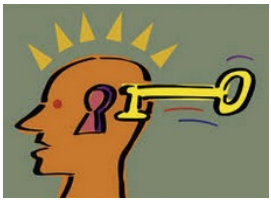


Science
Crucial Knowledge

Year 7

Page numbers highlighted in yellow

Biology

Biology is the study of living things

Chemistry

Chemistry is the study of how substances interact

Physics

Physics is the study of forces and energy

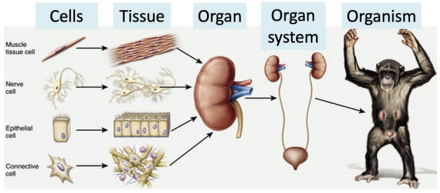
Core Crucial Knowledge

Year 7 + 8 Biology

Biology is the study of living things

MRS GREN – All living things carry out these 7 life processes

- **M**ovement – all living things move, even plants
- **R**espiration – the release of energy from glucose
- **S**ensitivity – all living things detect changes in their surroundings
- **G**rowth – all living things grow
- **R**eproduction – can be either sexual or asexual
- **E**xcretion – all living things produce and release waste products
- **N**utrition – taking in and using nutrients and food



Organisation – how living things are built

- Cells are the basic building blocks of all living organisms
- Tissues are groups of cells with a similar structure and function. Eg muscle tissue
- Organs are groups of tissues performing specific functions. Eg, heart
- Organs are grouped into organ systems, which work together to form organisms

Function of cell parts

- Nucleus – controls the cell, contains DNA
- Cell membrane – allows substances in and out of the cell
- Cell wall – for shape, structure, support. Made of cellulose in plants
- Mitochondria – aerobic respiration occurs here, to release energy from glucose
- Ribosomes – make protein
- Vacuole (plant only) – stores water and sap
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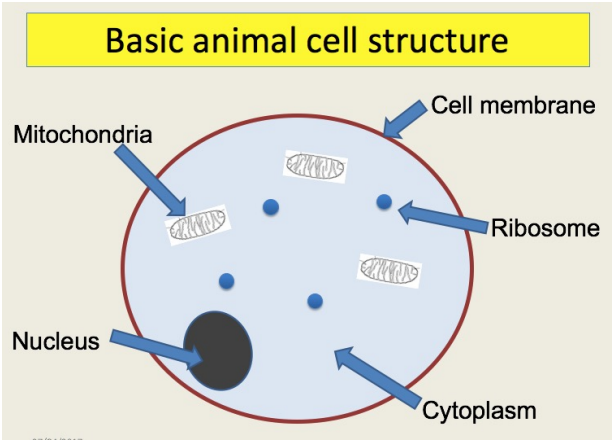
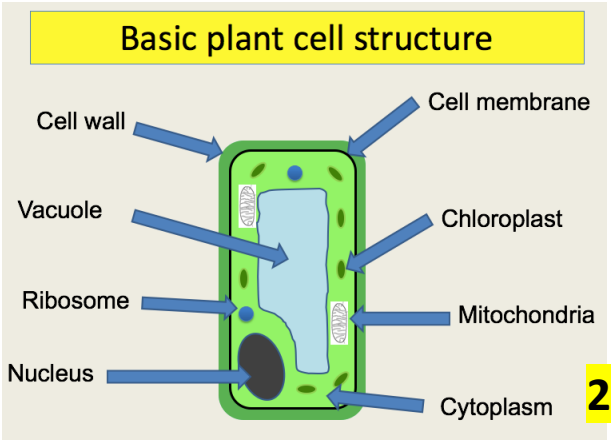
- Cytoplasm – liquid that fills the cell, chemical reactions occur here





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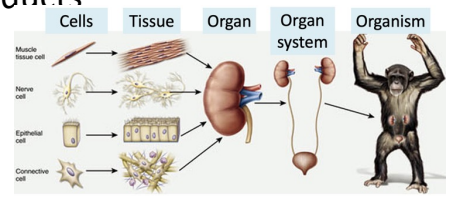

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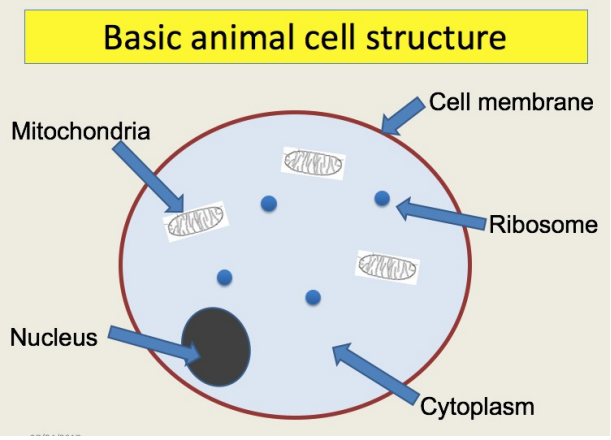
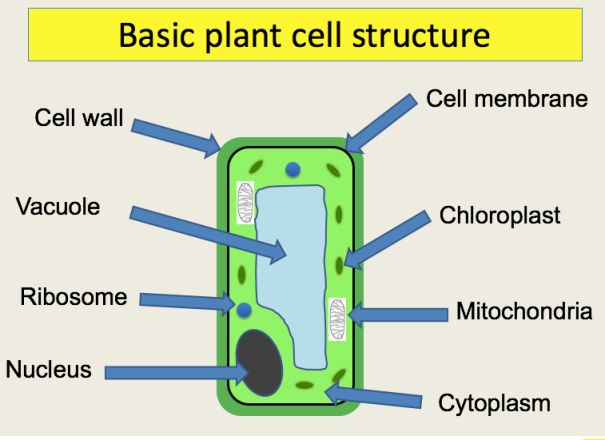
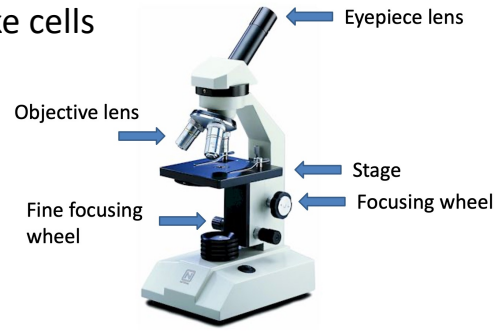




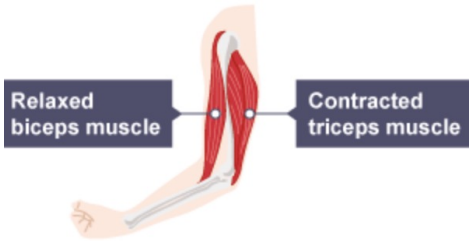
Microscopes

- Microscopes are used to look at very small objects like cells
- Magnification = eyepiece lens x objective lens



Muscles

- Can only pull
- Work in antagonistic pairs eg. biceps and triceps
- Tendons attach muscles to bones

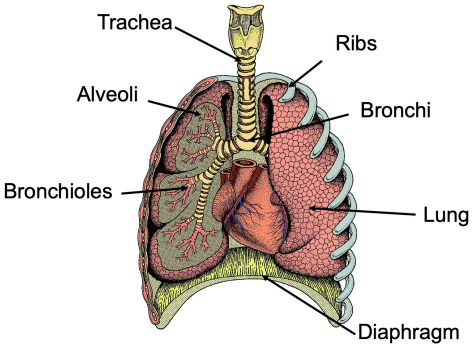


The skeleton

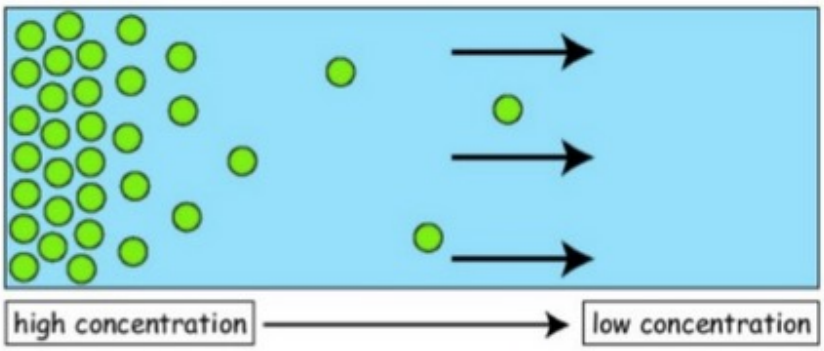
- The four functions of the skeleton are support, protection, storage and movement

The lungs and breathing

- The lungs have a large surface area
- The diaphragm is a muscle under the lungs
- When the diaphragm contracts we inhale
- When the diaphragm relaxes we exhale
- Gases are exchanged in the lungs by diffusion



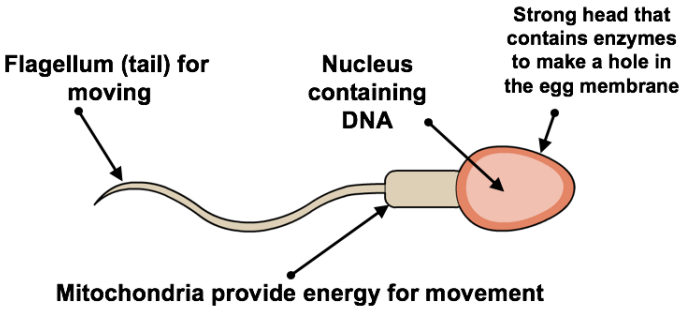
- Diffusion is the movement of particles from a high concentration to a low concentration



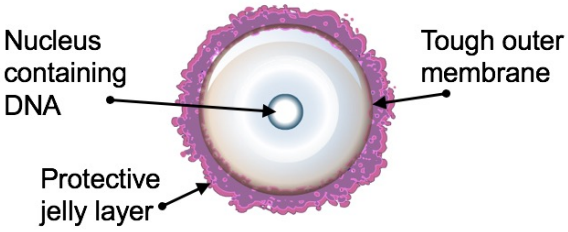
Gametes

- Gametes are sex cells (sperm and egg)
- Male gamete → sperm. Made in the testes
- Female gamete → egg. Made in the ovary

Adaptations of a sperm cell

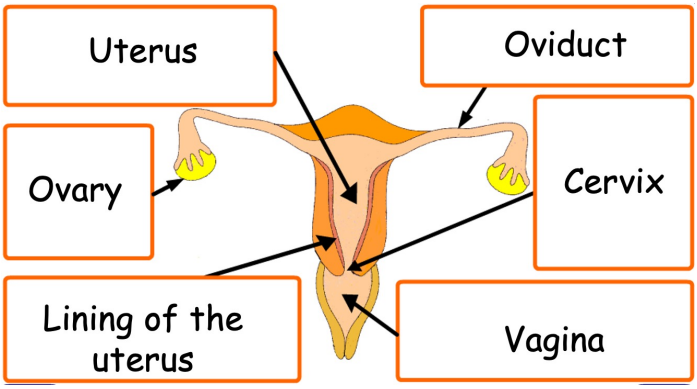


Adaptations of an egg cell



Sexual organs

- Male → penis
- Female → vagina



Fertilisation

- Fertilisation occurs when a sperm cell fuses with an egg cell
- This happens in the oviduct
- Once sperm and egg have joined, the resulting cell is called a zygote
- The zygote multiplies to form a ball of cells called an embryo
- The embryo implants in the wall of the uterus
- This grows and becomes a foetus

Pregnancy & Birth

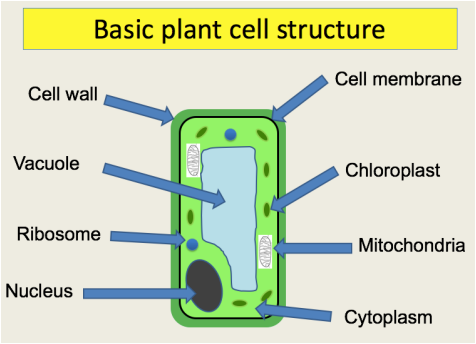
- Pregnancy in humans lasts for 40 weeks
- Oxygen and nutrients are passed into the foetus through the umbilical cord and placenta
- Carbon dioxide and waste products are removed from the foetus through the umbilical cord and placenta

Crucial Knowledge Year 7

7B3 Plants & Ecosystems

7B3

Function of cell parts



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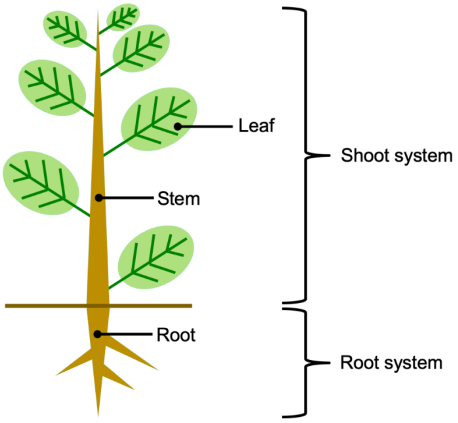
- Cytoplasm – liquid that fills the cell, chemical reactions occur here

Tissues

- A tissue is a group of cells with a similar structure and function
- Examples of plant tissues – root hair tissue, xylem tissue
- Root hair cells/tissue absorb water by osmosis
- Xylem tissue transports water around a plant

Plant organs



Adaptations of a leaf

- Large surface area to absorb lots of sunlight
- Lots of chloroplasts
- Stomata are pores (holes) on the bottom side of a leaf
- Stomata allow gas exchange – carbon dioxide in, oxygen out

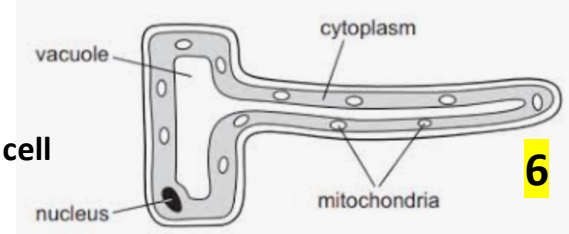
Photosynthesis

- Plants make their own food by photosynthesis
- Plants take in carbon dioxide through the leaves
- Plants take in water through the roots
- Plants absorb sunlight energy through the chloroplasts (in the leaf cells)
- Glucose and oxygen are produced by photosynthesis
- Photosynthesis word equation:

Carbon dioxide + water → glucose + oxygen

Limiting factors of photosynthesis

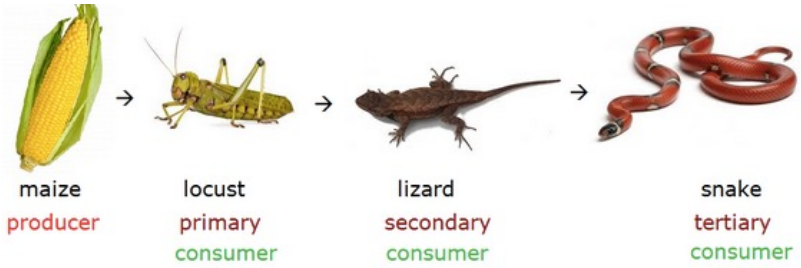
- Limiting factors are the thing in short supply – this prevents photosynthesis
- Light intensity
- Carbon dioxide levels
- Temperature



Root hair cell

Food chains

- Always start with a producer which makes its own food by by photosynthesis
- Producer → primary consumer → secondary consumer → tertiary consumer
- The arrows in a food chain show the flow of energy



Species

- A species is a group of living things that can interbreed (have babies)

Biodiversity

- Biodiversity is the amount of different species living in a habitat

Sampling techniques - Quadrats

- A quadrat is a hollow square frame used to estimate the number of organisms in an area

1. Place randomly in the area you wish to sample
2. Count up the number of organisms
3. Repeat many times and find the mean
4. Multiply the mean by the number of quadrats that will fit into the area to find your estimate

Core Crucial Knowledge

Chemistry is the study of how substances interact

Year 7 + 8 Chemistry

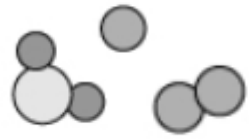
Atoms, elements, molecules, compound, mixture

- Atoms make up everything
- An element is made up of only one type of atom
- A molecule is made up of two or more atoms
- A compound is made up of two or more different atoms. Example: CO_2
- A mixture is a group of chemicals not bonded together. Example: air

Atom
Element

Elements
Molecules

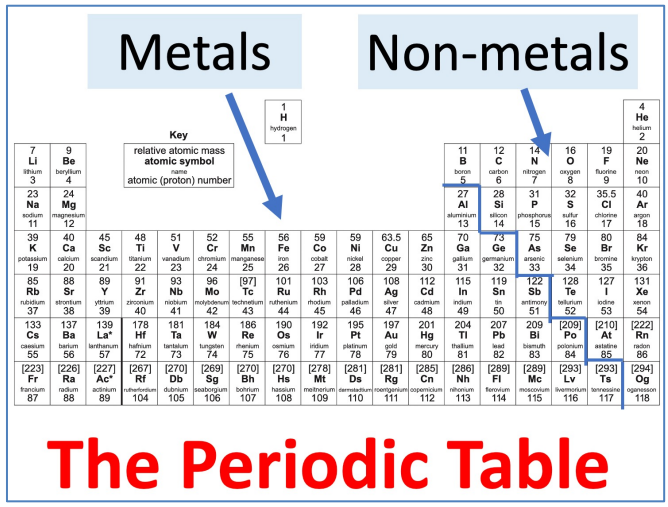
Compound



Mixture

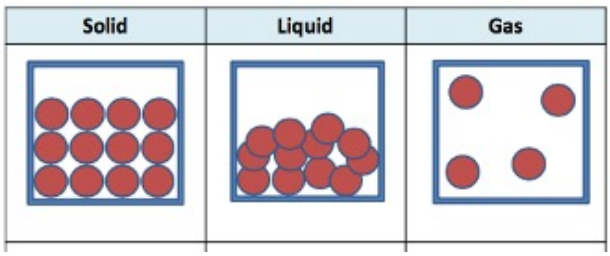
The Periodic Table

- All elements have their own symbol eg. H is hydrogen, Na is sodium
- Metals are on the left and in the middle
- Non-metals are on the right



The Periodic Table

Solid, liquid and gas particle diagrams



Word equations

- Reactants are the substances on the left, that are reacting
- Products are the substance on the right, that are made in the reaction
- The arrow shows a reaction has taken place

methane + oxygen ⟶ carbon dioxide + water

Reactant — Product

Atoms, elements, molecules, compound, mixture

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- An element is made up of only one type of atom
- A molecule is made up of two or more atoms
- A compound is made up of two or more different atoms. Example: CO_2
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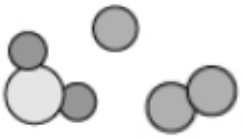
Atom
Element

Elements
Molecules

Compound



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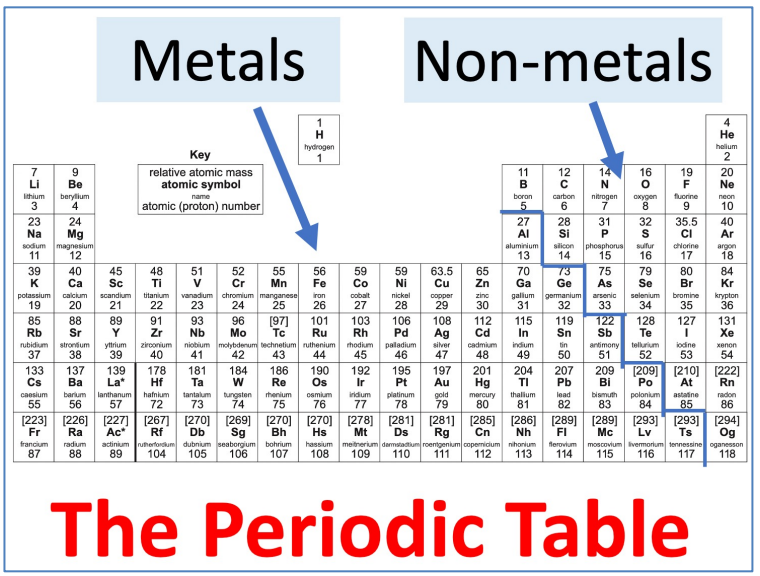
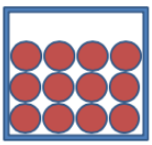


Solid, liquid and gas particle diagrams and properties

Solid	Liquid	Gas
		
Cannot be compressed	Cannot be compressed	Can be compressed
Fixed shape	Takes shape of container	Takes shape of container
Doesn't flow	Flows	Flows
High density	Quite high density	Low density

Key words

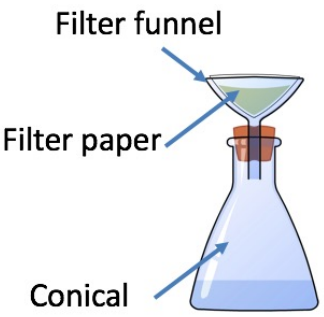
- A solute is a substance that dissolves in water eg. salt
- A solvent is a substance that dissolves other things eg. water
- A solution is a solute dissolved in a solvent eg. salty water

- Insoluble substances do not dissolve in water eg. sand
- Soluble substances do dissolve in water eg. salt

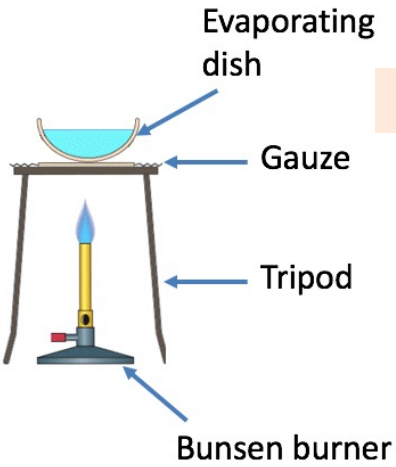
- A mixture is a group of chemicals not bonded together eg. air

Separating methods

- Filtration is used to separate insoluble substances from a liquid
- Evaporation is used to separate a liquid from a solid
- Distillation is used to separate liquids with different boiling points
- Chromatography is used to separate mixtures of different solubility

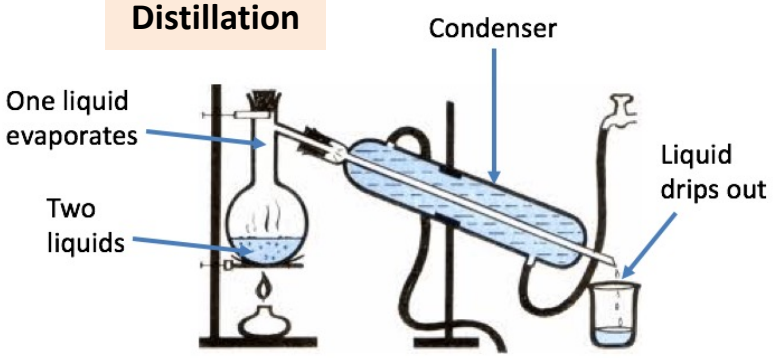


Filtration

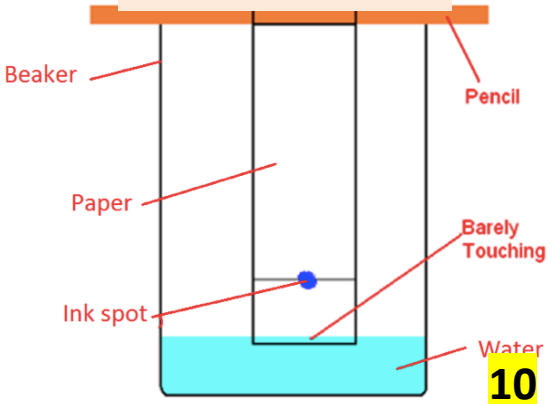


Evaporation

Distillation



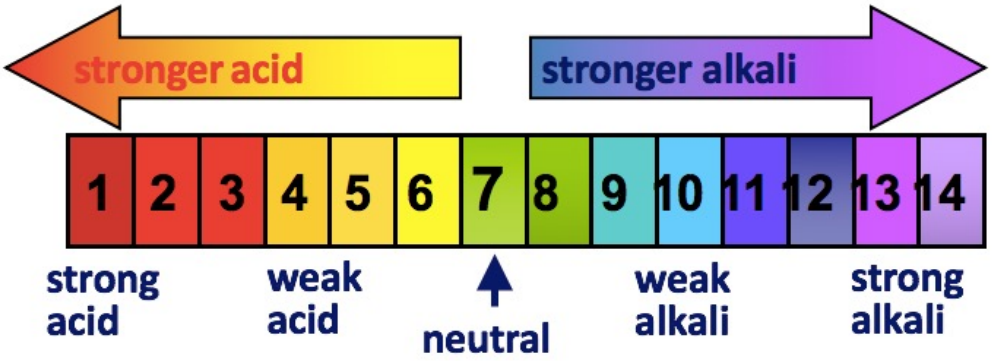
Chromatography



pH scale

- 1 to 6 is acid
- 7 is neutral
- 8 to 14 is alkali

Universal indicator colours →



Key equation

- Acid + alkali → salt + water

Common acids

- Hydrochloric acid HCl
- Sulfuric acid H_2SO_4
- Nitric acid HNO_3

Common alkalis

- Sodium hydroxide NaOH
- Magnesium hydroxide $Mg(OH)_2$
- Calcium hydroxide $Ca(OH)_2$

Naming salts

- Hydrochloric acid makes metal chlorides
  Hydrochloric acid + sodium hydroxide → sodium chloride + water

- Sulfuric acid makes metal sulfates
  Sulfuric acid + magnesium hydroxide → magnesium sulfate + water

- Nitric acid makes metal nitrates
  Nitric acid + calcium hydroxide → calcium nitrate + water

Bases and alkalis

- A base is a substance that neutralises an acid
- An alkali is a soluble base (dissolves in water)

Fuels

- A fuel is a substance that is burned to release energy
- Energy is measured in joules (J)
- A fire needs fuel, heat and oxygen to burn

Examples of fuels

Coal
Oil
Gas
Wood
Petrol

Hydrocarbons

- Hydrocarbons are molecules made of hydrogen and carbon only
- Hydrocarbons are found in crude oil
- Hydrocarbons burn in oxygen to produce carbon dioxide and water

- Hydrocarbon + oxygen → carbon dioxide + water

Complete combustion

- There is enough oxygen to fully burn the fuel and produce only carbon dioxide and water

Incomplete combustion

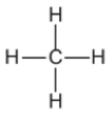
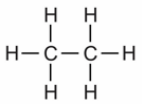
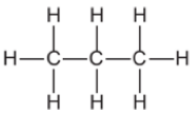
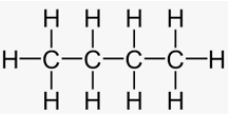
- There is not enough oxygen to fully burn the fuel
- Produces carbon monoxide, a toxic gas

Global warming and the greenhouse effect

- Carbon dioxide is a greenhouse gas
- Greenhouse gases trap heat in the atmosphere
- This causes the Earth to warm up
- Carbon dioxide is released when fossil fuels are burned

Alkanes

- The alkanes are a group of hydrocarbons
- The first four alkanes are:
  - Methane
  - Ethane
  - Propane
  - Butane

Name	Structural formula	Chemical formula
Methane		CH_4
Ethane		C_2H_6
Propane		C_3H_8
Butane		C_4H_{10}

Core Crucial Knowledge

Year 7 + 8 Physics

Physics is the study of forces and energy

Conservation of energy

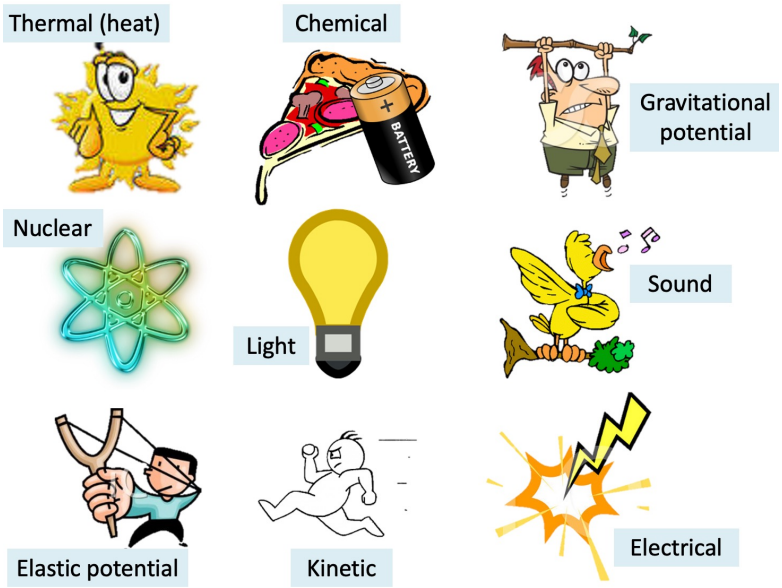
- Energy cannot be created or destroyed, only transferred from one form to another
- Energy is usually wasted as heat
- Example: A car uses petrol to move. The chemical energy in the petrol is transferred to kinetic energy, heat energy and sound energy. The total amount of energy overall is the same

Chemical energy → kinetic energy + heat energy + sound energy

10,000 J → 6000 J + 3000 J + 1000 J

Nine types of energy

- Thermal / heat
- Light
- Sound
- Chemical – all fuels contain chemical energy
- Kinetic – things moving
- Gravitational potential
- Elastic potential
- Nuclear
- Electrical



- Energy is measured in joules (J)

Forces

- Force is measured in newtons (N)
- Forces always come in pairs
- A force can change an object's shape, speed or direction

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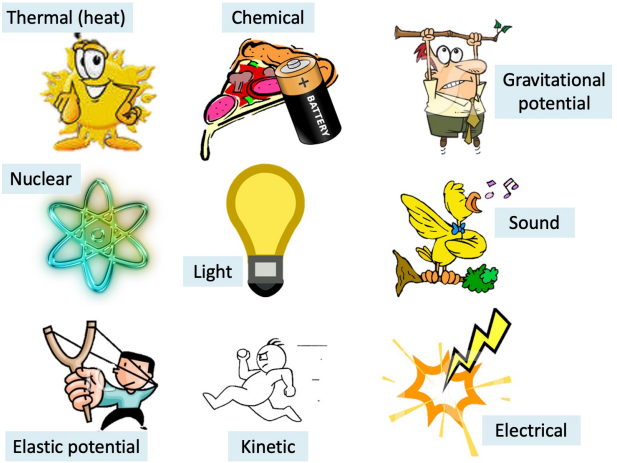

Fuels

- A fuel is a substance that is burned to release energy
- Energy is measured in joules (J)

Renewable energy

- Renewable energy sources will not run out
- Solar, wind, wave, hydroelectricity, tidal, geothermal, biomass

Non-renewable energy

- Non-renewable energy sources will run out
- Fossil fuels – coal, oil, gas
- Nuclear

Law of conservation of energy

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Chemical energy → kinetic energy + heat energy + sound energy
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Heat and temperature

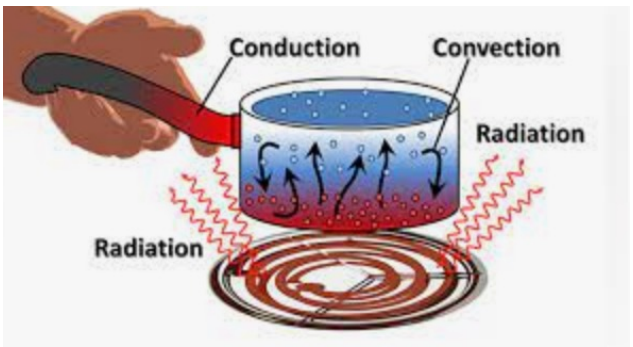
- Heat is how much thermal energy an object has
- Heat is measured in joules (J)
- Temperature is how hot or cold an object is
- Temperature is measured in degrees Celsius (°C)

Conduction

- Solids conduct heat
- Particles vibrate and collide with other particles
- This transfers the energy

Convection

- Convection happens in liquids and gases
- Hotter liquids or gases become less dense
- Less dense liquids or gases rise
- Cooler, more dense liquids or gases sink
- This sets up a convection current



Radiation

- Infra-red radiation does not require particles to travel through
- Infra-red radiation can travel through a vacuum

Insulators

- An insulator reduces energy transfer

Efficiency

- More efficient machines waste less energy
- Energy is usually wasted as heat

Power

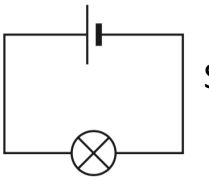
- Power is measured in watts (W)

Current
- Current is the flow of electrons
- Current is measured in amps (A)
- Current is measured with an ammeter

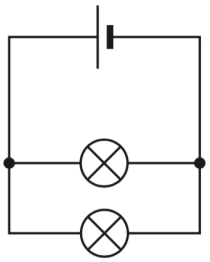
Potential difference (or voltage)
- Potential difference is the push given to the electrons by a battery
- Potential difference is measured in volts (V)
- Potential difference is measured with a voltmeter

Resistance
- Resistance means how hard it is for the current to flow
- Resistance is measured in ohms (Ω)

Series circuits
- Current is the same at all points
- Potential difference is shared by the parts of the circuit

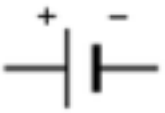

Series

Parallel circuits
- Current splits at a junction
- Potential difference is the same across all parts of the circuit

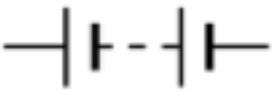

Parallel

Circuit symbols


Lamp (bulb)

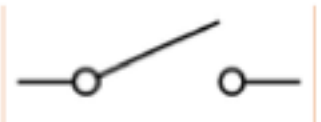


Cell


Battery

Ammeter

Voltmeter


Switch

Force fields

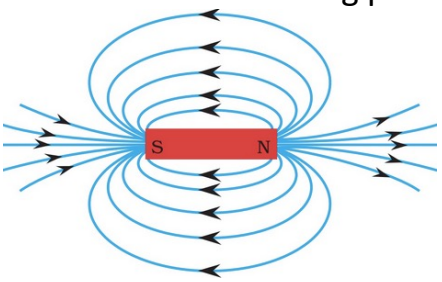
- A force field creates a non-contact force
- Objects do not have to be touching to experience a non-contact force
- There are 3 force fields:
  - Electric field
  - Magnetic field
  - Gravitational field

Static electricity

- Static electricity is the build up of charge on an insulator
- Current is the flow of electrons

Magnetism

- Like poles (two that are the same) repel, opposite poles attract
- Magnetic force is strongest at the poles of a magnet
- Magnetic materials – iron, steel, cobalt, nickel
- Magnetic field lines point from the north seeking pole to the south seeking pole
- The shape of the magnetic field →

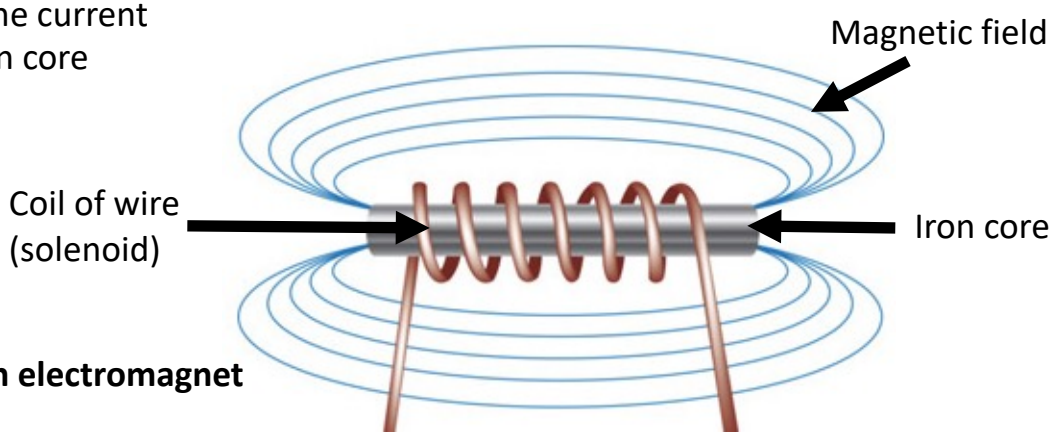


Electromagnets

- A moving current creates a magnetic field
- A coil of wire is called a solenoid
- An electromagnet is a magnet that can be switched on and off

How to increase the strength of an electromagnet

- Increase the number of coils of wire
- Increase the current
- Use an iron core



An electromagnet

Forces

- Force is measured in newtons (N)
- Forces always come in pairs
- A force can change an object's shape, speed or direction

Contact Forces

- Objects need to be touching to feel a force
- Friction
- Upthrust
- Air resistance

Non-contact Forces

- Objects do not need to be touching to feel a force
- Gravity
- Electrostatic
- Magnetism

Balanced forces

- Forces acting in opposite directions are the same

Non-balanced forces

- Forces acting in opposite directions are not the same
- The object will move in the direction of the largest force

- The overall force is called the resultant force
- The resultant force in the diagram above is 2N to the left (10 N – 8 N = 2 N)

Force and motion

- Forces always come in pairs
- Force is measured in newtons (N)
- If forces are unbalanced, an object will accelerate
- If forces are balanced, an object will remain at rest **or** will continue to move at a constant speed

Scalars and vectors

- Scalars have a number only. Eg. speed, distance, time
- Vectors have a number and a direction. Eg. velocity, acceleration, force

Speed

- Speed = distance ÷ time
- Unit of speed = metres per second (m/s)
- Unit of distance – metres (m)
- Unit of time = seconds (s)

- Velocity is speed in a stated direction

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

Acceleration

- Acceleration is the change in velocity
- The unit of acceleration is metres per second squared (m/s^2)

Work done

- Work done is the same as energy transferred
- Work done is measured in joules (J)

- Work done = force x distance moved