Science Knowledge Organisers

Year 9 PC1 (October Exam)

Kettering Science Academy

What is a 'knowledge organiser'?

A knowledge organiser is simply a collection of the all of the information which your teacher would like you to be able to **recall** from a particular topic. That means that it **does not have everything on it** for a unit of study but it does have **the most essential things to learn.**

A knowledge organiser has lots of facts and definitions on it. Did you know that there is as many new words in studying science as there is in studying a language?

A knowledge organiser does **not develop skills**, so good revision will involve **lots of practice questions** as well as learning the content of these organisers.

What do I do with it?

For most of us, the first thing that we learned at school in reception was our phonics sounds. We learned them by repetition – seeing them again and again until the association between the sound and the image stuck. We need to do the same thing with these knowledge organisers!

Your teacher will probably be using knowledge organisers as you are taught. They will be referred to in class and you should have regular small tests on what you have learned.

Our knowledge organisers are deliberately broken into small lesson sized chunks for you to learn. Typically a teacher may ask you to 'learn box 2 and 3' for a homework.

By the time you come to an assessment – an exam or test – you should already be familiar with the knowledge organisers and already know some of it. They can then be relearned as a part of the revision and assessment preparation procedure.

Retrieval Practice

A key part of learning anything is the act of trying to remember. In class, your teacher will be helping you to do this by asking lots of questions and setting quizzes. **The more often you try to remember something the more likely you are to remember it**. With knowledge organisers you can achieve the same thing at home.

Why are we doing this?

Research has shown that **the more you know** the **more you can learn.** By being able to recall the facts, you are able to understand more complicated ideas because you **already know what the key words mean.** You will also already have a set of ideas in your mind that the new ideas can connect to (this is often referred to as a **schema**).

What are the best techniques for memorising using a knowledge organiser?

READ COVER WRITE

Make sure you are working somewhere quiet and that you have something to write with and some paper. Focus on learning on part of the knowledge organiser only, for example box one. Read through it carefully several times. When you think you've got it, cover over the knowledge organiser and write it all down. Then check what you've been able to remember. Read the bits that you could not recall, cover and write again.

TEST ME

Once you have learned the sections, its time to see if you can remember larger amounts.

Ask a friend or family member to test you on the content of the knowledge organiser page. They don't need to be experts – only to say whether you have remembered it correctly.

TEST EACH OTHER

If you are revising with class mates, testing each other is great. By doing this you are thinking about what you need to know when you are answering questions but also when you are checking to see if your class mate is right. This works well on video calls!

MAKING FLASH CARDS

Some students find making flash cards really helps. You are thinking about what needs to be learned as you write! But don't fall into the trap of writing them and never using them! Once written they should be used regularly – you can test yourself with them or test each other!

Spaced Learning

All of the techniques work best when they are done **little and often**. Aim to repeat something you have learned a week – studies have shown that once you learn something, if you see it again after a week recall is better long term. Then again after a month… and so on.

Application

Once you have memorised some of the information, or have made a good start, it's a good idea to start trying to **use that knowledge**. Websites like **Seneca** and **Educake** provide great banks of questions for this.

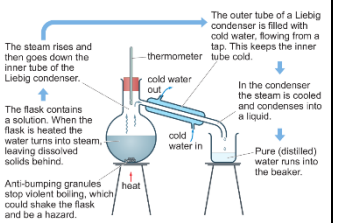
7E Mixtures and Separation

1. Mixtures	
Mixture	Two or more substances jumbled together but not joined together.
Suspension	A mixture of a solid and liquid, where the solid bits are heavy enough to settle out if the mixture is left to stand.
Colloid	A mixture of a solid, liquid or gas in a solid, liquid or gas where the substances do not settle out if left to stand.
Dispersed	Spread out without settling out, such as the bits in a colloid.
Opaque	Cannot be seen through- colloids are opaque / cloudy.
Solution	When a substance has dissolved in a liquid.
Transparent	Light can pass through and it can be seen through- solutions are transparent.
Filter	Something through which a liquid is passed to remove suspended pieces of solid.

2. Solutions	
Solvent	The liquid in which a substance dissolves to make a solution.
Solute	The substance that has dissolved in a liquid to make a solution.
Dissolve	When a substance breaks up into such tiny pieces in a liquid that it can no longer be seen and forms a solution.
Soluble	Describes a substance that can dissolve in a liquid.
Conservation of Mass	The total mass of a solution is the same as the mass of the dissolved substance plus the mass of the liquid at the start.
Saturated	A solution that contains so much dissolved solute that no more solute can dissolve in it.
Solubility	The amount of a substance that dissolves in a particular solvent at a particular temperature to make a saturated solution.

3. Evaporation	
Evaporation	When a liquid changes into a gas. Can be used to separate a liquid from the solid dissolved in it.
Sodium Chloride	The scientific name for table salt that we use on our food.
Rock Salt	When sodium chloride is found in thick layers of rock underground.
Extracting Rock Salt	Can be dug up or mined. Water can be pumped into layers of salt underground, dissolving the sodium chloride which is then pumped to the surface and heated to evaporate the water, leaving behind sodium chloride.
Boiling	When there is liquid turning into a gas in all parts of a liquid- creates bubbles of gas in the liquid.
Boiling Point	The temperature at which a liquid boils.

4. Chromatography	
Chromatography	Used to separate substances dissolved in a mixture.
Paper Chromatography	A concentrated dot of a mixtures is placed at the bottom of special chromatography paper. The bottom of the paper is dipped into a solvent (such as water). As the solvent moves up the paper is carries the dissolved substances.
Concentrated	A solution that contains a large amount of solute dissolved in a small amount of solvent.
Chromatogram	The results of chromatography such as a dried piece of paper for paper chromatography showing when the dissolved solids have been separated.
How chromatography works	Different substances in a mixture are carried at different speeds, depending on how soluble they are, which separates them out from each other.

5. Distillation	
Desalination	Separating water from the salts in salty/sea water to produce fresh drinking water.
Distillation	The process of separating a liquid from a mixture by evaporating the liquid and then condensing it to be collected.
Steam	Water as a gas.
Condenses	When a substance changes from its gas state into its liquid state.
Pure	A single substance that does not have anything else in it. (Pure water only contains water and no dissolved solutes)
Distillation Apparatus	
Solar Still	Energy from the Sun is used to evaporate salty/dirty water which is then condensed, forming pure/clean water.

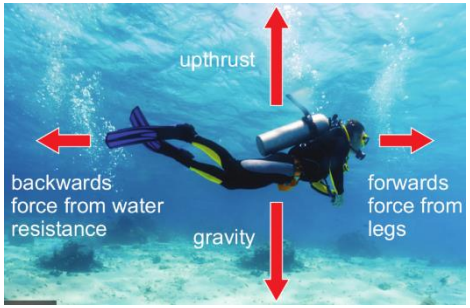
Lesson	Memorised?
1. Mixtures	
2. Solutions	
3. Evaporation	
4. Chromatography	
5. Distillation	

7K Forces

1. Different Forces

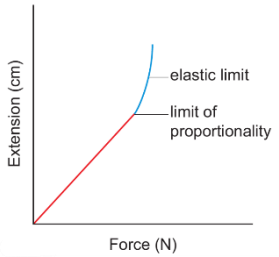
Force	A push or a pull.
Contact Forces	The thing providing the force needs to touch an object to affect it. *Friction, air resistance, water resistance, upthrust*
Upthrust	The force that makes things float.
Air Resistance	A force acting on objects moving through the air.
Water Resistance	A force acting on objects moving through water.
Non-Contact Forces	Forces that can affect an object from a distance. *Gravity, static electricity, magnetism*
Gravity	A force that pulls objects downwards.
Static Electricity	A force that attracts things.
Magnetism	A force that attracts objects made of iron, nickel or cobalt.
Newton (N)	The units for measuring forces.
Weight	The force of gravity pulling on something- measured in Newtons (N)
Mass	The amount of matter that makes up something- measured in kilograms (kg)
Representing Forces	We draw arrows on force diagrams to show the direction of a force; a bigger arrow shows a bigger force.

Force Diagram



2. Springs

Stretched	Made longer
Compressed	Made shorter
Spring	Made from coils of wire,
Extension	The difference between the original length and the stretched length.
Elastic	An object that returns to its original length when the force is removed.
Investigating Extension	Hang a spring from a clamp and measure its length. Add increasing numbers of masses and measure the extension each time.
Hooke's Law	Extension is proportional to the force applied.
Proportional	A relationship between two variables where if one doubles, the other will double.
Limit of Proportionality	The point at which the extension and force are no longer proportional.
Elastic Limit	The point at which the spring cannot return to its original length.
Force Meter	Springs are used inside to measure the force.

How Extension Depends on Force	

3. Friction

Friction	Force between two touching objects.
Increasing Friction	Using certain materials like rubber (used on racing cars to stop them from sliding off the road).
Reducing Friction	Make surfaces smooth or by using lubricants such as oil or grease.
Lubrication	Adding a lubricant
Friction Damage	Friction can wear things away like brake pads on a bike. Friction between parts of a car can cause it to overheat and stop working.

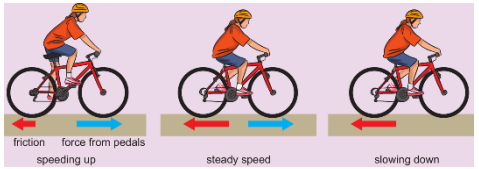
4. Pressure

Pressure	The amount of force pushing on a certain area.
The Size of Pressure	Depends upon the size of the force and the size of the area it is pushing on.
Pressure in Sport	Snowshoes spread out weight, reduce pressure and stop people sinking into soft snow.
Pressure in Everyday Life	It is easier to cut something with a sharp knife because it has a smaller edge so the force is concentrated over a smaller area.
Pressure formula	$\text{pressure} = \frac{\text{force}}{\text{area}}$
Pascal (Pa)	The units for measuring pressure. $1Pa = 1N/m^3$

5. Balanced and Unbalanced Forces

Balanced Forces	Two forces of the same size acting upon an object in opposite directions. Balanced forces will not change the speed of a moving object.
Unbalanced Forces	When one of the forces acting upon an object is larger than the other. If acting on a moving object unbalanced forces will change its speed.
Stationary	Not moving- stationary objects have balanced forces acting on them.

Force Diagram



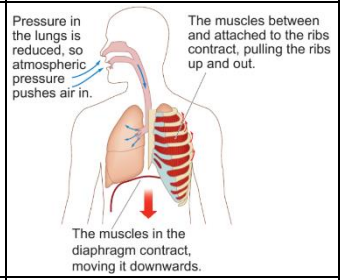
Lesson	Memorised?
1. Different Forces	
2. Springs	
3. Friction	
4. Pressure	
5. Balanced and Unbalanced Forces	

8C Breathing and Respiration

1. Aerobic Respiration

Robert Boyle	(1627-1691) placed a burning candle in a jar and sucked out all the air- the candle went out. Repeated with a mouse and the mouse died.
Joh Mayow	(1641-1679) did experiments to discover that only a certain part of the air was needed to keep candle burning and mouse alive.
Joseph Priestly & Antoine Lavoisier	(1733-1804) (1743-1794) Showed that oxygen was the part of air needed for the candle to burn and mouse to live- makes up 21% of air.
Aerobic Respiration	Using oxygen to release energy from glucose.
Aerobic Respiration Word Equation glucose + oxygen → carbon dioxide + water	
Combustion	The word equation for combustion (burning) of glucose is the same as above but occurs in a different way.
Reactants	The starting substances- written on left of word equation.
Products	The new substances made- written on right of word equation.

2. Gas Exchange System

Breathing	Muscle movement allowing the lungs to expand/contract.
Ventilation	Movement of air into / out of the lungs.
Diaphragm	Organ below the lungs that contracts / relaxes changing the size of the lungs.
Inhalation breathing in	
Mucus	Sticky liquid that traps dirt, dust and microorganisms.
Cilia	Tiny hairs on cells that sweep mucus from the lungs into the gullet to be swallowed.
Gas Exchange	The swapping of gases between the lungs and the blood.
Diffusion	Movement of particles from a high concentration to low.
Alveoli	Little pockets on the lungs.
Adaptations of Alveoli	They increase the surface area for faster diffusion. The walls are one cell thick for faster diffusion.

3. Getting Oxygen

Red Blood Cells	Take in oxygen when it gets into the blood.
Haemoglobin	Where the oxygen binds to in red blood cells.
Arteries	Blood vessels that carry blood from the heart to the body.
Capillaries	Tiny blood vessels that the arteries divide into. oxygen leaves red blood cells here and dissolves into the plasma.
Plasma	Liquid part of the blood that leaks out of the capillaries into the tissue fluid.
Tissue Fluid	Carries the oxygen to the cells.
Veins	Carry blood back towards the heart.
Exercise	Your muscles must release more energy so need more oxygen and glucose- your breathing and heart rates increase.
Frostbite	Blood vessels in skin narrow to avoid heat loss and less blood reaches cell. If the cells die this causes frostbite.
Heart Attack	Fatty substances build up inside blood vessels reducing blood flow causing cells to die.
Carbon Monoxide	Poisonous gas found in cigarette smoke- sticks to haemoglobin so red blood cells carry less oxygen.
Tar	In tobacco smoke- irritates alveoli and causes them to break apart leading to emphysema.
Asthma	Tiny tubes in lungs become narrow and fill with mucus meaning less air gets into and out of the lungs.

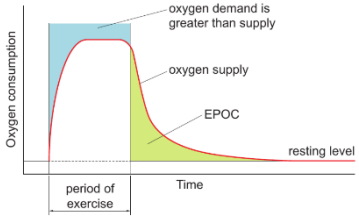
4. Comparing Gas Exchange

Limewater	Turns cloudy in the presence of carbon dioxide.
Hydrogen Carbonate Indicator	Turns from pink to yellow as carbon dioxide increases and the pH drops.
Gills	Water flows over feathery strands where oxygen diffuses into the blood and carbon dioxide out.
Stomata	Tiny holes in leaves that allow gas exchange.

5. Anaerobic Respiration

Anaerobic Respiration	Respiration that occurs in the cytoplasm of cells when oxygen isn't present during strenuous exercise.
Anaerobic Respiration Word Equation Glucose → lactic acid	
Energy	Anaerobic respiration releases less energy than aerobic.
Anaerobic Advantages	Allows for a quick, sudden burst of energy.
After Strenuous Exercise	Lactic acid enters the blood, is carried to the liver and converted back to glucose.
EPOC	Excess post-exercise oxygen consumption (or oxygen debt). Extra oxygen is needed after strenuous exercise to replace lost oxygen from blood / muscles and convert lactic acid to glucose.

Effect of exercise on oxygen demand



Lesson	Memorised?
1. Aerobic Respiration	
2. Gas Exchange System	
3. Getting Oxygen	
4. Comparing Gas Exchange	
5. Anaerobic Respiration	

8D Unicellular Organisms

1. Unicellular or Multicellular	
Cells	The basic unit of life. All organisms are made up of cells.
Unicellular	An organism made up of one cell.
Microorganisms	Organisms that are so small they can only be seen with a microscope.
Multicellular	An organisms made of many cells.
Diffusion	When particles spread to fill the area that they are in.
Kingdoms	All living organisms can be grouped into one of the five kingdoms.
Prokaryotes	Unicellular organisms that do not have a nucleus.
Protoctists	Mainly unicellular organisms. All have a nucleus.
Fungi	Mainly multicellular organisms that do not make their own food and have a nucleus.
Plants	Multicellular organisms that have a nucleus and make their own food.
Animals	Multicellular organisms that have a nucleus, do not make their own food and do not have a cell wall.
Bacteria	A type of microorganisms in the prokaryote kingdom.
Viruses	Not classed as living organisms because they cannot live without being inside a host.

2. Microscopic Fungi	
Asexual Reproduction	Producing new organisms from one parent only.
Budding	Type of asexual reproduction used by fungi in which a small new cell grows out from a parent cell.
Aerobic Respiration	Glucose + oxygen → carbon dioxide + water
Anaerobic Respiration	A type of respiration which does not require oxygen.
Fermentation	The anaerobic respiration of microorganisms. Glucose → carbon dioxide + water
Population	The number of a certain organism found in a certain area.
Limiting Factor	Something that stops a population growing.

3. Bacteria	
Lactic Acid	Produced by the anaerobic respiration of bacteria. Glucose → lactic acid
Enzymes	A substance that can speed up some processes in living organisms.
Binary Fission	Type of asexual reproduction used by bacteria in which a cell splits into two.
Chromosome	A long molecule that contains instructions for organisms and their cells.
Flagella	A tail-like structure that rotates, allowing a unicellular organism to move.
Statement Key	A series of descriptive statements used to work out what something is.

4. Protoctists	
Algae	A type of protoctist that uses photosynthesis.
Photosynthesis	Carbon dioxide + water → glucose + oxygen
Chloroplast	Found in plant and some protoctist cells- the site of food production through photosynthesis.
Chlorophyll	The green substance inside chloroplasts that absorbs light.
Producers	Organisms that are able to make their own food- always the start of a food chain.
Food Chains	A way of showing what eats what in an ecosystem.
Energy Transfer	Represented by an arrow on a food chain diagram.
Pyramids of Numbers	A way of showing the numbers of different organisms in a food chain.
Poison	Can build up and become more concentrated as you move along a food chain.

5. Decomposers & Carbon	
Ecosystem	All the physical environmental factors and all the organisms that are found in a habitat.
Decomposers	Organisms that feed on dead organisms or animal waste which allows substances to be recycled.
Decay	The breakdown of dead organisms or animal waste.
Soluble	A substance that can dissolved in a liquid.
Carbon Cycle	Shows how carbon compounds are recycled in an ecosystem.
Combustion	Burning fuels and releasing carbon dioxide into the air.
Feeding	Transfers carbon compounds stored in plants to the animals eating them.
Carbohydrates	A nutrient used as the main source of energy.
Proteins	A nutrient used for growth and repair.
Fats	A nutrient used for storing energy and as a thermal insulator.

Lesson	Memorised?
1. Unicellular or Multicellular	
2. Microscopic Fungi	
3. Bacteria	
4. Protoctists	
5. Decomposers & Carbon	

8K Energy Transfers

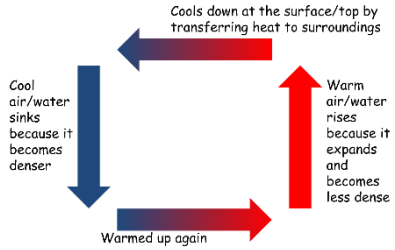
1. Temperature Changes

Temperature	How hot or cold an object is. *Measured in degrees Celsius (°C)*
Internal / Thermal Energy	The energy stored in the movement of particles. *Measured in Joules (J)*
Factors Affecting Amount of Internal Energy Stored	• temperature • material • mass
Energy Transfer	Always from a hotter object to a cooler one.
Evaporation	When a liquid turns into a gas. A way of transferring energy.
Cooling by Evaporation	The fastest moving particles escape a liquid to form a gas. The particles left are storing less energy so the temperature of the remaining liquid is lower.

2. Transferring Energy

Transferring Energy	Energy can be transferred by heating via evaporation, conduction, convection and radiation.
Radiation	A way of transferring Energy by heating through waves (it does not need a medium).
Emitting Radiation	All things give out (emit) infrared radiation, the hotter it is the more it emits.
Thermal Images	Instruments that measure infrared radiation and convert into maps of temperatures.
Conduction	When a solid is heated the particles vibrate more and these vibrations are passed through the solid transferring energy.
Thermal Conductors	Energy is transferred easily through them- metals.
Thermal Insulators	Energy is not transferred through them easily- wood / plastic.
Convection	In fluids (liquids and gases) when part of it is heated it become less dense and rises. Cooler fluid moves in to take its place and a convection current forms.

Convection Diagram



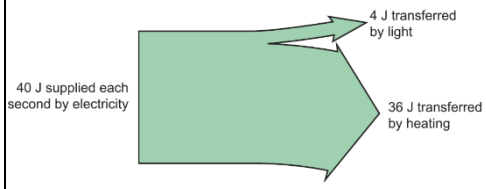
3. Controlling Transfers

Cold Climates	Houses are kept warm by burning fuel for heating and insulating houses to keep warmth inside.
Good Insulators	Brick, wood, carpet, feathers, wool.
Air	A very poor conductor because the particles are far apart
Hot Climates	Houses are kept cool by painting them white (light and shiny surfaces reflect infrared radiation).
Solar Panels	Painted black because dark colours absorb and emit infrared radiation well.
Vacuum Flask	Designed to reduce energy transfers and keep contents hot: • Plastic stopper to stop convection (and it is an insulator). • Glass walls with silver coating reflect radiation back in. • Vacuum between walls so no conduction or convection can occur.

4. Power and Efficiency

Power	The amount of energy transferred by an appliance per second.
Watts (W)	The units for measuring power. 1000W = 1kW (kilowatt)
Power Ratings	Tell us how much energy an appliance transfers.
Efficiency	The amount of useful energy transferred by a device compared with the amount of energy supplied to it.
Sankey Diagram	A diagram that represents energy transfers.

Sankey Diagram Example



Efficiency Formula

$$\text{efficiency} = \frac{\text{useful energy transferred}}{\text{total energy supplied}} \times 100\%$$

5. Paying for Energy

Kilowatt-hour (kWh)	The amount of energy transferred in 1 hour by an appliance. Used by energy companies to measure energy use.
Energy Use Formula	$\underset{\text{(kWh)}}{\text{energy use}} = \underset{\text{(kW)}}{\text{power rating}} \times \underset{\text{(hours)}}{\text{time}}$
Saving Money on Electricity / Gas Bills	Not using as much energy will save money. Insulating houses and using more efficient appliances will help with this.
Payback Time	How long it will take you to save the money that an efficiency measure costs.
Payback Time Formula	$\text{payback time} = \frac{\text{cost of change}}{\text{saving per year}}$

Lesson	Memorised?
1. Temperature Changes	
2. Transferring Energy	
3. Controlling Transfers	
4. Power and Efficiency	
5. Paying for Energy	

9F Reactivity

1. Types of Explosion

Explosion	Sudden increase in volume of gas and huge transfer of energy to the surroundings.
Physical Changes	Changes where no new substances were made.
Chemical Reaction	Changes where one or more new substances are made.
Flammable	A substance that catches fire easily.
Reactants	The starting substances- written on left of word equation.
Products	The new substances made- written on right of word equation.
Gas Pressure	The force gas particles exert by hitting the walls of the container they are in.
Increasing Gas Pressure	• Increasing number of particles • Decreasing size of container • Increasing temperature

2. Reactivity

Reactivity Series	List of metals in order of reactivity
Metals & Water	React to form metal hydroxides and hydrogen. *sodium + water → sodium hydroxide + hydrogen*
Metals & Acids Word Equation	metal + acid → salt + hydrogen *magnesium + sulfuric acid → magnesium sulfate + hydrogen*
Naming Salts	The first word in the salt is the metal the second depends on the acid used.
Hydrochloric Acid	Forms salts ending in chloride
Sulfuric Acid	Forms salts ending in sulfate
Nitric Acid	Forms salts ending in nitrate
Metals & Oxygen	React to form metal oxides *Zinc + oxygen → zinc oxide*
Oxidation	Reaction in which a substance gains oxygen.

Reactivity Series

Metal	Reaction with oxygen in air	Reaction with cold water	Reaction with dilute acid
potassium	🔥	🔥	💥
sodium	🔥	✓✓✓	💥
lithium	🔥	✓✓	✓✓✓
calcium	🔥	✓✓	✓✓✓
magnesium	🔥	✓	✓✓
aluminium	✓✓✓	●●●	✓✓
zinc	✓✓	●●●	✓✓
iron	✓✓	●●●	✓
tin	✓	●●●	✓
lead	✓	●●●	✓
copper	✓	✗	✗
mercury	●●●	✗	✗
silver	●●●	✗	✗
gold	✗	✗	✗
platinum	✗	✗	✗

Increasing reactivity

Key

💥 explosive	🔥 can catch fire	✓✓✓ reacts very quickly
✓✓ reacts quickly	✓ reacts	●●● slow or partial reaction
✗ no reaction		

Rust	Formed by the corrosion of iron and steel.
Preventing Rust	Use a barrier such as paint/ plastic/oil to keep away air/water
Sacrificial Protection	More reactive metals are attached to react with water & oxygen instead of the iron.

3. Energy and Reactions

Oxygen	Often needed in many chemical reactions that cause explosions.
Oxidising Agent	A substance that provides oxygen to oxidise another substance.
	**Oxidising** The hazard symbols for substances which are oxidising.
Potassium Nitrate	Oxidising agent mixed with powdered charcoal to make gunpowder.
Oxygen Test	Oxygen will relight a glowing splint.
Surface Area	Small pieces of solid have a greater surface area over which a chemical reaction can occur. Explosives react more quickly if the solid fuel is broken into tiny pieces.
Energy	Cannot be created or destroyed only transferred and stored.
Exothermic Reactions	Energy stored in the reactants is transferred to the surroundings. *e.g. combustion, neutralisation*
Endothermic Reactions	Energy is transferred from the surroundings to the reactants *e.g. thermal decomposition*
Hydrocarbon	Compound containing only hydrogen and carbon. *e.g. methane (CH_4)*

4. Displacement

Displacement Reaction	Reaction where a more reactive metal displaces (takes the place of) a less reactive one.
Displacement Reaction Word Equation	Aluminium + iron oxide→aluminium oxide + iron
Thermite Reaction	Displacement reaction between aluminium and iron oxide.
Energy	Thermite reaction needs an input of energy by lighting a fuse.
Thermite Reaction Uses	Used on a large scale to join two sections of railway track as molten iron runs into the gap and solidifies.
Solutions	Displacement reactions also occur in solutions. *e.g. zinc in copper sulfate*

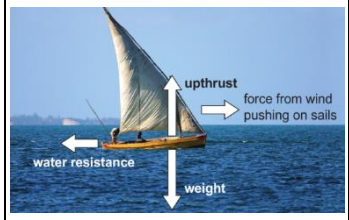
5. Extracting Metals

Native State	When a metal is found in the Earth as an element.
Ore	Rock that contains enough of a metal/metal compound to be worth mining.
Extracting Iron	Iron is found as iron oxide. Oxygen is removed by heating with carbon.
Extracting Iron Word Equation	Iron oxide + carbon → iron + carbon dioxide
Reduced	When a substance has lost oxygen.
Electrolysis	Used to extract reactive metals (e.g. aluminium) from their ores using electricity.
Extracting Aluminium Word Equation	Aluminium oxide → aluminium + oxygen
Potassium - Aluminium	Extracted through electrolysis
Zinc - Copper	Extracted by heating with carbon.
Silver- Platinum	Found in native state.

Lesson	Memorised?
1. Types of Explosion	
2. Reactivity	
3. Energy & Reactions	
4. Displacement	
5. Extracting Metals	

9I Forces and Motion

1. Forces and Movement

Friction	Force between two surfaces sliding across each other.
Reducing Friction	Using rollers or wheels / sleds in snowy countries
Balanced	When a force acting on an object is the same size as the force in the opposite direction.
Constant Speed	Caused by balanced forces acting on an object.
Unbalanced	Forces acting in opposite directions are not equal.
Resultant	The difference between the forward and backward force.
Accelerate	Get faster- caused by unbalanced forces.
Boat Force Diagram	
Drag	Acts to slow down objects moving through fluids (liquids/ gases) *e.g. water resistance and air resistance*
Top Speed	Dependent on the maximum force a vehicle can move forwards an on the friction/ drag acting to slow it down.

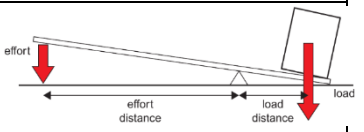
2. Energy For Movement

Food	Supplies humans the energy they need.
Solar Energy	Energy stored in food originally came from the Sun.
Kinetic Energy	Stored in anything that is moving.
Fossil Fuel	Fuels formed by remains of plants / animals that store large amounts of energy. *e.g. coal, oil, natural gas*
Non-Renewable	Resources that will run out one day like fossil fuels.
Using Fossil Fuels	Energy stored in oil and natural gas is used for transport. Energy released by burning fuels is transferred by heating for cooking or keeping warm
Gravitational Potential	Energy stored in raised objects.
Elastic Potential	Energy stored in stretched or squashed objects.
Thermal	Energy stored in the movement of particles. Transferred from hot objects to cooler ones by heating.
Renewable	Resources that will not run out. *e.g. wind, moving water*
Nuclear Energy	Non-renewable resource used to generate electricity.
Electricity	Cannot be stored, has to be generated by renewable or non-renewable resources.
Conservation of Energy	Energy cannot be created or destroyed, only transferred.
Efficiency	The useful energy transferred compared to the total energy transferred by a device.
Dissipated	Energy that spreads out.
Transfers	Energy is often transferred by heating or sound.

3. Speed

Speed	How far something can travel in a certain time.
Units	Dependent on measurements taken *e.g. miles per hour, metres per second*
Speed Formula	$\text{speed} = \frac{\text{distance}}{\text{time}}$
Mean Speed	Total distance travelled, divided by the total time taken.
Distance-Time Graph	Used to show how fast someone travelled during a journey. Also called a displacement-time graph
Displacement	Distance in a straight line between an object and its starting point.
Horizontal Line	Shows an object isn't moving on the distance-time graph.
Steep Line	Shows an object is moving quickly
Relative	Looking speed compared to another object which may be moving.

4. Turning Forces

Lever	Long bar used to life heavy objects.
Pivot / Fulcrum	Point that the lever turns around.
Effort	Force applied down on lever.
Load	The object being lifted.
Lever Diagram	
Force Multiplier	Effort distance is greater than the load distance meaning that the effort force is smaller than the force lifting the load.
Distance Multiplier	Large effort force moves a small distance and the load is moved a greater distance.
Moment	The turning effect of a force.
Units	Moments are measured in newton metres (**N m**)
Moment Formula	moment of the force (N m) = force (N) × perpendicular distance from the pivot (m)
Equilibrium	Opposing forces are balanced.

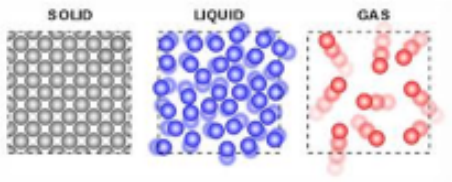
5. More Machines

Machine	Anything that helps us work with forces.
Ramp	A simple machine that means less force is needed to push an object up a slope compared to lifting.
Pulleys	Makes lifting a load easier by pulling down a rope.
Work	Amount of energy transferred when a force moves something.
Units	Work is measured in Joules (**J**)
Work Done Formula	work done (J) = force (N) × distance moved in the direction of the force (m)
Conservation of Energy	If a smaller force is needed to move something, the force has to move through a greater distance.

Lesson	Memorised?
1. Forces and Movement	
2. Energy For Movement	
3. Speed	
4. Turning Forces	
5. More Machines	

CC1-SC2: States of matter, separating and purifying knowledge organiser (H)

Lesson 1 States of matter



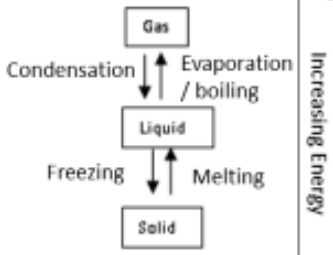
Arrangement of particles

Ordered Neat rows	Random Some touch	Random Apart

Movement of particles

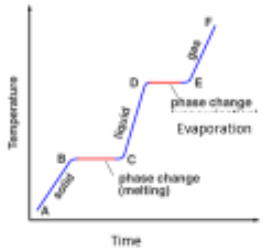
Vibrating about fixed position	Rolling over each other	Flying around with high energy

State Changes



Sublimation is going from a solid straight to a gas

Lesson 2 Heating / Cooling curves



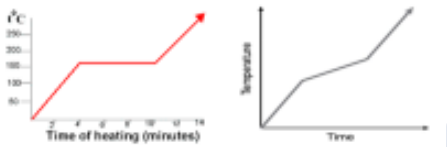
A heating or cooling curve shows how the temperature changes with time
State changes are shown as horizontal lines
During this time the energy is used to change state and not temperature

Lesson 3 Mixtures

- Mixtures contain substances which are not chemically combined and they can be separated
- Pure materials contain only one substance
- Impure materials contain a mixture of substances

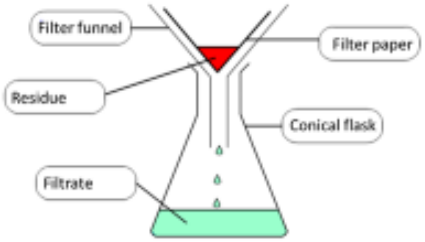
Pure substances have a sharp melting point
Impure substances have a range of melting points

Pure **Impure**



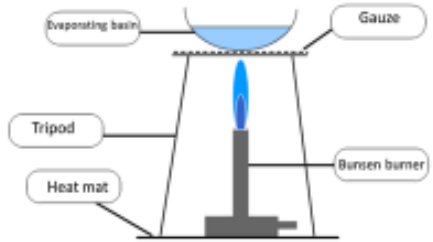
Lesson 4 Filtration and crystallisation

Filtration can be use to separate an insoluble solid from a liquid or from a solution



Filtration works because the large particles of the residue can not pass through the small gaps in the filter paper

Crystallisation can be used to separate a soluble solid from a solution of that solid

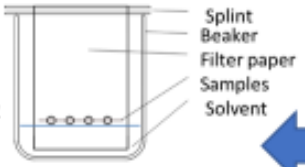


In crystallisation of a solution the **solvent** is **evaporated** from a **solution** to leave the **solute**

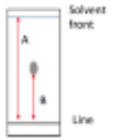
Lesson 5 Chromatography

Chromatography is used to separate a mixture of substances. E.g. a mixture of different dyes in an ink.

The mixture separates because some dyes like the solvent more and some like the paper more.



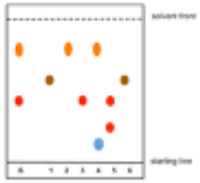
Calculating Rf values



A = Distance solvent has travelled

B = Distance substance has travelled

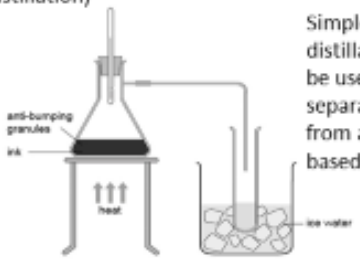
Rf = Distance substance has travelled (B) / Distance solvent has travelled (A)



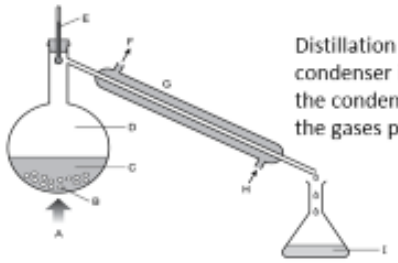
You can compare how far inks have travelled (Rf values) to analyse the dyes in an unknown mixture

Lesson 6 Distillation

Distillation is used to separate a solvent from a solution or from a mixture of solvent (fractional distillation)



Simple distillation – can be used to separate water from a water based ink



Distillation with a condenser is better as the condenser cools the gases produced

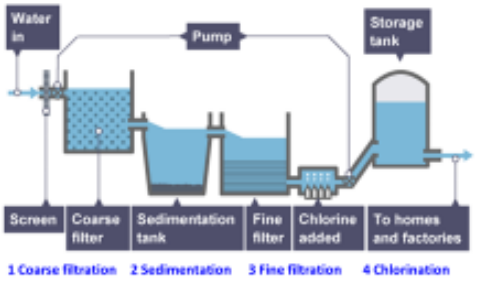
State changes involved in distillation - boiling/evaporation and condensation

Risk Assessment
Hazard – what is dangerous e.g. Bunsen Burner
Risk – the hard it could do e.g. Hair could catch fire
Control measure – How you make it safe e.g. tie your hair back

Lesson 7 Purifying water

Water is used for many things around the home and comes from a variety of sources

Water is purified to remove impurities (silt and mud, chemicals, dissolved salts)



Course filtration – filtered to remove twigs etc.
Sedimentation – a chemical is added which makes particles sink to bottom
Fine filtration – filtered through sand
Chlorination – to kill bacteria

Distilled water is pure water and contains no dissolved salts. It is used for laboratory tests.
Sea water contains dissolved sodium chloride
Mineral water contains many dissolved salts
We do not use distillation to make drinking water as it uses a lot of energy and would be expensive

B5: Health, Disease & the Development of Medicines

1. Health and Disease

Health	A state of complete physical, social and mental wellbeing.
Physical Health	Being free from disease, active, fit, sleeping well and no substance abuse.
Mental Health	How you feel about yourself.
Social Health	Having healthy relationships and how your surroundings affect you.
Disease	An illness that prevents the body from functioning normally.
Communicable Disease	Diseases caused by pathogens, can be spread from one person to another.
Non-Communicable Disease	Diseases caused by genes or lifestyle. Cannot be spread from one person to another.
Correlated Diseases	Getting one disease increases your chance of another due to diseases weakening organ systems, damaged immune system, and weaker defences.
Pathogen	A microorganisms that causes disease.

2. Non-Communicable Diseases

Genetic Disorders	Diseases caused by inheriting faulty genes from parents.
Malnutrition	Getting too little or too much of a particular nutrient.
Deficiency Disease	Disease caused by the lack of a certain nutrient.
Anaemia	Lack of iron. Causes fewer and smaller red blood cells and low energy.
Kwashiorkor	Lack of protein. Swollen belly, small muscles, stunted growth.
Rickets	Lack of calcium or vitamin D. Causes weak bones leading to bowed legs.
Scurvy	Lack of vitamin C. Swollen bleeding gums, muscle and joint pain, lack of energy.
Drug	Chemical that changes the way the body works.
Cirrhosis	Fatal liver disease caused by drinking too much alcohol over a long period of time.
Impact of Liver Disease / Alcohol	Fifth largest causes of death in the UK, increasing 450% in the last 30 years. Costs £500 million each year to treat.

3. Cardiovascular Disease

Obesity	A condition in which someone is overweight for their height and large amounts of fat builds up around major organs.
Cardiovascular Disease	Disease in which the heart or circulatory system is affected.
Heart Attack	When the heart stops pumping due to a lack of oxygen reaching it.
BMI	Body mass Index $\text{BMI} = \frac{(\text{weight in kilograms})}{\text{height in meters}^2}$ BMI over 30 is obese
Waist:hip Ratio	Waist measurement ÷ hip measurement Better method of measuring abdominal fat which is linked with cardiovascular disease.
Smoking	Harmful substances from smoke can damage blood vessels, increase blood pressure, make blood vessels narrower and increase risk of blood clots.
Stent	A small mesh tube that is inserted into a narrowed artery and opened up to widen it.
Treating Heart Disease with Lifestyle	More exercise and a better diet can treat cardiovascular disease and giving up smoking.

4. Pathogens

Types of Pathogen	Bacteria, virus, protist, fungi.
Tuberculosis	Bacteria. Damages lungs causing bloody cough, fever and weight loss.
Cholera	Bacteria. Sever life-threatening diarrhoea.
Chalara Ash Dieback	Fungi. Kills the leaves of ash trees, killing the tree.
Malaria	Protist. Multiplies inside red blood cells and liver cells and causes fever and weakness.
Haemorrhagic Fever	Virus, e.g. Ebola. Liver and kidney damage, internal bleeding and fever.
HIV	Human immunodeficiency virus attacks white blood cells, causing AIDS.
AIDS	Acquired Immunodeficiency Syndrome. Weakened immune system making simple infections deadly. Caused by HIV.
Hidden Pathogens	Many types of bacteria live in our bodies. Some are essential for health, others may not affect us most of the time. *Helicobacter pylori* can cause stomach ulcers some of the time.

5. Spreading Pathogens

Airborne	Spread through the air. Colds/flus/TB by infected droplets in saliva being passed into the air by coughing or sneezing. Chalara ash dieback by fungal spores carried by wind.
Waterborne	Spread through contaminated water. Cholera
Oral Route	Pathogen enters body through the mouth by eating/drinking.
Vectors	Organisms that carry a pathogen from one person to the next. Mosquitos are vectors for malaria.
Bodily Fluids	Spreading through contact with bodily fluids such as blood or semen. HIV
Hygiene	Keeping things clean to remove or kill pathogens.
Epidemic	When many people over a large area are infected with the same pathogen at the same time.

6. Physical & Chemical Barriers

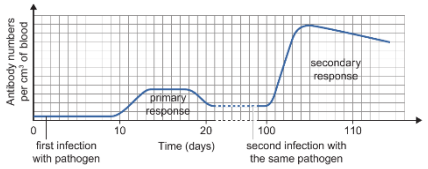
Chemical Defences	Kill pathogens or make them inactive before they can infect us.
Lysozyme	Enzyme found in mucus, tears and sweat that kills some bacteria.
Hydrochloric Acid	Found in the stomach, reducing pH to 2, killing most pathogens.
Physical Barrier	Block or trap pathogens so they cannot enter the body.
Mucus	Sticky secretion that traps pathogens- found in most body openings (nose, mouth, etc.).
Ciliated Cells	Specialised cells with hair like cells that sweep mucus out of the body.
Skin	Blocks pathogens from entering the body.
STIs	Sexually transmitted infections – pathogens spread via sexual activity.
Preventing STIs	Use barrier contraception (such as condoms) to prevent mixing of fluids.
Screening	Large scale testing of people to check if they have an STI so they can be treated. This helps to reduce the spread of STIs.

7. The Immune System

Immune System	Destroys pathogens that manage to infect us.
Antigens	Chemical markers on the surface of pathogens that identify them as a pathogen. Unique to each pathogen.

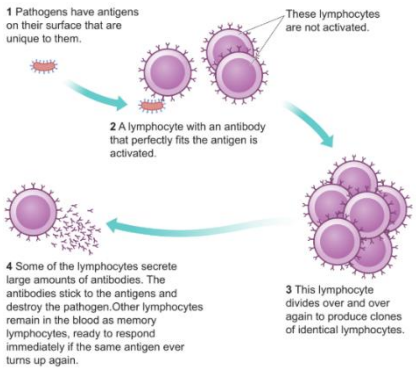
Lymphocyte	White blood cells that produce antibodies. Each lymphocyte produces a different antibody.
Antibodies	Molecules with a specific shape that can attach to a specific antigen on a pathogen and kill it.
Activated Lymphocyte	When an antigen sticks to an antibody, it activates the lymphocyte causing it to make many copies of itself that make the same antibodies.
Memory Lymphocyte	Lymphocytes left over after an infection that retain the ability to fight the pathogen.
Immune	The body has memory lymphocytes to fight the pathogen if it returns so it can't be harmed by it.

Primary Response vs. Secondary Response



Vaccine	A weakened or inactive version of a pathogen.
How vaccines work	Vaccines are harmless versions of pathogen that still have the antibodies on them, so the immune response is triggered without any risk of disease.

How the Immune System Attacks Pathogens



8. Antibiotics	
Antibiotics	Substances that kill bacteria or inhibit their processes without harming human cells.
Penicillin	The first antibiotic discovered by Alexander Fleming. Produced by a mould.
Resistance	Widespread use of antibiotics has led to resistance, meaning many antibiotics don't work as well as they once did.
Drug Development	Developing new medicines involves many stages that take a lot time and money.
Discovery Phase	Developing new chemicals that might work as medicines.
Pre-Clinical Phase	Testing on cells grown in the lab, or on animals, to see if the chemical has any useful effect.
Small Clinical Trial	Testing on a few healthy people to check for safety.
Large Clinical Trial	Testing on many patients to discover how effective the drug is and determine the dose.
Side Effects	Unwanted effects of the medication that can be quite harmful.
Dose	The correct amount of the medicine that needs to be given to the patient.

Lesson	Memorised?
1. Health and Disease	
2. Non-Communicable Diseases	
3. Cardiovascular Disease	
4. Pathogens	
5. Spreading Pathogens	
6. Physical & Chemical Barriers	
7. The Immune System	
8. Antibiotics	