8C3 Combustion Knowledge Organiser

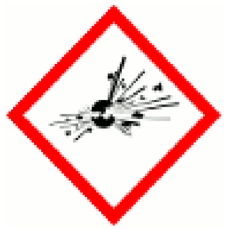
Burning Fuels

Fuels are usually **hydrocarbons** which are burnt to release **energy.**
Examples of fuels are: wood, methane, petrol and diesel.
When a hydrocarbon burns it reacts with oxygen from the air to produce **carbon dioxide** and **water**.
However, when Hydrogen burns it reacts with oxygen from the air to produce water only.

Fire Safety

Flammable

Oxidising



Explosive

The three sides of the fire triangle are: fuel, oxygen and heat.
If you want to put out a fire you remove at least one side of the fire triangle. It is easier to remove the heat or oxygen than the fuel.

Burning Candles

An experiment to find the effect of volume of air on the burning time of a candle.
The method is:

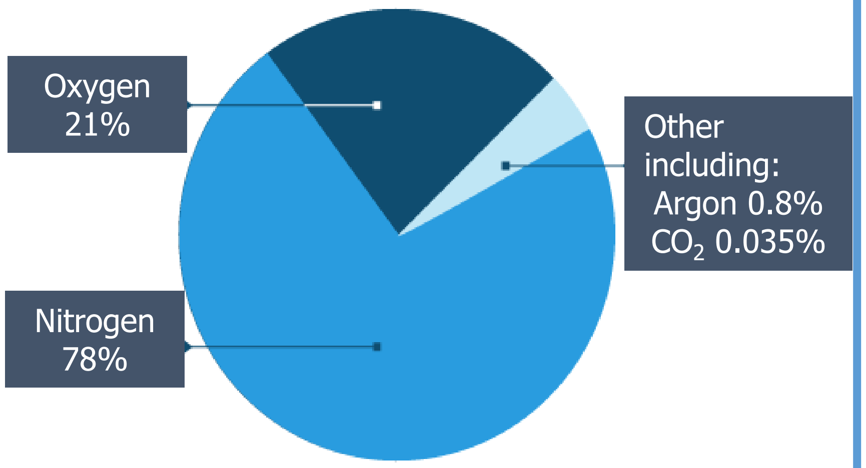
1. Place a small candle on a safety mat.
2. Light the candle.
3. Place a 100 cm^3 beaker over the candle and start the stop clock.
4. Time how long it takes for the candle to go out.
5. Repeat with four more different sized beakers.
6. Repeat each beaker 3 times.

Result: As the size of the beaker increases the time taken also increases.

Gas Tests

Hydrogen – lit splint, causes squeaky pop.
Oxygen – glowing splint, relights.
Carbon Dioxide – limewater turns cloudy.
Chlorine – Blue litmus paper turns red then white.

Gases in the atmosphere



Air Pollution

Lots of pollutants are released when fuels burn.
For example;
Carbon dioxide, nitrogen oxides and sulphur dioxide.

These gases cause environmental problems such as acid rain. This happens when sulphur reacts with oxygen to make sulphur dioxide and then it dissolves in rain water to make it acidic

8C2 Metals

Properties of metals and non-metals

Property	Metals	Non-metals
Appearance	Shiny	Dull
State at room temp	Solid (except mercury)	Half are solids, half are gases, one is liquid (bromine)
Density	High	Low
Strength	Strong	Weak
Malleable or brittle	Malleable (can bend without breaking)	Brittle (will shatter when hammered)
Conduction (heat/electricity)	Conduct both well	Poor (graphite only non-metal conductor)
Magnetic	Only iron, cobalt and nickel	None

How metals are extracted

Potassium
Sodium
Calcium
Magnesium
Aluminium

Metals ABOVE CARBON, because of their high reactivity, are extracted by ELECTROLYSIS

Carbon

Zinc
Iron
Tin
Lead
Copper

Metals BELOW CARBON are extracted by heating them with carbon in a BLAST FURNACE

Silver
Gold
Platinum

These LOW REACTIVITY metals blatantly won't need to be extracted because they are SO unreactive you'll find them on their own, not in a metal oxide

Metal		Reaction with AIR	Reaction with WATER	Reaction with ACIDS
Potassium	K	Burn vigorously to form metal oxides	React with cold water H_2O (l) to form $H_{2\,(g)}$ and (metal)$OH_{(aq)}$	Strong reaction with **diluted acid (aq)** to form $H_{2\,(g)}$. Metal replaces H in compound to form a salt.
Sodium	Na			
Calcium	Ca	Burn with decreasing vigour down the series to form metal oxides		
Magnesium	Mg		Only reacts with **steam H_2O(g)** to form $H_{2\,(g)}$ and metal oxide	
Aluminium	Al			
Zinc	Zn			
Iron	Fe			
Lead	Pb	React slowly (when heated) to form an oxide layer	No reaction	React with **concentrated acid (l)**. Metal replaces H to make a salt. Some of the acid decomposes into $NO_{2\,(g)}$ and $H_2O_{(l)}$.
Copper	Cu			
Mercury	Hg			
Silver	Ag	No reaction		No reaction
Gold	Au			

General Equations for metal reactions

Metal + Oxygen → Metal Oxide
Metal + Water → Metal Hydroxide +Hydrogen
Metal + Acid → Salt + Hydrogen

Displacement- When a more reactive metal will displace a less reactive metal from solutions of its compounds

- Sodium + Zinc Carbonate → Sodium Carbonate + Zinc
- Magnesium + Iron Oxide → Magnesium Oxide + Iron

Advantages of Recycling	Disadvantages of Recycling
Conserves raw materials. Less energy is used so less fossil fuels are used. Reduces waste in landfill. Avoids the use of mining for ores. Less damage to habitats. Less energy needed to melt and reform metals than to extract them. Produces less carbon dioxide.	Carbon dioxide is a greenhouse gas. Greenhouse gases cause global warming. Electricity for electrolysis is expensive and usually comes from fossil fuels.

8C3 Acids- Part 1

Acid	**A substance that dissolves and produces acid particles, H^+ ions and has a pH value below 7**
Alkali	**A substance that dissolves and produces alkali particles, OH^- ions and has a pH value above 7**
Neutral	**A solution that contains equal number of acid and alkali particles and a pH of 7**
Indicator	**A substance that changes colour and is used to identify solutions as acids, neutral or alkaline**
Base	**Any substance that reacts with an acid to neutralise it- can be solid or a solution**
Neutralisation reaction	**A reaction between an acid and alkali or an acid and base.** **Salt and water are produced in this reaction and the solution finishes with pH of 7**

Common acids	Formula
hydrochloric acid	HCl
sulfuric acid	H_2SO_4
nitric acid	HNO_3
Common alkalis	**Formula**
sodium hydroxide	$NaOH$
potassium hydroxide	KOH
calcium hydroxide	$Ca(OH)_2$

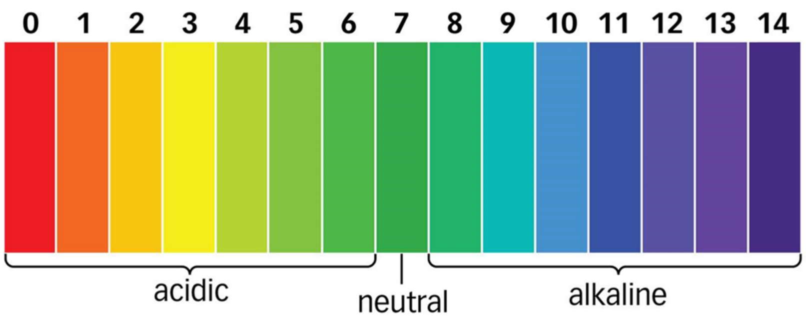
D common laboratory acids and alkalis

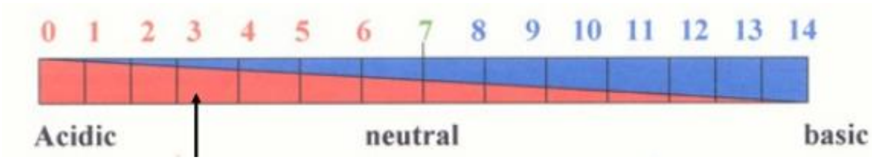
indicator	litmus	phenolphthalein
colour in alkaline solutions	blue	pink
colour in acidic solutions	red	colourless

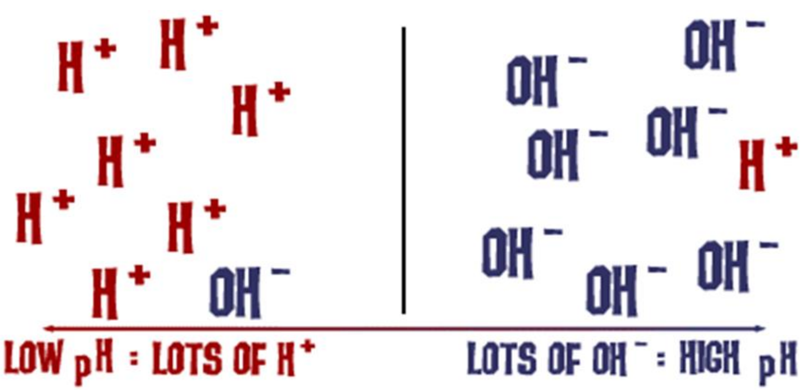
8C3 Acids- Part 2

The pH scale

It measures the acidity or alkalinity of a solution







Neutralisation – what happens.

When a base and an acid react together, this equation is followed:

Base + Acid → Salt + Water

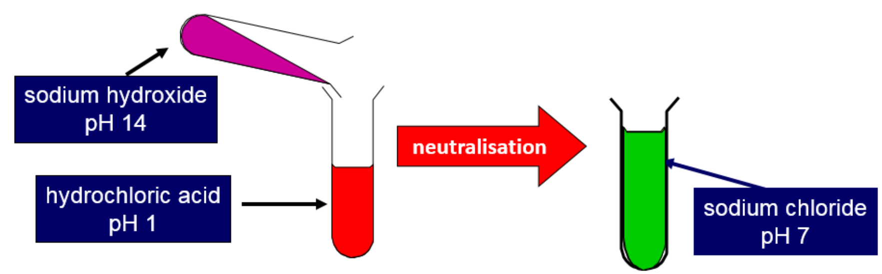
An example reaction

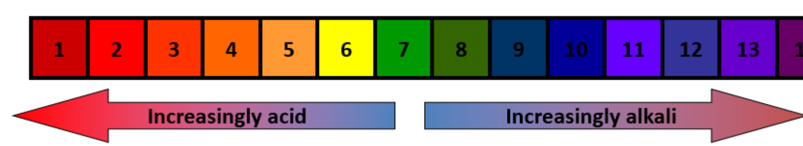
sodium hydroxide + hydrochloric acid → sodium chloride + water

(A SALT)

Each acid will make its own family of salts.

Acid	Salt formed
hydrochloric acid	chloride
sulfuric acid	sulfate
nitric acid	nitrate





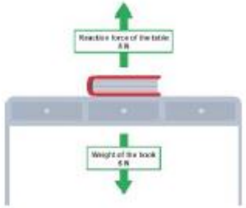
8P1 Knowledge organiser: Forces and Motion

Force Diagrams

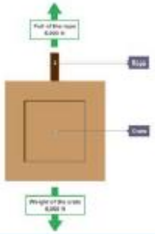
To show the forces acting on a body we use a free body force diagram. A **free body force diagram** shows all of the forces that are acting on the body. It has arrows that show the direction the force acts, the larger the arrow, the larger the force. A free body fore diagram should always have labelled arrows.

A boat floating

A book on a desk



A crate held up by a rope



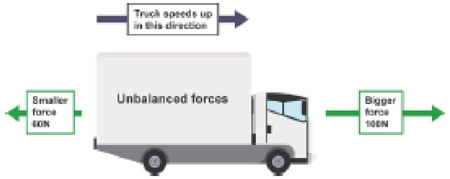
Unbalanced Forces

If the forces are unbalanced on an object there are two things that could happen:

1. If the object is stationary then it will move in the direction of the resultant force
2. If the object is moving, then the object will speed up or slow down in the direction of the resultant force.

For example, what is the resultant force on the lorry below?

100N-60N= 40N (to the right)



Remember the resultant force does not tell you what direction the lorry is moving in.

- If the resultant force is in the same direction as the movement of the lorry then the lorry will speed up
- If it is in the opposite direction the lorry will slow down

The larger the resultant force the larger the change in movement.

When a force is applied to an object it can lead to a change in the objects

- **Speed**
- **Direction of movement**
- **Shape (think about a rubber band)**

Forces can also be divided into 2 types, contact forces and non contact forces.

1. Contact forces for example friction, are caused when two objects are in contact.
2. Other forces for example gravity, are non contact forces. The two objects do not need to be in contact for the force to occur.

Gravity	The force of attraction between two objects with mass
Electrostatic	The force between two charged objects
Magnetic	The force that enables a compass to work
Air resistance/ Drag	The force when a material travels through a fluid
Friction	The force when two materials rub together
Upthrust	The upwards force felt by an object in a fluid
Normal contact force	The force that acts at the point of contact between two objects
Tension	The force that is transmitted through a string, rope, cable or wire when it is pulled tight by forces acting from opposite ends.
Elastic	Force exerted by a compressed or stretched spring upon any object that is attached to it

Balanced Forces

When we talk about the total force acting on object we call this the **resultant force**. When the forces acting in opposite directions are the same size we say the forces are **balanced**. This means one of two things:

1. The object is stationary (not moving)
2. The object is moving at a constant speed

This is known as Newton's first law.

For example, the resultant force acting on this object is 5N-5N=0N

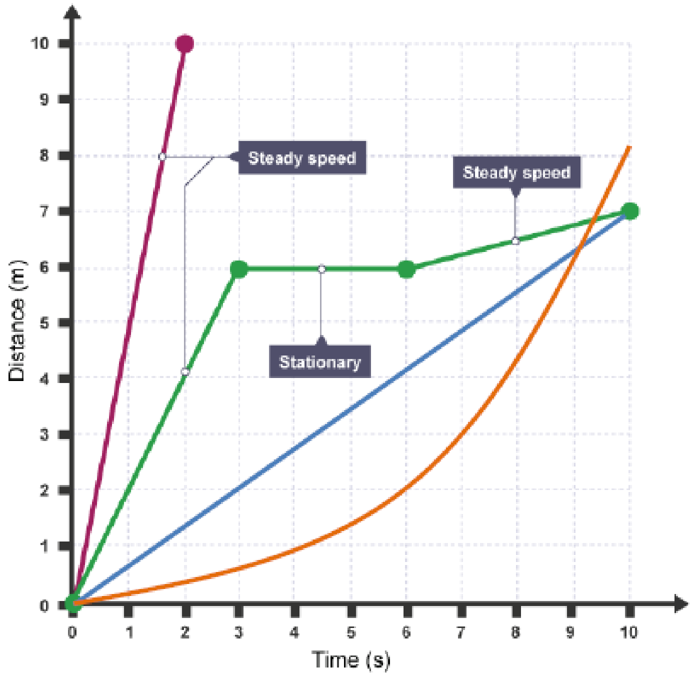
$$Speed = \frac{Distance}{Time}$$

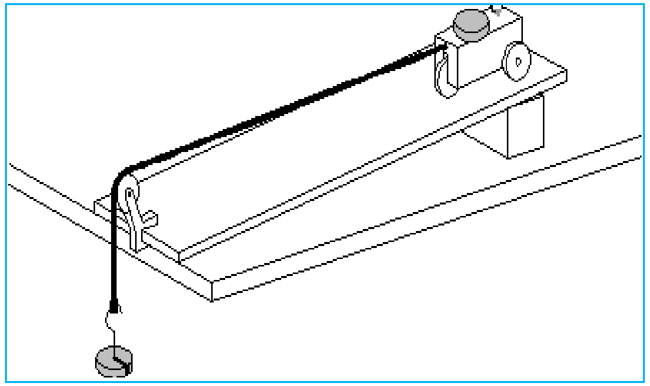
$$Weight = Mass \times GFS$$

$$F = m \times a$$

Interpreting Distance-time graphs

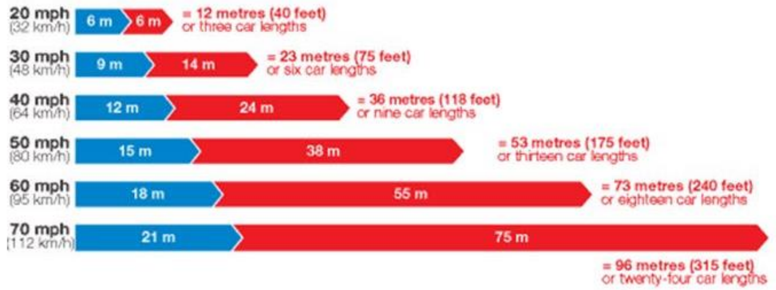
- A straight diagonal line of a distance-time graph shows that the object is travelling at a steady/constant speed.
- A straight horizontal line on a distance-time graph shows that the object is not moving (stationary)
- If a curved line were to appear on a distance-time graph (orange line) this shows the object is accelerating.





F=ma practical
Independent variable: Mass of trolley
Dependant variable: Acceleration of trolley
Control variable: Height of ramp, surface of ramp, force on pulley, trolley.

Results: As the mass of the car increases the acceleration of the trolley decreases.



Thinking distance
Distance travelled from seeing the hazard to the moment you react to it
Braking distance
Distance travelled from when the brakes are applied to when the car comes to a stop.

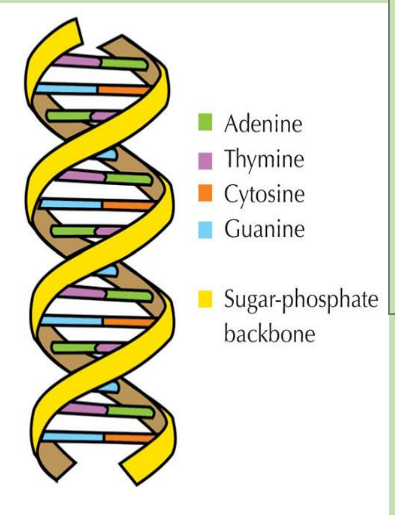
Factors that increase stopping distance:

- Alcohol/Drugs
- Mobile phones
- Distractions
- High mass car
- High starting speed
- Worn brakes and tyres
- Icy/wet roads

Mass	Weight
The amount of **matter** in an object	The **force** acting on an object, due to gravity
Never changes	Changes depending on the **strength of gravity**
Measured in **kg**	Measured in **N**

Newton's 1st Law: Motion will not change unless there is a balanced force acting on an object.
Newton's 2nd Law: The bigger the size of the resultant force on an object, the more the object will accelerate.
Newton's 3rd Law: If object A pushes on object B, then object B pushes on A with the same force but in the opposite direction.

Year 8 Knowledge Organiser : 8A – Genes and inheritance



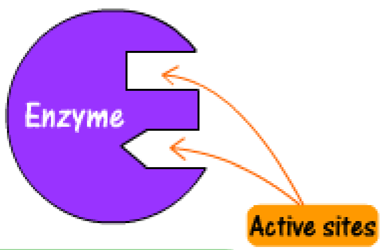
In DNA, the complementary base pairs are held together by hydrogen bonds.

DNA is the molecule which controls our characteristics. It makes up 'genes' which code for proteins

Enzymes

carbohydrase	=	breaks carbohydrate into sugar molecules
lipase	=	breaks fat into glycerol and fatty acids
protease	=	breaks protein into amino acids

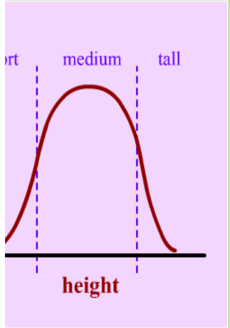
Enzymes are biological catalysts. They speed up chemical reactions within the cell.

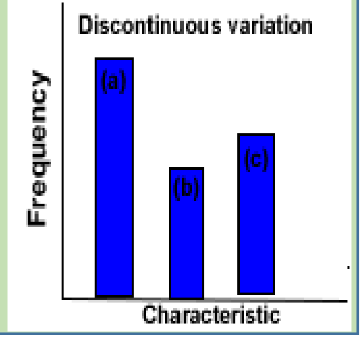


Enzymes are found in the cells of all living things

They are protein machines.

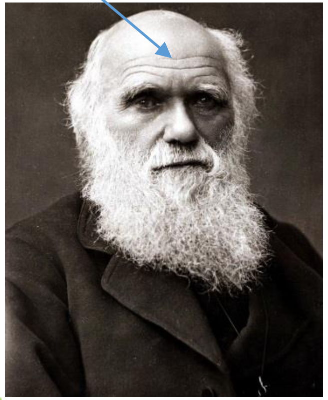
Variation is the difference between members of the same species. It can be caused by environmental or genetic factors.

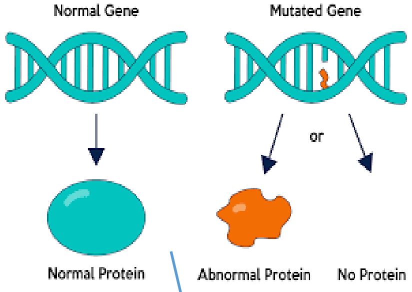




Term	Description
Species	A group of individuals that are physically similar that can produce fertile offspring
Variation	The presence of differences between living things of the same species
Competition	Interaction between groups of organisms seeking to access limited supplies of factors required for life e.g. light, space, food
Natural selection	A process that causes populations to change over time.
Evolution	The change in species over long periods of time
Gene	The basic units of genetic material inherited from our parents. A gene is a section of DNA which controls part of a cell's chemistry - particularly protein production.

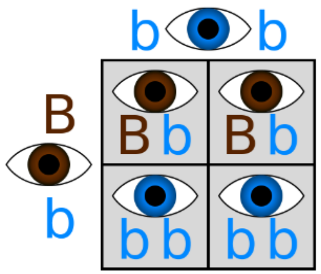
Charles Darwin proposed the theory of 'natural selection' to explain evolution

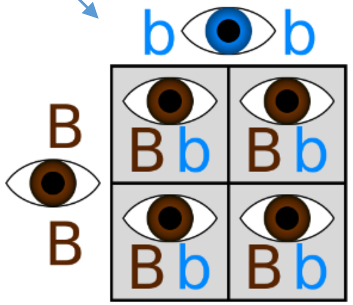




Mutation is the change in the base sequence of DNA.

Punnett squares are used to help you determine what genes the child of two parents will have. Everyone has 2 copies of a certain gene (called an **allele**): 1 copy comes from your mum and 1 copy comes from your dad. But since your mum and dad each have 2 copies, how do you know which ones you will get?

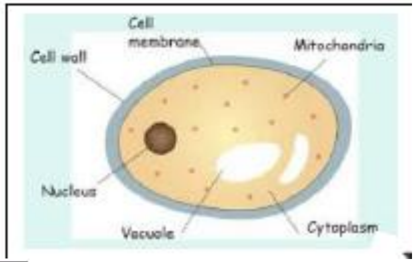




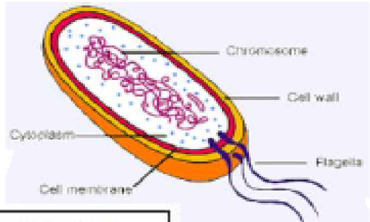
Year 8 Knowledge Organiser : Health and Disease

<u>Pathogens</u> are microorganisms that cause infectious disease. Pathogens may be **viruses, bacteria, protists or fungi**. They can be spread by direct contact, by water or by air. Bacteria and viruses may reproduce rapidly inside the body.

Fungi can also cause disease, by growing on living tissue (for example, athlete's foot is caused by a fungus).

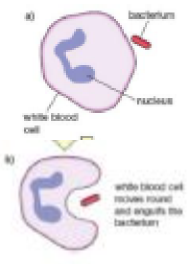


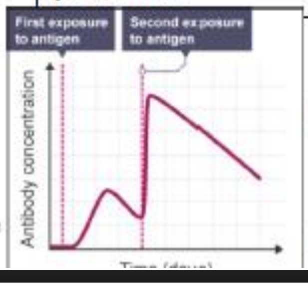
Bacteria reproduce rapidly and can release poisonous chemicals, called toxins, that damage our cells.
Examples of diseases caused by pathogenic bacteria include cholera, tuberculosis (TB) and food poisoning.

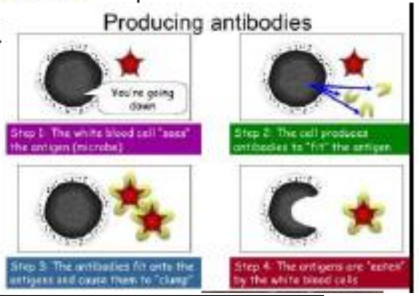


<u>The specific defence system:</u>

<u>White blood cells</u> help to defend against pathogens by: **phagocytosis, antibody production & antitoxin production.**



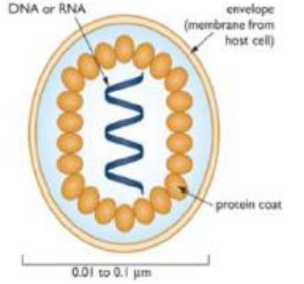




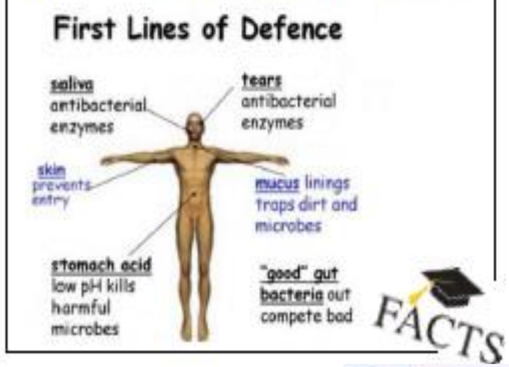
<u>**Antibiotics**</u>, such as penicillin, are medicines that help to cure **bacterial disease by killing** infective bacteria inside the body. It is important that specific bacteria should be treated by **specific antibiotics**. The **emergence of strains resistant to antibiotics** is of great concern. **Antibiotics cannot kill viral** pathogens.

<u>Painkillers</u> and other medicines are used to **treat the symptoms** of disease but do not kill pathogens.

Viruses need a host to survive. They cause disease symptoms by reproducing **inside** cells, and bursting the cell from the inside. This releases them, so they can be passed onto other host cells or other people (e.g. by coughing or sneezing out mucus that contains the viruses).



<u>The non-specific defence systems</u> of the human body against pathogens include the skin, nose, trachea and bronchi & stomach.



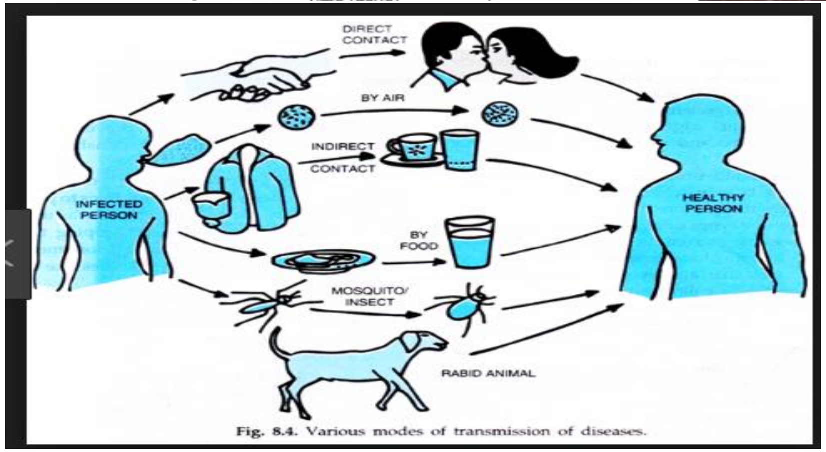
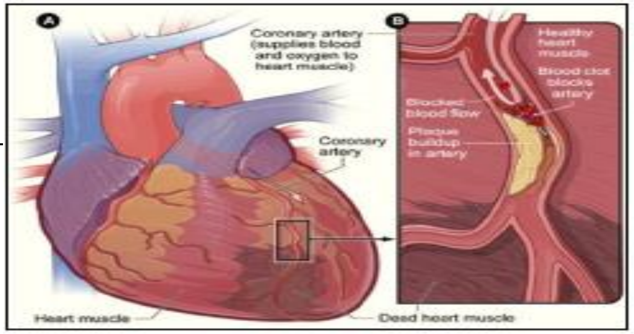
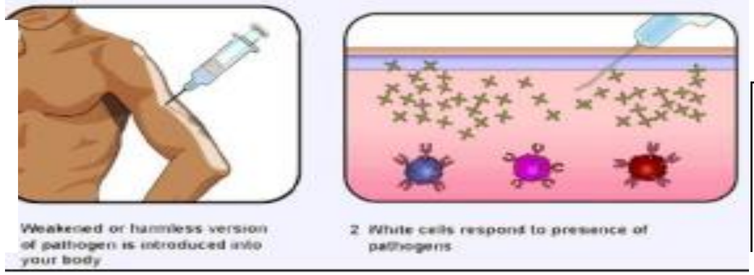


Fig. 8.4. Various modes of transmission of diseases.

In <u>coronary heart disease</u> layers of **fatty material** build up inside the **coronary arteries**, narrowing them. This **reduces the flow of blood** through the coronary arteries, resulting in a **lack of oxygen** for the heart muscle.

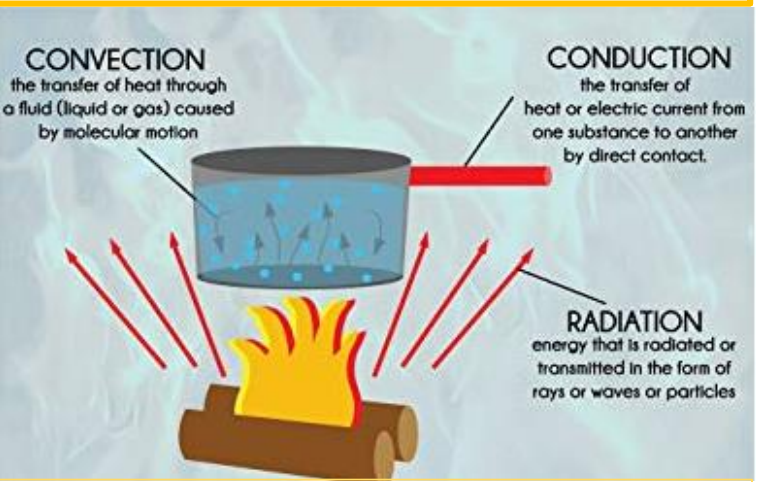


<u>Health</u> is the state of physical and mental well-being. **Diseases**, both **communicable** and **non-communicable**, are major causes of ill health. Other factors including **diet**, **stress** and **life situations** may have a profound effect on both physical and mental health.

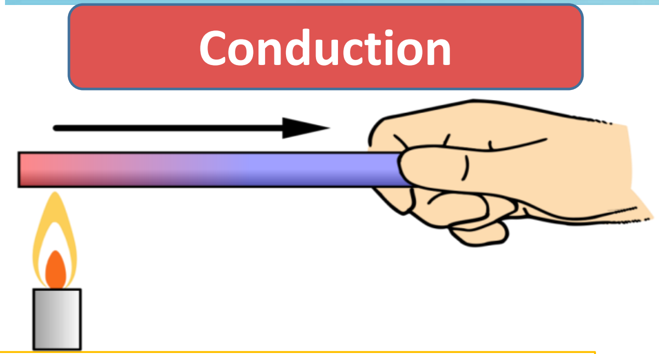


<u>Vaccination</u> involves introducing small quantities of **dead or inactive** forms of a pathogen into the body to stimulate the white blood cells to produce **antibodies**. If the same pathogen re-enters the body the white blood cells respond quickly to produce the correct antibodies, preventing infection. The spread of pathogens can be reduced by **immunising** a large proportion of the population

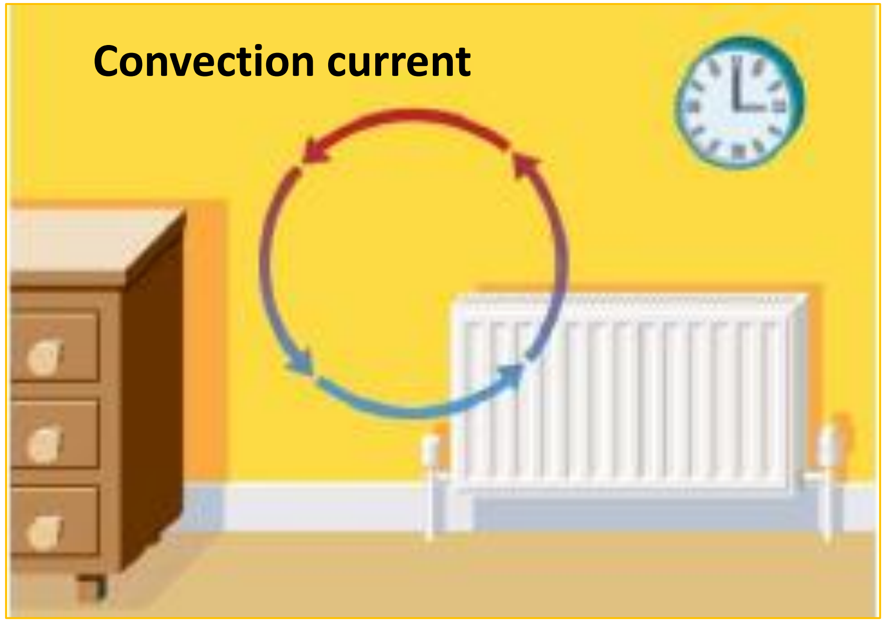
Year 8 P3 Knowledge Organiser: Energy (part 2)



Conduction
Particles bump into nearby particles and make them vibrate more. This passes the thermal energy through the substance by conduction, from the hot end to the cold end.



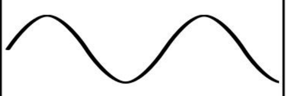
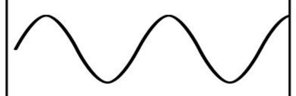
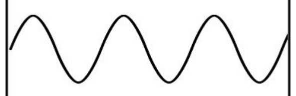
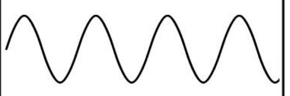
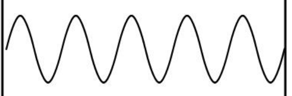
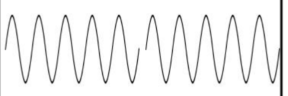
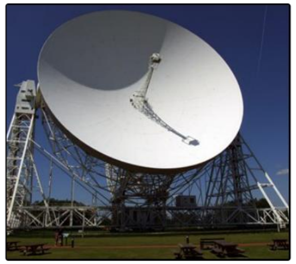
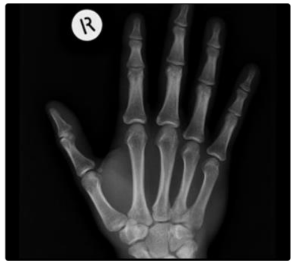
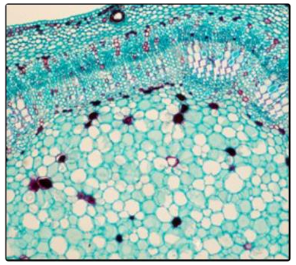
Convection
Particles with a lot of thermal energy in a liquid or gas move apart, the liquid or gas becomes less dense and rises, taking the place of particles with less thermal energy.



Infra-red Radiation
All objects transfer thermal energy by emitting **infra-red radiation,** the hotter an object is the more infra-red radiation it emits. Infra-red radiation is part of the electromagnetic spectrum.

$$Efficiency\ (\%) = \frac{Useful\ energy\ output}{Total\ energy\ input} (\times 100)$$

Uses and Dangers of the Electromagnetic Spectrum

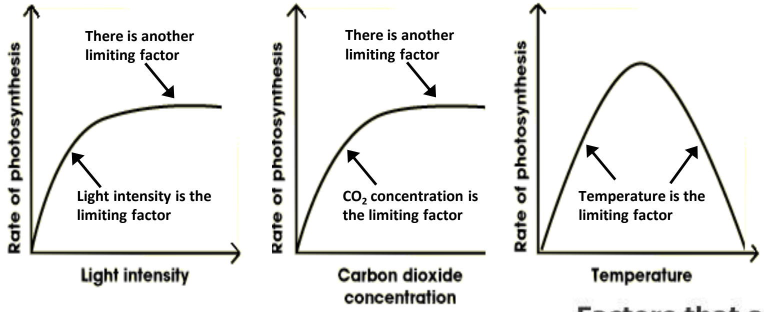
	Radio Waves	Microwaves	Infrared	Visible Light	Ultraviolet	Xray	Gamma
Properties All electromagnetic waves travel at the same speed in a vacuum. They all travel at the speed of light: 3 x 10^8 m/s (or 299,792,458 m/s)	 Lowest Frequency: Longest Wavelength: Lowest Energy: Wavelength - 10^3 m Frequency - 10^4Hz	 Wavelength - 10^{-2} m Frequency - 10^8Hz	 Wavelength - 10^{-5} m Frequency - 10^{12}Hz	 White light is a mixture of all the colors of the rainbow. Wavelength - 10^{-6} m Frequency - 10^{15}Hz	 Wavelength - 10^{-8} m Frequency - 10^{16}Hz	 Wavelength - 10^{-10} m Frequency - 104Hz	 Highest Frequency: Shortest Wavelength: Highest Energy: Wavelength - 103 m Frequency - 104Hz
Uses	 Radio waves are used in radio telescopes to study far away objects in space. Radio waves are also used for RADAR, broadcasting, and communication.	 Microwaves can be used for communication between mobile phones. Microwaves can also be used to heat food. Microwaves cause the water molecules in food to get warmer.	 Infrared radiation is used for thermal imaging. Infrared rays are also used for cooking food in toaster ovens. IR is used to control your TV from your remote as well.	 Visible light is used to see things. It can be used in telescopes (to see really big things that are far away) or microscopes (really small things). It is also used in cameras to make photographs.	 Ultraviolet rays are used in tanning salons. Special ink is put into some bills and it shines (Fluoresces) when UV light is shined on it. This is used to check for counterfeit bills.	 X-rays are used for airport security and medical imaging. If you go to the hospital and they suspect you have a broken bone, they will send you for an X-ray scan.	 Gamma rays are used for sterilizing medical equipment. They are also used for treating cancer patients.
Dangers	 No Danger	 Microwaves can cause damage to your internal tissues as they heat up water. Your body is made of a lot of water.	 Infrared can cause skin burns.	 No danger	 Ultraviolet rays can leave to sunburn and damage to eyes. Exposure over a long time can increase the risk of getting skin cancer.	 X-rays can damage cells which can cause mutations which may lead to cancer.	 Gamma rays have extremely high energy which can cause cells to mutate leading to cancer.

Year 8 Knowledge Organiser : 8B1: Plant Transport

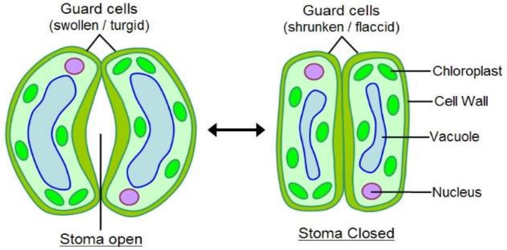
Word equation for photosynthesis

$$\text{carbon dioxide + water} \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{glucose + oxygen}$$

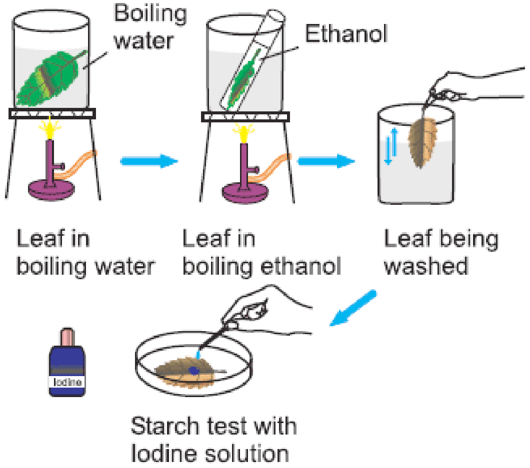
Limiting factors affect the rate of photosynthesis



Stomata (pores) control the rate of gas exchange and water loss in leaves

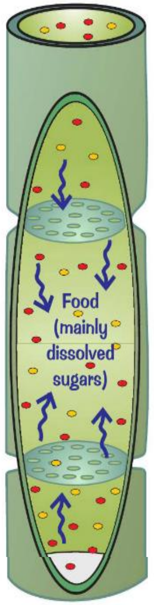


Starch test to identify the products of photosynthesis



Factors that affect transpiration rate

Factor	Description	Explanation
Light	Transpiration increases in bright light	The *stomata* open wider to allow more carbon dioxide into the leaf for photosynthesis. More water is therefore able to *evaporate*.
Temperature	Transpiration is faster in higher temperatures	Evaporation and *diffusion* are faster at higher temperatures.
Wind	Transpiration is faster in windy conditions	Water vapour is removed quickly by air movement, speeding up diffusion of more water vapour out of the leaf.
Humidity	Transpiration is slower in humid conditions	Diffusion of water vapour out of the leaf slows down if the leaf is already surrounded by moist air.



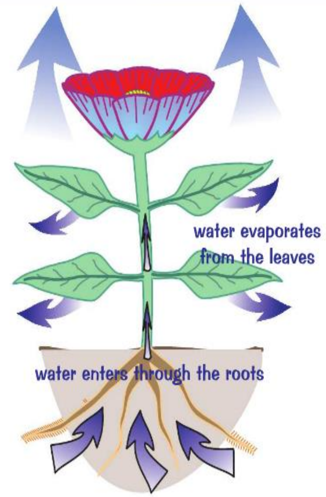
Phloem Tubes Transport Food:

1) Made of columns of living cells with small holes in the ends to allow stuff to flow through.
2) They transport food substances (mainly dissolved sugars) made in the leaves to growing regions (e.g. new shoots) and storage organs (e.g. root tubers) of the plant.
3) The transport goes in both directions.

Xylem Tubes Take Water UP:

1) Made of dead cells joined end to end with no end walls between them and a hole down the middle.
2) They carry water and minerals from the roots to the stem and leaves in the transpiration stream (see below).

Transpiration is the Loss of Water from the Plant



1) Transpiration is caused by the evaporation and diffusion (see page 11) of water from inside the leaves.
2) This creates a slight shortage of water in the leaf, and so more water is drawn up from the rest of the plant through the xylem vessels to replace it.
3) This in turn means more water is drawn up from the roots, and so there's a constant transpiration stream of water through the plant.
4) Transpiration is just a side-effect of the way leaves are adapted for photosynthesis. They have to have stomata in them so that gases can be exchanged easily. Because there's more water inside the plant than in the air outside, the water escapes from the leaves through the stomata.

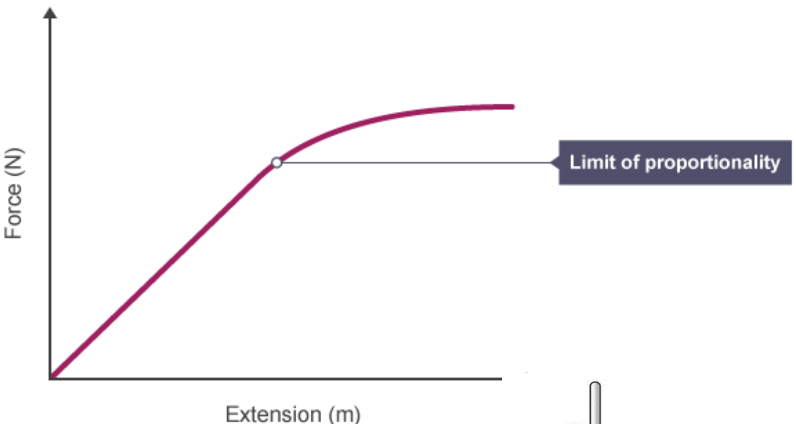
8P2 – Pressure knowledge Organiser

Hooke's law

Extension happens when an object increases in length, and compression happens when it decreases in length. The extension of an elastic object, such as a spring, is described by Hooke's law:

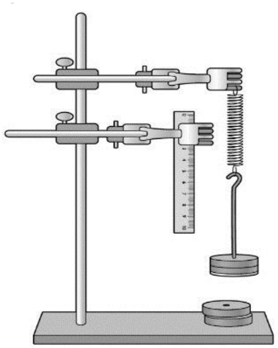
$$f = k \times x$$

force = spring constant × extension



Deforming

After going past their elastic limit, a spring or rubber band will not return to its original shape and therefore will behave differently.



Measuring density

You need to know two things to measure the density of a substance:

- the mass of a sample of some of it
- the volume of that sample

The mass is measured using a balance. The volume of a liquid is easily measured using a measuring cylinder. The volume of a solid can be measured by:

- measuring the side of a cube or block of the substance, then using mathematics to calculate its volume, or
- using a displacement can (also called a eureka can) – the sample is lowered into a container of water and the volume of water it displaces or pushes out of the way is the same as the volume of the object

Density Properties

Solids

The particles in solids are very close together. They are tightly packed, giving solids high densities.

Liquids

The particles in liquids are close together. Although they are randomly arranged, they are still tightly packed, giving liquids high densities. The density of a substance as a liquid is usually only slightly less than its density as a solid.

Water is different from most substances: it is less dense as a solid than as a liquid, because its particles move apart slightly on freezing. This is why ice cubes and icebergs float on liquid water.

Gases

The particles in gases are very far apart, so gases have a very low density.

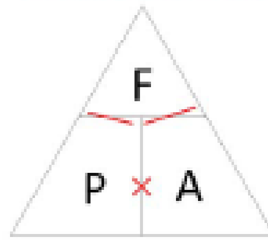
Pressure on surfaces

You may have been warned about swinging around on one leg of a chair. Apart from the risk that you will damage the chair or hurt yourself, the chair leg can damage the floor. This is because it puts too much pressure on the floor.

Calculating pressure

To calculate pressure, you need to know two things:
the force or weight exerted
the surface area over which the force or weight is spread

Pressure = Force ÷ Area

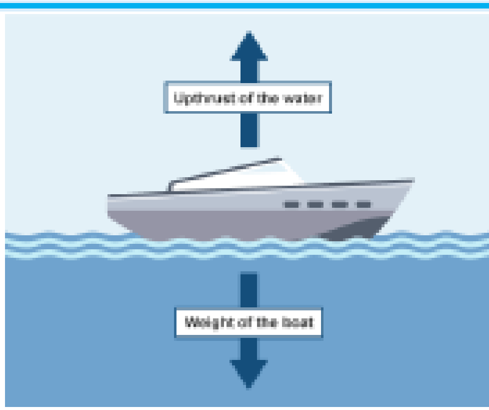


Example

A force of 20 N acts over an area of 4 m^2. Calculate the pressure.
pressure = force ÷ area
= 20 N ÷ 4 m^2 = 5 N/m^2
Notice that the unit of pressure here is N/m^2 (newtons per square metre). Sometimes you will see another unit being used. This is called the pascal and it has the symbol Pa.
1 Pa = 1 N/m^2, so in the example above the pressure is 5 Pa.

Pressure in liquids

Liquid pressure is exerted on the surface of an object in a liquid. This pressure causes upthrust. An object placed in a liquid will begin to sink. As it sinks, the liquid pressure on it increases and so the upthrust increases. For a floating object, the upthrust is equal and opposite to the object's weight. An object will continue to Sink if its weight is greater than the maximum upthrust.



Pressure in fluids

Liquids and gases are fluids. A fluid is able to change shape and flow from place to place. Fluids exert pressure on surfaces, and this pressure acts at 90° to those surfaces – we say that it acts normal to the surface.

$$p = \rho \times g \times h$$

$$Pressure = density\ x\ gravity\ x\ height$$

Density = Mass (kg) / Volume (m^3)
(kg/m^3)