushes past	Outside flower, feathery – form a network to catch drifting pollen grains

Fertilisation

After pollination the pollen makes a pollen tube down the style to the ovary. The nucleus of the pollen cell travels down the tube to the ovum – when the cell join, this is fertilisation. The cell made when the pollen and ovum fuse will become the seed, which can become a new plant. Plants then form fruits, often from the ovary walls.



Keywords

Pollen: Contains the plant male sex cells found on the stamens.

Ovules: Female sex cells in plants found in the ovary.

Pollination: Transfer of pollen from the male part of the flower to the female part of the flower on the same or another plant.

Fertilisation: Joining of a nucleus from a male and female sex cell.

Seed: Structure that contains the embryo of a new plant.

Fruit: Structure that the ovary becomes after fertilisation, which contains seeds.

Carpel: The female part of the flower, made up of the stigma where the pollen lands, style and ovary.

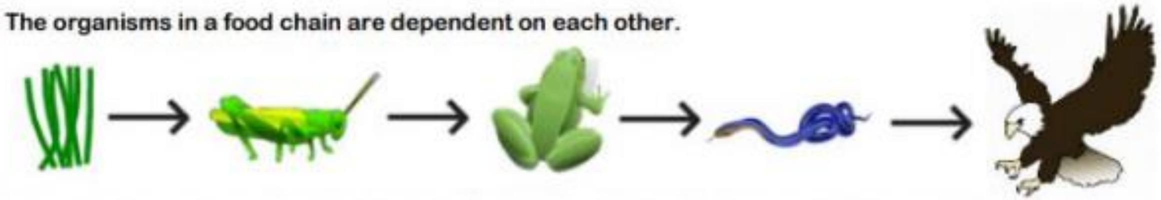
Seed Dispersal

Plants compete with each other for factors including light, water, space, minerals in the soil. Seeds must be dispersed or spread away from each other and from the parent plant. This is to reduce competition between parent plant and new plants.

Method	Detail	Examples
Wind	Seeds have lightweight parts, wings or parachutes	Dandelion, sycamore
Animals (inside)	Brightly coloured and tasty fruits contain seeds with indigestible coats, so that the seeds pass through the animal's digestive system undamaged	Tomato, plum, raspberry, grape
Animals (outside)	Fruits have hooks that attach them to the fur of passing animals	Goose grass, burdock
Self-propelled	Have a pod that bursts open when ripe, throwing the seeds away from the plant	Pea pod

Food Webs & Interdependence

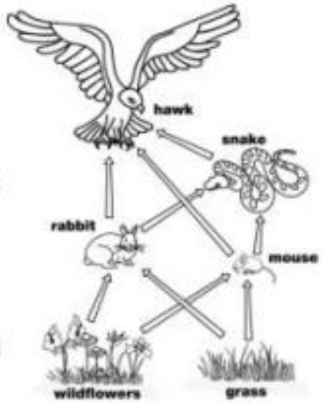
The organisms in a food chain are dependent on each other.



For example, grass is eaten by the caterpillar, which eaten by the frog, which is eaten by the snake, which in turn is hunted by the bird.

The grass is the producer in this food chain, and producers are at the start of all food chains. The grass captures the energy from the sunlight to photosynthesise and make glucose. The glucose provides energy for the grass to grow. When the caterpillar eats the grass, some of the energy left in the grass is transferred to the caterpillar. This energy is passed down the food chain.

Changes in the number of one organism in an area – its population can affect other organisms in the same food chain.
The number of plants in an area can be affected by the amount of rain, sunlight, minerals and space available to grow.
The number of animals can be affected by the availability of food habitats, mates, water and disease.



Keywords

Food web: Shows how food chains in an ecosystem are linked.

Food chain: Part of a food web, starting with a producer, ending with a top predator.

Ecosystem: The living things in a given area and their non-living environment.

If the population of mice caught a disease, then there would be more competition between the Hawk and Snake to catch the Rabbit. This could then cause the number of Rabbits to decrease.

ECOSYSTEMS I Respiration and Photosynethesis

All Saints Catholic High School Science

Aerobic Respiration

Respiration is a series of reactions that takes place in the cells of animals and plants.
Energy is released in the reaction. The mitochondria, found in the cell cytoplasm, is where respiration happens.

Glucose + Oxygen → Carbon Dioxide + Water (+energy)

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

'Energy' is in brackets because it is not a substance. This type of respiration, where oxygen is used, is known as aerobic respiration. Oxygen (from breathing) is carried from the lungs to all the cells of the body in the blood. The waste products (carbon dioxide and water) are taken away from the cells by the blood and breathed out from the lungs.

Anaerobic Respiration

Although anaerobic respiration does release some energy, it does not release as much as aerobic respiration does.

Glucose → Lactic Acid (+energy)

The lactic acid produced during anaerobic respiration builds up in muscles. This can be felt as an aching in muscles during or after exercise.

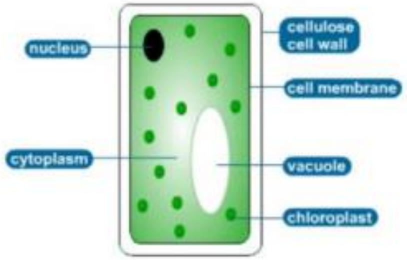
Anaerobic Respiration In Microbes

Anaerobic respiration happens in microorganisms such as bacteria because they need to release energy from glucose. Yeast (unicellular fungi), carry out a process called fermentation.

Glucose → Ethanol + Carbon Dioxide

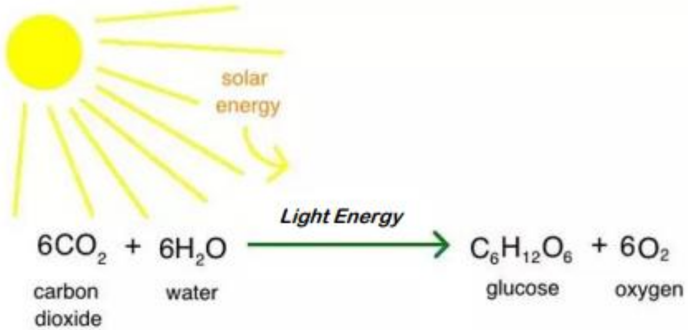
The ethanol (alcohol) is useful for brewers, and carbon dioxide is useful to bakers because it helps their bread rise.

Green plants and algae do not eat food to get their energy, Instead they make their own food by a process called photosynthesis.
Photosynthesis takes place inside plant cells within the chloroplasts.
Below shows a diagram of a plant cell.



Chloroplasts contain a green pigment called chlorophyll. This absorbs light energy needed for photosynthesis to occur.

Plants use the raw materials; Carbon Dioxide and Water. With the presence of light energy from the sun, the raw materials are converted into Glucose and Oxygen.



Keywords

Aerobic respiration: Breaking down glucose with oxygen to release energy and producing carbon dioxide and water.

Anaerobic respiration (fermentation): Releasing energy from the breakdown of glucose without oxygen, producing lactic acid (in animals) and ethanol and carbon dioxide (in plants and microorganisms).

This plant is deficient in nitrate ions. There is poor grown and yellow leaves. Nitrate ions are needed to build proteins and to help the plant grow.

This plant is deficient in phosphate ions. Phosphate ions are needed to ensure good root growth.

The leaves are starting to turn purple.

This plant is deficient in Magnesium ions. Yellow leaves start to form, so rate of photosynthesis is reduced. Magnesium ions are needed for photosynthesis.

This plant is deficient in Potassium ions. Potassium ions are needed for making flowers and fruit.

The leaves are turning yellow, with dea spots.

Keywords

Fertilisers: Chemicals containing minerals that plants need to build new tissues.

Photosynthesis: A process where plants and algae turn carbon dioxide and water into glucose and release oxygen.

Chlorophyll: Green pigment in plants and algae which absorbs light energy.

Stomata: Pores in the bottom of a leaf which open and close to let gases in and out.

GENES J Variation Human Reproduction

All Saints Catholic High School Science

Keywords

Gamete: The male gamete (sex cell) in animals is a sperm, the female an egg.

Fertilisation: Joining of a nucleus from a male and female sex cell.

Ovary: Organ which contains eggs.

Testicle: Organ where sperm are produced.

Oviduct, or fallopian tube: Carries an egg from the ovary to the uterus and is where fertilisation occurs.

Uterus, or womb: Where a baby develops in a pregnant woman.

Ovulation: Release of an egg cell during the menstrual cycle, which may be met by a sperm.

Menstruation: Loss of the lining of the uterus during the menstrual cycle.

Reproductive system: All the male and female organs involved in reproduction.

Penis: Organ which carries sperm out of the male's body.

Vagina: Where the penis enters the female's body and sperm is received.

Foetus: The developing baby during pregnancy.

Gestation: Process where the baby develops during pregnancy.

Placenta: Organ that provides the foetus with oxygen and nutrients and removes waste substances.

Amniotic fluid: Liquid that surrounds and protects the foetus.

Umbilical cord: Connects the foetus to the placenta.

Keywords

Species: A group of living things that have more in common with each other than with other groups.

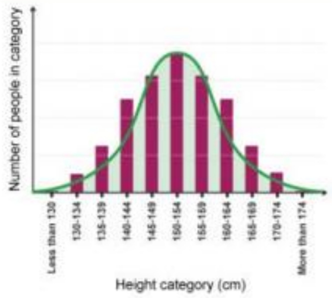
Variation: The differences within and between species.

Continuous variation: Where differences between living things can have any numerical value.

Discontinuous variation: Where differences between living things can only be grouped into categories.

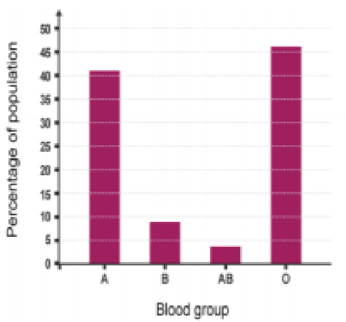
Continuous Variation

Human height is an example. It ranges from the smallest person on Earth to the tallest. Continuous variation shows characteristics that change gradually over time.



Discontinuous Variation

A characteristic of any species with only a limited number of possible values. Eye colour and blood group are examples.



Inherited Variation

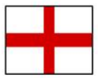
Variation in characteristics that is a result of genetic information from parents.

Examples include:

- Eye colour
- Hair colour
- Lobed or lobeless ears
- Ability to roll your tongue.

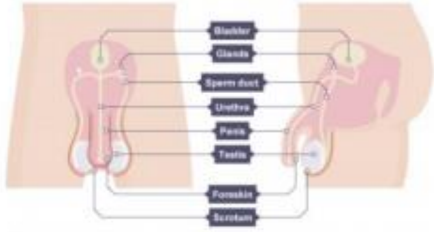
Environmental Variation

Characteristics of animal and plant species can be affected by factors such as climate, diet, accidents, culture and lifestyle.
If you eat too much food then you will become heavier.
Variation caused by the surroundings is called environmental variation. Examples include your language and religion.



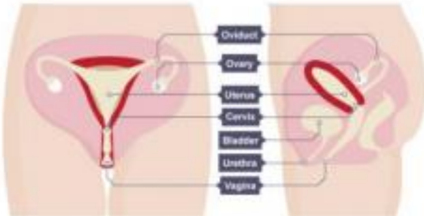
The Male Reproductive System

The testes produce millions of make gametes (sex cells) called sperm. The sperm pass through sperm ducts, and mix with fluids produce by the glands. The penis passes urine and semen out of the males body. The urethra is the tube which carries the urine or semen.



The Female Reproductive System

The two ovaries contain hundreds of undeveloped female gametes. These are called ova (one is called an ovum). Women have these cells in their body from birth.
Each ovary is connected to the uterus by an oviduct, sometimes known as the fallopian tube. Every month, an egg develops, becomes mature and is released from an ovary.



- The uterus is where a baby develops until its birth.
- The cervix is a ring of muscle at the lower end of the uterus. It keeps the baby in place while the woman is pregnant.
- The vagina is a muscular tube that leads from the cervix to the outside of the woman's body.

Fertilisation

Fertilisation is when a sperm cell and ovum fuse. Sperm cells are released into the female reproductive system during sexual intercourse (ejaculation). Only one sperm cell breaks through the cell membrane and enters the ovum.

The Menstrual Cycle

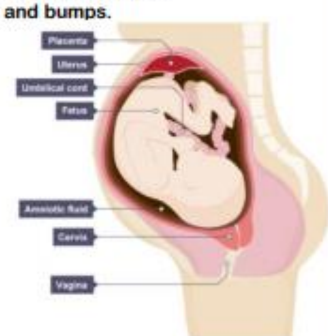
The menstrual cycle prepares the female body for pregnancy by causing eggs (ova) to mature and be released. The process lasts for 28 days.

Days 1-5	• 'period' happens (menstruation), where uterus lining breaks down.
Days 6-13	• Uterus lining builds up (thickens) to prepare for pregnancy. The egg (ovum) matures in the ovary
Day 14	• Egg (ovum) released from the ovary and travels down the oviduct
Days 15-28	• Uterus lining stays thick, in case the egg is fertilised

Foetus Development & Placenta

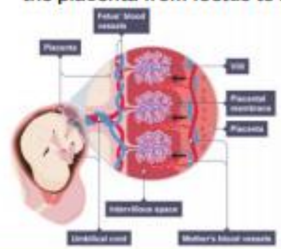
The foetus relies upon its mother as it develops.

- Protection against knocks and bumps.
- Oxygen
- Nutrients (food & Water)



The placenta is an organ responsible for providing oxygen and nutrients, and removing waste substances. It grows into the wall of the uterus and is joined by the foetus by the umbilical cord.

- Oxygen and nutrients diffuse from mother to foetus.
- Carbon dioxide and other waste substances diffuse across the placenta from foetus to mother.



GENES J Evolution Inheritance

All Saints Catholic High School Science

Keywords

Inherited characteristics: Features that are passed from parents to their offspring.

DNA: A molecule found in the nucleus of cells that contains genetic information.

Chromosomes: Thread-like structures containing tightly coiled DNA.

Gene: A section of DNA that determines an inherited characteristic.

Keywords

Population: Group of organisms of the same kind living in the same place.

Natural selection: Process by which species change over time in response to environmental changes and competition for resources.

Extinct: When no more individuals of a species remain.

Biodiversity: The variety of living things. It is measured as the differences between individuals of the same species, or the number of different species in an ecosystem.

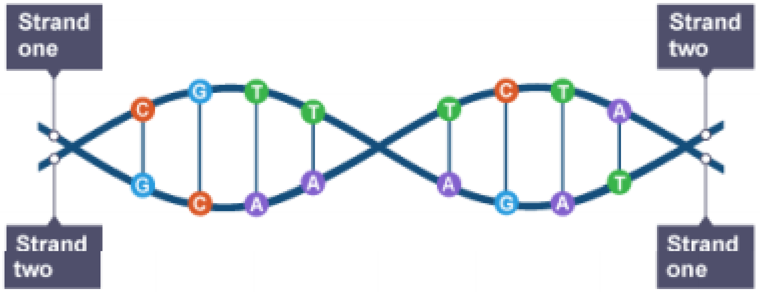
Competition: When two or more living things struggle against each other to get the same resource.

Evolution: Theory that the animal and plant species living today descended from species that existed in the past.

DNA

DNA is found in the nuclei of cells and organized into chromosomes. This genetic information is passed from one generation to the next. It is called heredity and why we resemble our parents. The genetic information itself is contained in a complex molecule called DNA.

DNA molecules contain two strands. The strands are twisted around each other to form a double helix. These strands are held together by bonds between base pairs.



A DNA molecule showing its base pairs, G–C and A–T

Evolution

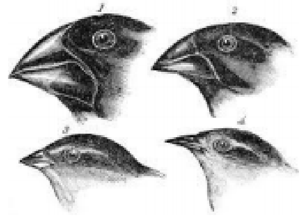
Change in the inherited characteristics of a population over time through a process of natural selection, which may result in the formation of a new species.

The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.

Natural selection of variants that give rise to phenotypes best suited to their environment.

- Variation (mutation)
- Adaptation
- Survival

& Reproduction



Extinction

The permanent loss of all the members of a species

<u>Reasons for extinction:</u>

- Introduction of a NEW disease
- Introduction of a NEW competitor
- Introduction of a NEW predator / overhunting
- Lack of food / prey
- Environmental change (temp., rainfall, loss of habitat etc.)
- Natural disaster