Year 7 Progress Booklet:

Name: _____ Class: _____

Science Teacher: _____ Pathway: _____

Progress Sheet:

In Science this year I would like to _____

_____

_____

Assessment	Date	Score	F / I / H	☺ 😐 ☹
Baseline assessment				
Organisation marking task				
Organisms assessment				
Energy Marking Task				
Graph marking task				
Periodic table marking task				
Matter assessment				
Electricity marking task				
Speed and graphs marking task				
Forces and ecosystems assessment				
Acids and alkalis task				

In Science next year I would like to _____

_____

Contents

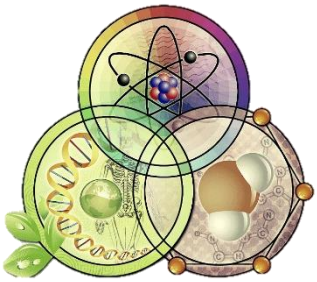
What is Science and why do we study it?

Science is the study of the natural world through observation and experiment.

In science we study a variety of different topics that relate to us and the world around this.

In science we learn knowledge and skills, we consider how we make observations, write predictions, develop inferences that we can make from our observations, how to communicate findings and improve our lives and the world around us.

Biology: the study of living organisms, their structure, adaptations and environment.



Chemistry: studies the properties of matter and how matter interacts with energy.

Physics: the study of matter and small parts that make up matter, its motion and behaviour through space and time, including energy and forces.

Where can science take us?

Whether you choose to continue to study science or use the skills it gives you, science opens a wide variety of doors, including doctor, engineer, material scientist, microbiologist, economist, meteorologist, accountant, analyst.

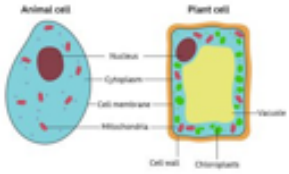






What will we learn this year?

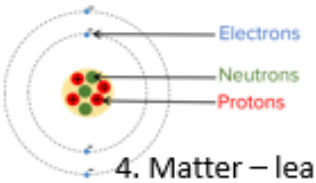
1. Introduction to Science – what equipment do we use? What are standard units of measurement? How do we successfully draw a graph?



2. Organisms – learn about how living things are organized, including types of cells and how the skeleton works. A more detailed look at the reproductive system and healthy pregnancy.

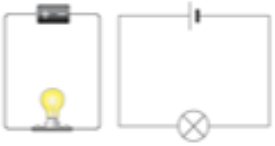
3. Energy – what is an energy store? How does energy get transferred from one place to another?

How do magnets and compasses work?



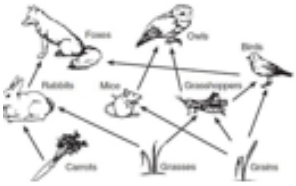
4. Matter – learn about states of matter, the periodic table and the structure of an atom. Learn how to separate different types of mixture.

5. Energy – look at electricity – what is current? How do electromagnets work?



6. Forces – what is a force? Learn how to calculate speed and gravity.

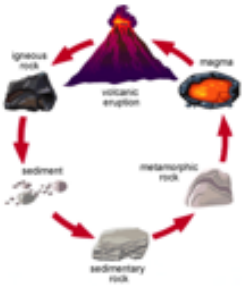
Look at speed and relative motion.



. Genes and ecosystems – what is ariation? How does this relate to :cosystem relationships between predators and prey?

8. Reactions – learn what acids and alkalis are and how the react together.

9. Earth Science – find out the Earth's place in the solar system and what it is made from.



Lab Rules:

The lab rules are designed to keep you and the people around you safe. Make sure you have read these carefully.

1. Only enter the lab when you are told to do so by a teacher.

2. Do not run or mess about in a lab.
3. Keep your bench and floor clear – put bags and coats in provided storage spaces or neatly under your chair.
4. Follow all instructions first time, every time.

5. Wear goggles from the start of the practical until the teacher tells you to take them off.

6. Replace lids on all chemical bottles and only touch them when instructed to do so.
7. When using a Bunsen burner – tie hair back and tuck in ties.
8. Stand up during practical work.

9. Do not eat or drink in the lab – never smell or taste anything that is in the lab – if you do, report it to the teacher.

10. Wash your hands carefully after every practical lesson.
11. If you are burnt or a chemical splashes on your skin – wash the area immediately and report it to the teacher.

12. Do not put solid waste down the sink – it goes in the bin unless instructed otherwise.
13. Wipe up all small spills and report bigger ones to your teacher.

14. Report any breakages to the teacher.
15. Enjoy your practical lessons – ask questions, be inquisitive and learn some amazing science!

I have read and understand the rules of the lab at SMS, signed: _____ Date: _____

Periodic Table:

The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

Key: relative atomic mass / **atomic symbol** / name / atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Working Scientifically Learning Journey:

	KS2	Year 7	Year 8	GCSE
Using lab equipment	• Decide on appropriate equipment to carry out an investigation. • Measure temperature using a thermometer. • Filter paper and funnel for filtration. • Measure accurately and precisely - including the use of a protractor to measure angles. • Using a Newtonmeter to measure force.	• Chromatography paper and solvent tank. • Distillation equipped including round bottom flask, condenser, conical flask. • Quadrat for ecosystem sampling.		
Mathematical formula	Mean = (result 1 + result 2 + result 3) ÷ 3	• Weight = mass x gravitational field strength • Speed = distance / time • Efficiency = (useful energy output ÷ total energy input) x 100 • Calculating current in a series and parallel circuit	Pressure = force / area	Use an appropriate number of significant figures in calculation. • work done = force × distance • force applied to a spring = spring constant × extension • Acceleration = change in velocity ÷ time taken • resultant force = mass × acceleration • momentum = mass × velocity • kinetic energy = 0.5 × mass × speed 2 • gravitational potential energy = mass × gravitational field strength × height • Power = energy transferred ÷ time and Power = work done ÷ time • Efficiency = useful power output ÷ total power input • wave speed = frequency × wavelength • charge flow = current × time • potential difference = current × resistance • power = potential difference × current and power = current2 × resistance • energy transferred = power × time • energy transferred = charge flow × potential difference • Density = mass ÷ volume
Scientific method	• Ask questions and recognise they can be answered in different ways. • Observations can be used to suggest answers to questions. • Set up comparative and fair tests, explaining which variables need to be controlled and why. • Draw scientific, labelled diagrams • Gather and record data to answer questions. • Drawing conclusions from data. • Ask further questions based on data collected. • There are 5 types of scientific enquiry observing over time, fair testing, research, pattern seeking, sorting and classifying. • Identify and control variables. • Take repeat measurements when appropriate. • Write a prediction for a scientific enquiry. • Report and present findings from enquiries. • Identify relationships from data and comment on relationships.	• Identify independent, dependent and control variables. • Write a hypothesis. • Write a method. • Write conclusions based on data. • Write evaluation for scientific enquiry.		• Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. • Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences. • Use scientific theories and explanations to develop hypotheses. • Carrying out and represent mathematical and statistical analysis. • Representing distributions of results and make estimations of uncertainty. • Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.

Graphs	Draw bar charts Draw a scatter graph Draw a line graph	Interpreting graphs		
Scientific theory	• Use relevant scientific language and illustrate, communicate and justify their scientific ideas. Scientific ideas have changed over time due to increased evidence.			Understand how scientific methods and theories develop over time. Appreciate the power and limitations of science and consider any ethical issues which may arise. Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.

Maths:
Using and manipulating mathematical formula, rounding to significant figures and decimal places, measuring angles, calculating means.

English:
Writing scientific reports.

Art:
Drawing accurate diagrams.

IT and Design Technology:
Following methods, using specialized equipment.

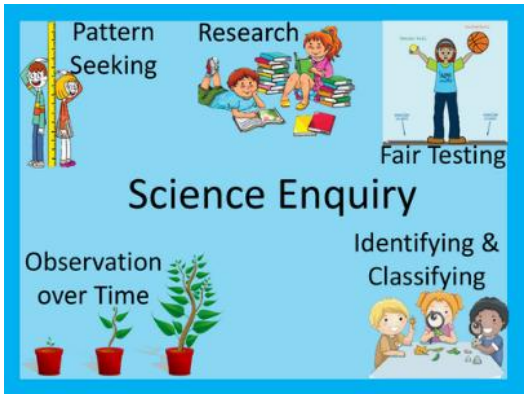
Working Scientifically Knowledge Organiser:

Keyword / Concept	Definition
Types of enquiry	Observing over time, research, classifying, fair testing, and pattern seeking.
Variable	A value that could be changed during an experiment.
Independent variable	The thing that you change
Dependent variable	The thing that you measure
Control variable	The thing that you keep the same
Prediction	What do you think will happen in an investigation and why?
Equipment	Special pieces of glassware and tools that allow you to carry out scientific investigations.
Risk assessment	A list of hazards, risks and how to reduce the chances of them.
Method	Step by step set of instructions on how to carry out an investigation
Conclusion	An explanation of what is found out during an investigation and why.
Evaluation	An explanation of what has gone well with an investigation and what can be done to improve it if carried out again.
Accuracy	An accurate measurement is considered to be close to the true value. Accurate readings are done by using suitable equipment.
Precision	How close together measurements are.
Anomaly	A result that does not fit the pattern.
Scale	A set of numbers that indicate certain intervals on a graph / measuring equipment used for measurement.
Axis	The horizontal (x axis) and vertical (y axis) lines on a graph that contain the scales.
Line of best fit	A line that follows the trend of data showing the correlation of results

Working Scientifically:

1. Aim:
   What are you investigating?
   In this investigation we are going to …..

2. Type of enquiry:



3. Identifying variables:
   - Independent variable
   - Dependent variable
   - Control variable
4. Prediction:
   - Can you predict what your results will show?
     I predict that if I change the (independent variable) it will *increase/decrease* the (dependent variable)
   - Can you use a scientific idea to support your prediction?

5. Risk Assessment:

What are the risks with your investigation?

- ❑ Identify the hazard.
- ❑ State what harm the hazard can do (risk).
- ❑ How could you stop any accidents from happening?
- ❑ If an accident occurred, what would you do?

Hazard	Risk	Preventing Risk	What to do if an accident happens.

6. Method:

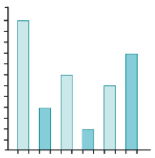
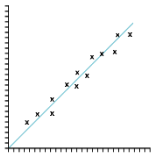
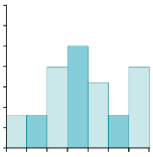
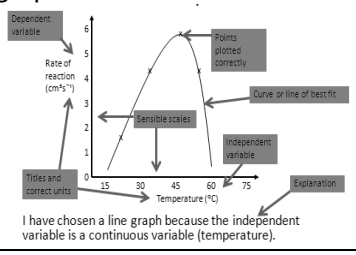
Make sure your method has:

- ☐ Numbered steps (step 1:…..)
- ☐ Written in a clear order
- ☐ Short, simple sentences
- ☐ Bossy verbs (Collect, Measure, Pour)
- ☐ Be specific – use amounts or timings
- ☐ Do not use I, we, you
- ☐ You may want to include a diagram

7. Collecting Results:

Independent variable (units)	Dependent variable (units)			
	Repeat 1	Repeat 2	Repeat 3	Mean Average

8. Representing data:

Types of Graph:	Graph Check List:
• Bar chart: When one of our variables is discrete, we draw a bar chart. 	☐ Drawn with a pencil and ruler ☐ Axes drawn using the lines on the graph paper ☐ X axis – independent variable (what you changed) ☐ Y axis – dependent variable (what you measured) ☐ Axes labelled – what do the numbers/words mean make sure you include units ☐ Scales are evenly spaced ☐ Bar chart – bars equal widths with spaces between them. ☐ Line graph – points drawn with small x, line of best fit. ☐ Histogram – bars equal without spaces between them. ☐ Title – This graph shows….
• Line graph: When both variables are continuous, we draw a line graph. 	
• Histogram: When continuous data is grouped into categories, we draw a histogram. 	

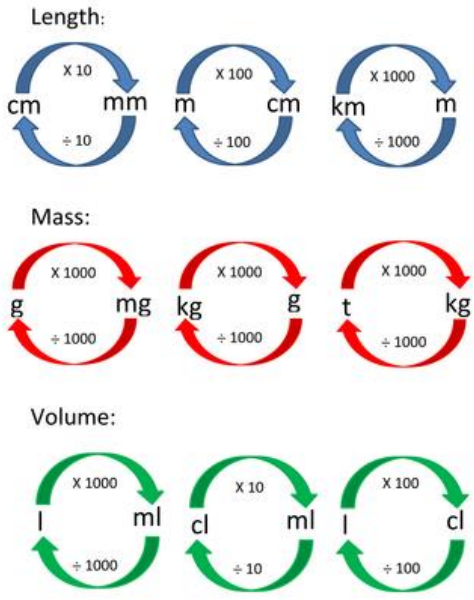
9. ***Conclusion:***

- When the (independent variable) increases / decreases, (dependent variable) ….
- We can see this from… (use your data).
- This happened because… (explain your results using science).
- Was your prediction correct? My prediction was correct/not correct because…

10. ***Evaluation:*** Answer these questions below in full sentences to evaluate your experiment.
    A measurement is repeatable if the same experimenter repeats the investigation using the same method and equipment and gets the same result.
    a. Were the range and number of readings you took sufficient to see whether you had repeatable results?
    b. Can you explain any anomalous results?

    An experiment gives valid results if it is a fair test and provides repeatable results. If a variable should be controlled but isn't, then the experiment will not be a fair test.
    c. How successful were you at keeping your control variables the same throughout your investigation?
    d. Were the results of your investigation valid? How do you know?
    e. How could you increase the validity of your results? (How could you overcome any weaknesses with your method?

Thing being measured	Standard Units	Equipment if applicable
Energy	Joules (J)	
Force	Newtons (N)	Newton meter
Length	Metres (m)	Ruler
Speed	Metres per second (m/s)	
Gravity	Newton per kilogram (N/kg)	
Volume	Centimetres cubed (cm^3)	Measuring cylinder
Current	Amps (A)	Ammeter
Temperature	Degrees celcius (°C)	Thermometer
Mass	Kilogram (kg)	Balance
Distance	Metres (m)	Trundle wheel / meter ruler / tape measure
Time	Seconds (s)	Stopwatch
Angle	Degrees (°)	Protractor



Scientific Skills

Big Picture: Science involves asking questions, investigating and observing the world around us. In order for us to do this we need to think about the equipment we use and how to stay safe.

Careers:

Engineer, architecture, scientist, economist, technician, glass blower, microbiologist.





Tier 3 Vocabulary:

Equipment, safety, safety goggles, Bunsen Burner, measuring cylinder, beaker, measuring, investigation.

Circle how confident you feel at the start of the topic and the end of the topic.

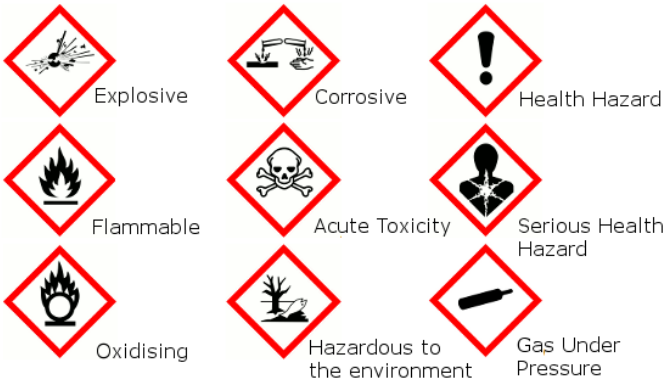
Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Bunsen burners are used to heat substances and involve an open flame.		
Measuring cylinders are for measuring the volume of a liquid.		
Balance is for measuring the mass of a solid.		
Thermometer is for measuring temperature		
Test tubes are for small chemical reactions		
Boiling tubes are for small chemical reactions or for heating small quantities.		
Beakers and conical flasks are for larger chemical reactions.		
Funnels have filter paper in them and designed for separating mixtures.		
Scientific diagrams are simple forms of drawings that can be used in experiment plans.		
Diagrams should be in two dimensions, with single lines and drawn with a pencil and ruler.		
Scales are used on pieces of equipment for measuring.		
kilo = x 1000		
centi = / 100		
milli = / 1000		
Energy = joules		
Force = newtons		
Length = meters		
Volume = cm^3		
Temperature = Degrees celcius (°C)		
Mass = kilograms		
Time = seconds		
Angle = degrees (°)		
Graph success criteria: • Drawn with a pencil and ruler • Graph should take up at least 2/3 of the graph paper. • Evenly spaced scales on axes • Labelled axes including units • Independent variable on x axis • Dependent variable on y axis • Bar chart - bars equal widths • Bar chart - spaces between bars • Line / scatter graph - small crosses to show data points. • Line / scatter graph - line of best fit • Graph title		

Knowledge Organiser:

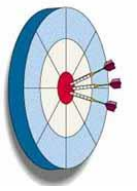
Accuracy	The value closest to the true value.
Precision	How close together measurements are.
Oxidising	Provides oxygen and can cause a fire or explosion.
Explosive	Chemical is unstable and could explode.
Flammable	Catches fire easily.
Gas under pressure	Compressed gas could explode if damaged or heated.
Toxic	Can cause death if swallowed, breathed or absorbed through the skin
Corrosive	Attacks and destroys living tissues.
Health hazard	Could cause irritation and harmful if swallowed, inhaled or contact with the skin.
Serious health hazard	Cause serious and long term damage to health.
Hazardous to the environment	Chemicals may present an immediate or delayed danger to the environment, including toxicity to aquatic life.
Bunsen burner	Piece of laboratory equipment used to heat things in a lab.
Measuring cylinder	Piece of equipment for measuring the volume of a liquid.
Thermometer	Piece of equipment for measuring the temperature.
Ruler	Piece of equipment used for measuring length.

Hazard symbols are a way of identifying what hazards are associated with chemicals:



Measuring:

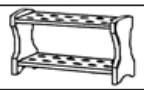
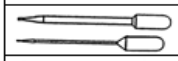
- Accuracy the value closest to the true value.
- Precision how close together measurements are.



Accurate and precise – accurate = the darts are all on bullseye, precise = the darts are all close together.

What are you measuring?	Equipment?	Units?
Mass	Balance	Grams
Length	Ruler	cm
Volume of a liquid	Measuring cylinder	cm^3
Angle	Protractor	°
Temperature	Thermometer	°C

Lab Equipment:

Equipment	Name	Equipment	Name
	Test tube		Measuring cylinder
	Boiling tube		Tripod
	Beaker		Gauze
	Conical flask (i.e. cone-shaped)		Bunsen burner
	Crucible		Filter funnel (with paper)
	Tongs		Test tube holders
	Mortar and pestle		Thermometer
	Pipe clay triangle		Test tube holder
	Stand boss and clamp		Balance
	Dropping pipette		Evaporating basin
	Glass rod		Spatula

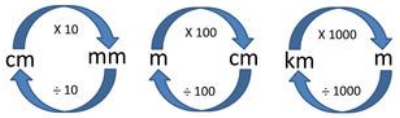
Units of measurement:

Thing being measured	Standard Units	Equipment if applicable
Energy	Joules (J)	
Force	Newtons (N)	Newton meter
Length	Metres (m)	Ruler
Speed	Metres per second (m/s)	
Gravity	Newton per kilogram (N/kg)	
Volume	Centimetres cubed (cm^3)	Measuring cylinder
Current	Amps (A)	Ammeter
Temperature	Degrees celcius (°C)	Thermometer
Mass	Kilogram (kg)	Balance
Distance	Metres (m)	Trundle wheel / meter ruler / tape measure
Time	Seconds (s)	Stopwatch
Angle	Degrees (°)	Protractor

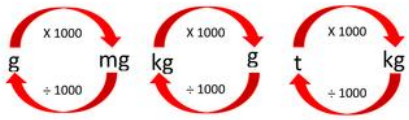
Sometimes the standard units are not a convenient size, so we use bigger or smaller versions. An extra part is added to the name of the unit to show when we are using bigger or smaller versions. This is called a prefix.

Prefix	Meaning	Example
kilo	1000	1 kilogram (kg) = 1000 grams
centi	1/100	100 centimetres (cm) = 1 metre
milli	1/1000	1000 milligrams (mg) = 1 gram
micro	1/1 000 000 (1 millionth)	1,000,000 micrometres (µm) = 1 metre

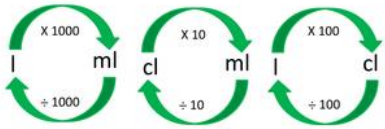
Length:



Mass:



Volume:



Organisms Learning Journey:

Big Picture: Cells are the building blocks of life on Earth, they code for who we are. How do our cells and DNA make us who we are today?

Biology: Features of an organism relate to it's survival and therefore natural selection and evolution.

Chemistry: Cells are the building blocks of all living things, cells are the building blocks of all things. The chemical compounds in cigarettes, drugs and some food substances can diffuse from the mothers blood to the foetus.

Physics: respiration is the process of living things releasing energy.
Force = moment ÷ perpendicular distance

	KS2	Year 7	Year 8	Year 9	GCSE
Cells and organisation	• Animals need water, food and air for survival. • Human growth and development: baby, --> toddler --> child --> teenager --> adult. • Seven life processes are: movement, respiration, sensitivity, growth, reproduction, excretion, nutrition. • Cell --> tissue --> organ --> organ system --> organism • Organ systems in the human body include the circulatory system, digestive system, nervous system, respiratory system, skeletal system.	• Cells are the building blocks of life. • Cells are made of different components all with specific functions, plant and animal cells contain different things. • Plant and animal cells contain a nucleus, cytoplasm, cell membrane and mitochondria. • Plant cells also contain chloroplasts, a vacuole and cell wall. • Specialised cells allow different parts of organisms to develop and are adapted to suit their purpose.	• Specialised cells are part of the adaptations of organ systems - the respiratory system contains cilia to remove mucus and bacteria. • Respiration is a chemical reaction that releases energy and occurs in the mitochondria. • Photosynthesis is a chemical reaction that happens in the chloroplasts of plant cells.	• Unicellular organisms are organisms that consist of only one cell such as bacteria. • The DNA is not found in a nucleus. • Magnification = size of image ÷ actual size of the object. • Diffusion is the movement of materials in and between cells.	• Plant and animal cells are examples of eukaryotic cells. • Bacteria cells are eukaryotic cells - their DNA is a single loop called a plasmid. • Stem cells are undifferentiated cells that can become specialised cells - cell differentiation. • Cells divide during the cell cycle which is called mitosis. • The rate of diffusion is affected by the concentration gradient, temperature and surface area of the membrane. • Osmosis is the movement of water from a dilute solution to a concentrated solution through a partially permeable membrane. • Active transport is the movement of substances from a more dilute solution to a move concentrated solution requiring energy from respiration.
Movement	• Humans have skeletons and muscles for support, protection and movement. • Inside the bones is where red blood cells are made.	• Skeleton is there for support, movement, protection and making blood cells. • Skull protects the brain, ribcage protects the heart and lungs, backbone protects the spinal cord. • Joints link bones together. Cartilage covers the end of bones in a joint. • Ligaments join two bones in a joint. • Antagonistic muscle pairs work against each other to move bones in joints - an example are the bicep and tricep. • Force = moment ÷ perpendicular distance	• Calcium is needed for strong bones - a calcium deficiency could lead to conditions such as osteoporosis. • Rickets is a condition usually found in children caused by a vitamin D deficiency.		

Reproduction	• The changes that happen as humans develop into old age. • During puberty changes include growth spurts, mood swings, hair growth on the body, face and genitals, voice deepens (males), breasts grow (females), hips widen (females), penis gets larger (males). • Life cycle of mammals. • Describe the life process of reproduction in some plants and animals. • Evolution and natural selection are caused by variation within a species - characteristics are passed on through generations when organisms reproduce.	• Puberty causes changes to the body during adolescence, it is the time when the body prepares itself for reproduction. • Animal reproduction - humans breed sexually requiring sperm from the father and an egg from the mother, the join in a process called fertilisation. • Female reproductive system includes: vagina, cervix, uterus, oviduct, ovary. • Male reproductive system includes: penis, testicle, scrotum, glands, sperm duct. • Ovulation is the release of an egg cell from the ovary - this happens once a month. • Fertilisation happens in the oviduct. • The placenta is the organ responsible for providing oxygen and nutrients to a developing foetus and removing waste substances, it develops inside the uterus during pregnancy. • The placenta connects the mother and foetus via the umbilical cord.	• Plant reproduction - plants require pollen (male sex cell) and an ovule (female sex cell) which join together during fertilisation to produce offspring. • Plants require the wind or pollinators for reproduction to happen.		• The menstrual cycle is controlled by hormones - these include oestrogen, follicle stimulating hormone (FSH), luteinising hormone (LH) and progesterone. • People use contraception to prevent pregnancy. • Hormones can be used to treat infertility such as IVF. • In sexual reproduction, there is a mixing of genetic information which leads to variation in the offspring. • Meiosis is the type of cell division that leads to the formation of gametes, these cells aren't identical. Asexual reproduction involves only one parent and no fusion of gametes which leads to identically identical offspring.

Food technology:
Calcium and vitamin D are taken in through the food that we eat.

Geography:
Populations vary based on genetic variability – global diversity.

PE:
Red blood cells are required to move oxygen round the body which is needed for respiration which releases energy.
Heart rate increases during exercise.
Joints are used to move our skeleton, understanding the human body allows us to stay fit and do sport.

PSCHE:
Healthy diet is required to keep a healthy body – including maintaining a healthy weight and reducing the risk of cardiovascular disease.
Puberty, healthy relationships, healthy pregnancy, safe and consensual sex.

History:
Over time, survival of mothers and babies during pregnancy and early life has improved to advances in health care and understanding of human biology.

Organisms Target Sheet:

Cells:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

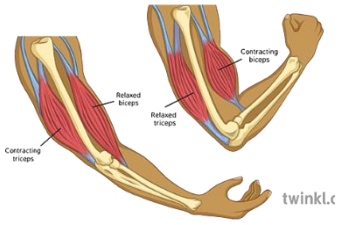
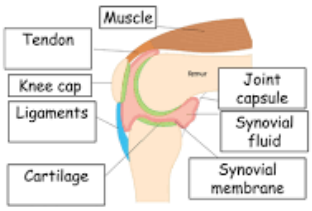
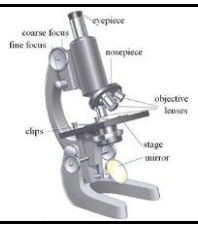
Key Knowledge	Confidence before topic - RAG	Confidence after topic - RAG
Cells are microscopic and living things are made of billions of them working together.		
An organism is a living thing.		
Cell → tissue → organ → organ system → organism		
Both animal and plant cells contain: cell membrane, cytoplasm, nucleus and mitochondria.		
Only plant cells contain: cell wall, vacuole and chloroplasts.		
The nucleus contains DNA.		
The cell membrane controls what moves in and out of a cell.		
The cytoplasm is the site of chemical reactions in the cell.		
The mitochondria is the site of aerobic respiration which releases energy.		
The cell wall strengthens the cell and supports the plant.		
The vacuole contains cell sap.		
The chloroplasts absorb light and are the site of photosynthesis.		
Specialised cells have a specific role to perform. Specialised cells have special features that allow them to perform their job.		
Microscopes are used to see objects that are too small to be seen by the naked eye.		
The parts of a microscope are: eyepiece, objective lenses, stage, stage clips, arm, mirror, light source, fine focus and course focus.		
The skeleton has four main functions: To support the body To protect some of the vital organs in the body To help the body move To make blood cells.		
Joints link bones together. Cartilage covers the end of bones in a joint. Ligaments join two bones in a joint.		
Antagonistic muscles are pairs of muscles when one of those muscles relaxes, the other contracts.		
Force = moment / perpendicular distance		
Different muscles have different strengths - arm muscles are stronger than the muscles in the skin. Strength of a muscle can be measured by how much force it exerts. The strength of muscles can be measured using a newton scale.		

Careers: Nutritionist, dietician, doctor, nurse, sports coach / scientist, blood scientist, counciler, therapist.



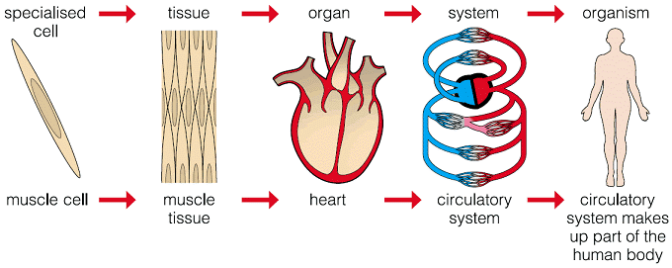


Knowledge Organiser:

Antagonistic muscle pair	Muscles working in opposite directions to create movement. When one contracts (gets shorter), the other relaxes. 
Backbone	The bone that protects the spinal cord.
Cartilage	Smooth tissue found at the end of bones, which reduces friction between them and stops them rubbing.
Cell	The basic unit of an organism, contains smaller parts called organelles to carry out life processes.
Cell membrane	Controls what moves in and out of the cell.
Cell wall	Strengthens plant cells and provides support.
Chloroplast	Absorb light energy so that plants can make food by photosynthesis.
Cytoplasm	Where the chemical reactions take place in the cell.
Joints	Places where bones meet. 
Ligaments	Connect bones in joints.
Microscope	Piece of equipment used to see objects that are too small to be seen by the naked eye. 
Mitochondria	The site of aerobic respiration which releases energy.
Nucleus	Contains genetic material (DNA) that controls the cell.
Organ	Group of different tissues working together to carry out a job.
Organ system	Group of organs with related functions working together to perform certain functions within the body.
Organelle	Specialised part of a cell which performs a specific function.
Organism	Any living thing.
Ribcage	The bones that protect the heart and lungs.
Skeleton	The support structure for an organism. In humans, this is bones inside the body.
Skull	The bone that protects the brain.
Tendons	Connect muscles to bones.
Tissue	Group of cells of one type.
Vacuole	Contains a watery fluid called sap. It keeps the cell firm.

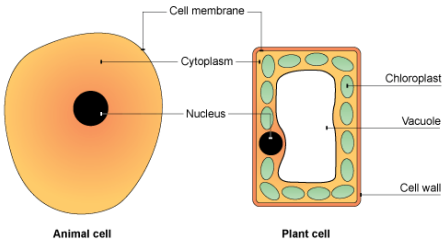
Organisation:

Cells are described as the building blocks of life. Cells can be organised to create multicellular organisms.



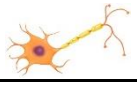
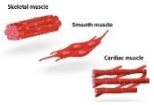
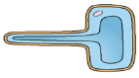
Cells:

Cells contain smaller parts (organelles) that have specific jobs.

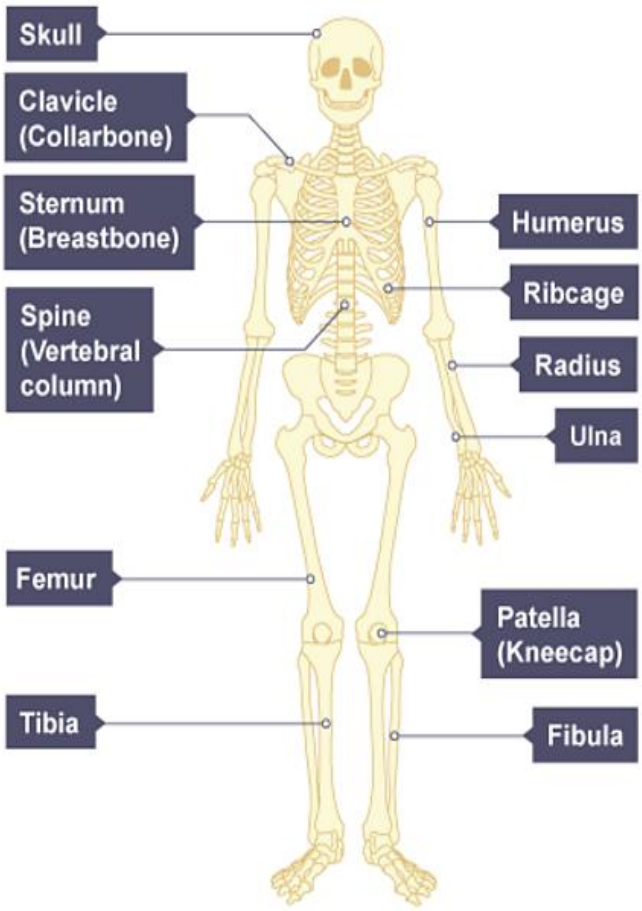


Organelle	**Function**
Nucleus	Contains genetic material that controls the cell.
Cell membrane	Controls what goes in and out.
Cytoplasm	Where the chemical reactions take place.
Mitochondria	The site of aerobic respiration which releases energy.
Cell wall	Strengthens plant cells and provides support.
Vacuole	Contains a watery fluid called sap. It keeps the cell firm.
Chloroplast	Absorb light energy so that plants can make food by photosynthesis.

Specialised cells have shape and structures that make them well suited (adapted) to doing their job.

Name of cell	Diagram of cell	Function of cell
Nerve cell		Carries electrical impulses around the body.
Red blood cell		Carries oxygen round the body. This cell contains no nucleus.
Sperm cell		Carries fathers DNA to the egg cell in a woman for fertilisation.
Muscle cell		Held together in bundles which pull together to make muscles contract.
Root hair cell		Absorbs minerals and water into the roots of a plant. Has a large surface area.
Palisade cell		To carry out photosynthesis in a plant cell.

Skeleton: The human skeleton is the bones in your body. The skeletal system is there for support, movement and making red blood cells.



Organisms Target Sheet:

Reproduction:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
The parts of the male reproductive system are: glands, sperm ducts, urethra, penis and testes.		
The parts of the female reproductive system are: oviducts, ovaries, uterus, cervix and vagina.		
Puberty is the time where the reproductive system matures.		
The time between puberty and adulthood is called adolescence.		
The menstrual cycle lasts about 28 days.		
Changes in puberty happen because of the production of sex hormones.		
Fertilisation is the fusing of the nucleus of a sperm cell with the nucleus of an egg cell.		
Sexual reproduction produces offspring that are unique because they get half of their genes from each parent.		
A fertilised egg divides to form a ball of cells called an embryo.		
It takes about 40 weeks for a baby to fully develop - this is called gestation.		
The placenta is an organ responsible for providing oxygen and nutrients to the foetus and removing waste substances.		
The placenta grows into the wall of the uterus and is joined to the foetus by the umbilical cord.		
The mother's lifestyle can affect the developing foetus. The chemicals in drugs, alcohol and cigarettes can be transferred to the baby through the umbilical cord and placenta.		

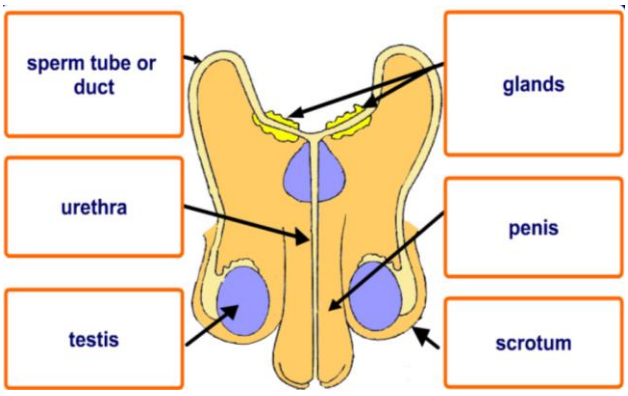
Careers: Midwives, fertility nurses, conservation zoologists, fertility counsellors, animal breeders.



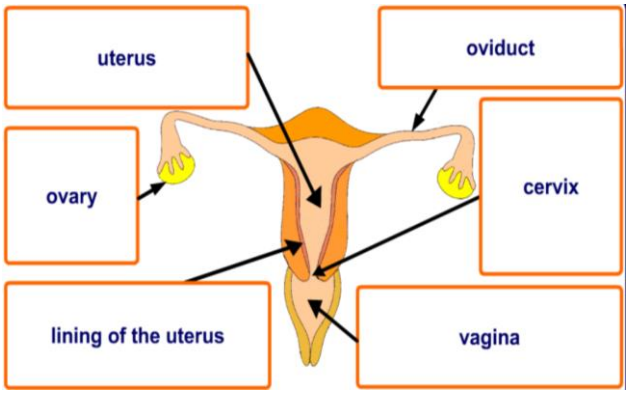

Knowledge Organiser:

Abstinence	Not partaking in any sexual activity.
Consent	Permission for something to happen or an agreement to do something.
Contraception	A method of preventing unwanted pregnancy during sexual intercourse.
Egg	Female reproductive cell produced in the ovaries
Embryo	A developing baby in the early stages (usually before three months)
Fertilisation	When the nucleus of the egg and sperm cell join together, creating one cell.
Foetus	An unborn baby that has developed from an embryo.
Gametes	Sex cells – in humans these are the egg and sperm cells
Gestation	The time during which a fertilized egg develops into a baby ready to be born.
Hormone	Chemical messanger in the body that stimulates a response
IVF	In vitro fertilization – the egg cell is fertilized outside of the body.
Menstrual cycle	Recurring series of events that happen in the female reproductive system about every 28 days.
Ovulation	The release of an egg from the ovary
Penis	The male reproductive organ
Placenta	Organ responsible for providing oxygen and nutrients and removing waste substances between mother and foetus.
Pregnancy	The period of time where a women is carrying a developing fetus
Puberty	A period of time where adolescents bodies are becoming capable of reproduction.
Sperm	Male reproductive cell produced in the testes
Vagina	The female reproductive organ

Male Reproductive System:



Female Reproductive System:

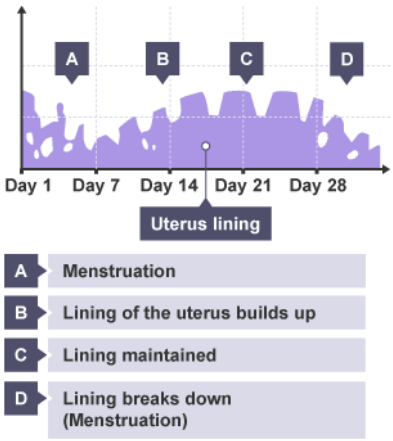


Puberty:

Puberty usually occurs during teenage years and is your body preparing for sexual maturity. Both boys and girls bodies will change during puberty. There is no set time or pattern in which these changes happen. Typically girls will reach puberty before boys.

Menstrual Cycle:

The female reproductive system includes a cycle of events called the menstrual cycle. It lasts about 28 days, but it can be slightly less or more than this. The cycle stops while a woman is pregnant.



Day 1 - Bleeding from the vagina begins because the uterus lining is breaking down.

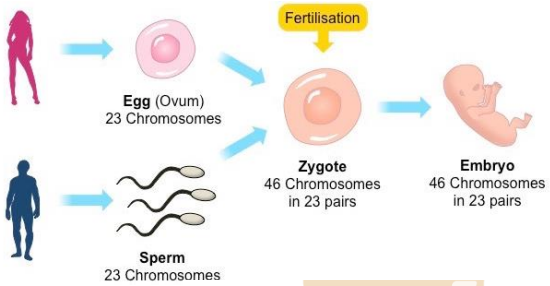
Day 5 - Bleeding stops. Egg starts to mature in an ovary.

Day 14 – Mature egg is released from the ovary – ovulation.

Day 28 – If the egg is not fertilised, the cycle starts again.

Fertilisation:

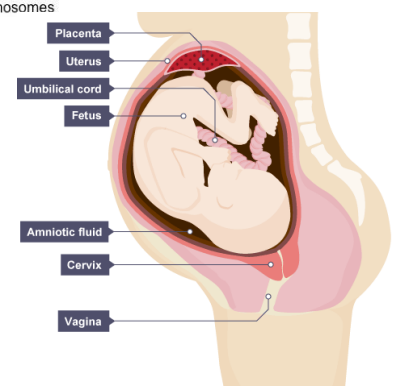
Fertilisation is when the egg cell nucleus and the sperm cell nucleus combine, this happens inside the woman's oviduct. The fertilised egg cell implants into the woman's uterus lining and the cell begins dividing. The tiny ball of dividing cells is called an embryo . After the implantation of an embryo the woman is said to be pregnant.

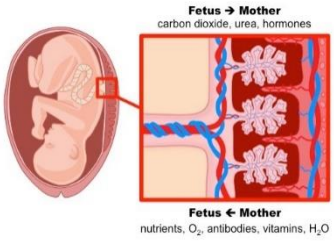


Pregnancy:

Pregnancy in humans is approximately 39 weeks. During this time the baby will develop inside the mother. The foetus relies on its mother as it develops. The foetus needs:

- Protection against knocks, bumps and temperature changes.
- Oxygen for respiration.
- Nutrients (food and water).
- The removal of waste substances.





The placenta is an organ that allows useful substances to pass from mother to baby and waste substances to pass from baby to mother.

Pregnancy and Lifestyle:

A mothers lifestyle during pregnancy can affect the a baby.
Pregnant women need to:

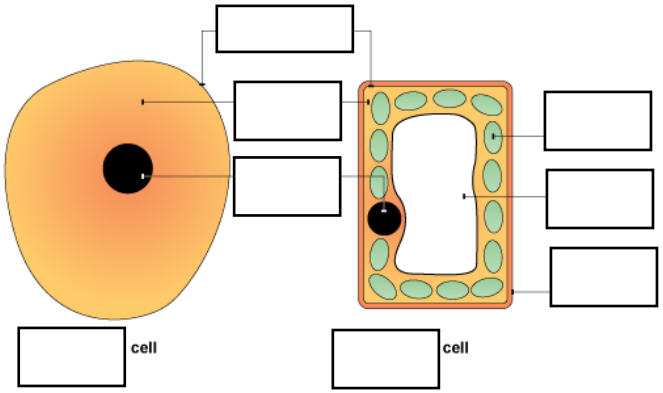
- Not drink alcohol or take drugs.
- Maintain a healthy balanced diet
- Exercise regularly.

Consent:

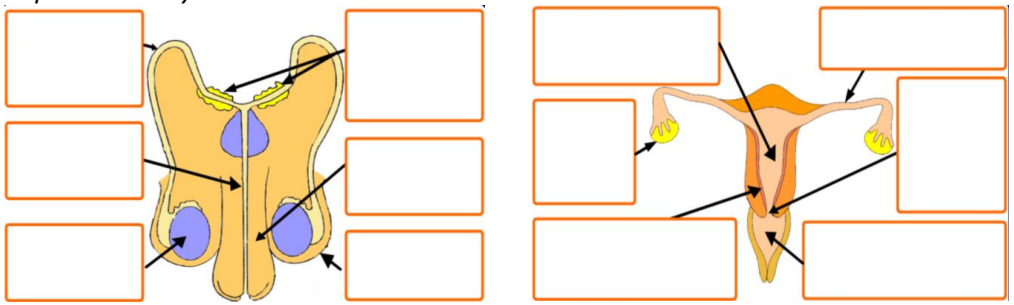
The age of consent to any form of sexual activity is 16 for both men and women. The age of consent is the same regardless of the gender or sexual orientation of a person and whether the sexual activity is between people of the same or different gender.

Organisms Revision:

Cell Structure:



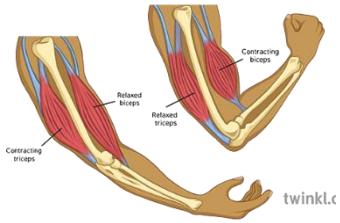
Reproductive System:



Specilaised Cells:

Reproduction:

Movement:



Pregnancy:

Energy – Part 1 Learning Journey:

Big Picture: Energy is a quantity described as being in stores that can be transferred between stores. What does the big bang have to do with energy stores and efficiency?

Biology:
- Food is a chemical energy store, humans transfer this energy by eating food.
- Energy consumed in our food is measured in joules or calories.
- Animals have adaptations that allow them to navigate using magnetic fields around the Earth.

Chemistry:
- Exothermic reaction – energy is transferred to the environment.
- Endothermic reactions – energy is transferred from the surroundings.
- Materials are chosen based on their characteristics – magnetic materials can be used for scrap yards, fridges and many others.

Physics:
- Forces cause and object to move, change direction or speed – the amount of force will relate to the amount of energy.
- Power relates to the energy and force.

	KS2	Year 7	Year 8	Year 9	GCSE
Energy		• There are eight different forms of energy stores, these are: • Kinetic, internal (thermal), elastic potential, gravitational potential, electrostatic, magnetic, nuclear, chemical. • The law of the conservation of energy states that energy can't be created or destroyed only transferred from one form to another. • Efficiency is how good a device is at transferring energy input into useful energy output. • Efficiency = $\frac{Useful\ energy\ output}{Total\ energy\ input}\ x\ 100\ \%$ • Dissipation refers to energy that is transferred and wasted. • Simple machines give a bigger force but with a smaller movement.		• Energy can be transferred through four transfer pathways: mechanical, electrical, radiation and heating. • Internal energy is stored within materials.	• A system is an object or group of objects. There are changes in the way energy is stored when a system changes. • Kinetic energy = 0.5 × mass × speed^2 • Elastic potential energy = 0.5 × spring constant × extension^2 • Gravitational potential energy . = mass × gravitational field strength × height • Change in thermal energy = mass × specific heat capacity × temperature change • The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.
Magnetism	• Magnets have two poles, they either attract or repel. • Like poles will repel. Opposite poles will attract.	• When two like poles are put together then repel. When two opposite poles are put together they attract. • The region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel) is called the magnetic field. • Compasses are used for navigation. • Electromagnets are made from a coil, core and current. • An electromagnet is created when an electric current flows in a wire creating a magnetic field around the wire. • An electromagnet can be made stronger by: increasing the number of coils, increasing the size of the core or changing the material, increasing the current through the coil.		•	• A permanent magnet produces its own magnetic field. An induced magnet is a material that becomes a magnet when it is placed in a magnetic field. Induced magnetism always causes a force of attraction. When removed from the magnetic field an induced magnet loses most/all of its magnetism quickly. • The direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point. The direction of a magnetic field line is from the north (seeking) pole of a magnet to the south(seeking) pole of the magnet. • When a current flows through a conducting wire a magnetic field is produced around the wire. The strength of the magnetic field depends on the current through the wire and the distance from the wire.

Maths: Efficiency and percentage calculations.

Design Technology: Magnets are used in some tools, such as screwdrivers, to help hold things in place.

Food Technology: Energy stored in foods is related to the amount of chemical energy stored.

Geography:
- Renewable and non-renewable energy resources.
- Compasses are used to navigate using North, South, East and West.

PSCHE: Electromagnets are used in modes of transport, including the movement of trains on the London underground.

Careers: Thermal insulation engineers, solar panel installers, sales managers and mechanics, data analysts.




Energy and Magnetism Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Energy is measured in Joules (J).		
There are eight different forms of energy stores, these are: Kinetic, internal (thermal), elastic potential, gravitational potential, electrostatic, magnetic, nuclear, chemical.		
The law of the conservation of energy states that energy can't be created or destroyed only transferred from one form to another.		
The total energy of a system stays the same.		
Efficiency is how good a device is at transferring energy input into useful energy output.		
$Efficiency = \frac{useful\ energy\ output}{total\ energy\ input}\ x\ 100$		
Levers, pulleys and gears reduce the amount of force needed to do work, therefore they increase efficiency.		
A bar magnet has two poles - north and south. Like poles repel and dislike poles attract.		
A magnet makes a magnetic field around it. You cannot see this field, but its effects can be observed.		
Three types of metal are magnetic: cobalt, iron and nickel.		
The Earth behaves like a giant magnet. The Earth produces a magnetic field in which the field lines are most concentrate at the poles. Compasses rely on this magnetic field to work.		

Knowledge Organiser:

Attract	When magnets pull each other closer
Component	The objects that a circuit provides energy too.
Conservation of energy	The idea that energy cannot be created or destroyed, it can only be transferred from one store to another.
Efficiency	The proportion of useful energy out of a process compared to total energy put in.
Energy Store	Somewhere energy is stored until it is transferred into a different store.
Joules	The unit used to measure energy.
Kinetic	The energy store of a moving object.
Magnet	An object that permanently creates a magnetic field
Magnetic field	The area within which a magnetic object can imparts a magnetic force.
Potential energy	An energy store that is in object because of its position or state.
Repel	When magnets push each other apart

Stores of energy

Energy can be stored in different ways. Energy is then moved from one store to another. There is considered to be 8 different ways of storing energy.

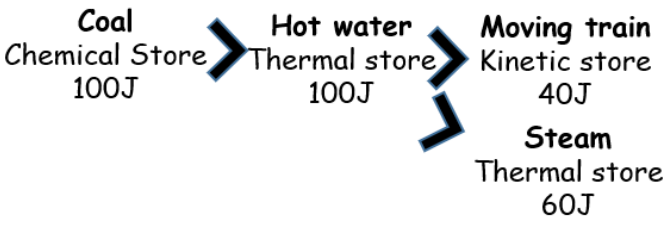
kinetic	Moving objects have kinetic energy.
thermal	All objects have thermal energy.
chemical	Anything that can release energy during a chemical reaction.
elastic potential	Things that are stretched.
gravitational potential	Anything that is raised.
electrostatic	Charges that attract or repel.
magnetic	Magnets that attract or repel.
nuclear	The nucleus of an atom releases energy.

Conservation of energy

Energy is measured in Joules (J). It can never be created or destroyed. It can only be transferred from one store to another. So, if a process starts off with 100J, then after the end of the process all 100J will be present somewhere.

Efficiency:

When energy is transferred, some energy is wasted. The less energy that is wasted during the transfer, the more efficient the transfer is.



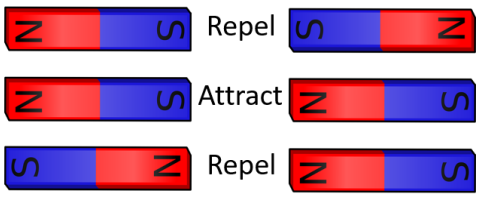
In the example above the kinetic store is useful, the thermal store is wasted.

We can use this equation to calculate the efficiency of this process.

$$\text{Efficiency} = \frac{\text{Useful Energy Output}}{\text{Energy Input}} \times 100\%$$

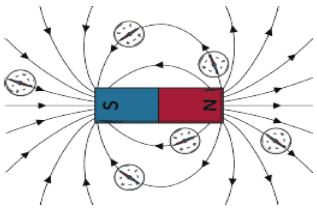
Magnetism:

- Magnetism is a non-contact force.
- Magnetic materials can be magnetised or attracted to a magnet.
- There are three metals that can be used to make magnets or are attracted to magnets; Cobalt, Iron (found in steel) and Nickel.
- A bar magnet is a permanent magnet, it has a north pole and a south pole.

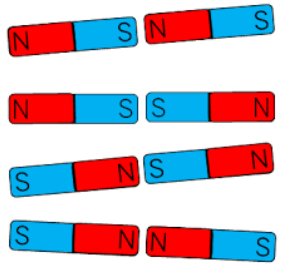


Magnetic fields

- All the Earth's magnetic field so we can see which direction the north pole is. In the image, compasses are aligning with the field from a permanent magnet.
-
- A compass uses the Earth's magnetic field to point North.



Energy and Magnetism Revision:

Energy Stores:	*Bar Magnets:* 
Conservation of Energy:	*Magnetic Fields:*
Efficiency:	*Compasses:*

Matter Learning Journey:

Big Picture: There are 118 known elements, what happens when these elements are chemically or physically changed?

Periodic Table, Atomic Structure and Bonding Learning Journey:

Chemistry:
Atoms make up everything, the atomic structure will determine their reactivity.

Physics:
- Atoms make up everything, their arrangement leads to the properties of materials.
- Electrons are free to move in metals which allows them to conduct electricity.
- Electrostatic forces hold ions together in some compounds.

	Year 7	Year 8	Year 9	GCSE
Periodic table	• The Periodic Table shows all 120 known elements. • Elements in the periodic table are shown with their name and chemical symbol. • Metals are found on the left side of the periodic table, non-metals are found on the right of the periodic table. • Group 1 - alkali metals, Group 7 - halogens, Group 0 - noble gases. • Naming compounds: metal first, non-metal second - non-metal on it's own the end of the word changes to -ide, the non-metal and an oxygen the end of the word changes to -ate. • Metals are found on the left and towards the bottom of the periodic table, non metals are found towards the right and top of the periodic table.	• Elements in group 0 are known as noble gases and are very unreactive. • Elements in group 1 are known as the alkali metals, they are highly reactive. Their reactivity increases as you go down the group. • Elements in group 7 are known as the halogens, they are reactive. Their reactivity decreases as you go down the group. • A more reactive halogen will displace a less reactive halogen from a solution of its salt.	• The modern Periodic Table was devised by Mendeleev who used atoms atomic number and their properties to arrange them into groups and periods. • The atomic number on the periodic table shows the number of protons and electrons. • The number of neutrons = atomic mass - atomic number	• Elements in the same group in the periodic table have the same number of electrons in their outer shell (outer electrons) and this gives them similar chemical properties. • Group 0 are unreactive because their atoms have stable arrangements of electrons - they have a full outer shell. The boiling points of noble gases increase with increasing relative atomic mass. • Group 1 elements re very reactive because they have a single electron on their outer shell. • Group 7 elements are reactive because they have 7 electrons in their outer shell. • Group 7 elements are non-metals and consist of molecules made of pairs of atoms. • As you go down group 7, the melting and boiling points increase.
Atomic structure	• All things are made of atoms. • Atoms are made of protons, electrons and neutrons. • Protons and neutrons are found in the nucleus of an atom. • Electrons are found on shells round the outside of the nucleus. • Protons have a + 1 charge. • Electrons have a -1 charge. • Neutrons have no charge.	• All substances are made of atoms, an atom is the smallest part of an element that can exist. • Conservation of mass states that no atoms are created or destroyed so the same number of atoms are in the reactants and products.	• Atoms are made of protons (+1), electrons (-1) and neutrons (0). • The number of protons and electrons are equal in an atom.	• Evidence of the structure of the atom, meant that theories have changed over time, from the sphere to plum pudding to the nuclear model. • The relative mass of an atom is the mass of the protons + mass of the neutrons. • An isotope is the same element with a different number of neutrons. • Electrons occupy energy levels (shells), and their arrangement can be represented by numbers, for example NA = 2, 8, 1. • There are three types of strong chemical bonds: ionic, covalent and metallic. For ionic bonding the particles are oppositely charged ions. • Some atomic nuclei are unstable. The nucleus gives out radiation as it changes to become more stable. This is a random process called radioactive decay.

Design Technology:
Materials are chosen based on their properties, the arrangement of elements on the periodic table is based on elemental characteristics.

History:
Evidence over time, causes the changes in theories.

States of Matter Learning Journey:

Chemistry:
Physical changes occur when no new substances are made.

Biology:
Substances move based on their chemical properties – gas exchange happens in the alveoli.

Physics:
Energy changes lead to the change in state.

KS2	Year 7	Year 8	Year 9	GCSE
• Solids hold their shape, liquids form a pool, gases escape from an unsealed container. • When objects are heated or cooled they change state. • When ice is heated it melts, turning into water, when water is heated it evaporates and turns into a gas. • Solids have a fixed shape and volume. Solids can't be compressed, solids can't flow. • Liquids take the shape of the bottom of their container, can't be compressed, liquids flow. • Gases have no fixed volume, they take up the space in the container. • Gases can be compressed. • Evaporation is the process of a liquid turns into a gas. • Melting is the process of a solid turning into a gas. • Freezing is the process of a liquid turning into a solid. • Condensation is the process of a gas turning into a liquid.	• Solids have particles that are very close together and are held in place by strong forces of attraction. • Solid particles are able to vibrate but do not move, have a regular arrangement and small amounts of energy. • Liquid particles are close together and touching, however they are in a random arrangement. • Liquid particles are able to move over each other, have an irregular arrangement and have more energy than solid particles. • Gas particles have large amounts of kinetic energy so move quickly in the area they are in. • Gas particles are free to move and have no fixed arrangement. • Sublimation is the process of a solid turning into a gas. • Changes of state occur when the amount of energy particles have change. • For condensation and freezing to occur the particles need to reduce the amount of energy that they have, this reduces the movement of the particles and the intermolecular forces reform. • Diffusion is the movement of particles from an area of high concentration to low concentration. • A heating curve show the energy changes that happen when a substance changes state. • A cooling curve shows the energy changes that happen when a substance changes state.	• Taught in physics: Density is the amount of particles within a unit volume. • Solids are denser than liquids, liquids are denser than gases. • Sound travels fast through solids as they are more dense because the particles are closer together.	• Intermolecular forces are found between particles in solids and liquids, changes of state occur when these forces are formed or broken depending on the kinetic energy of the particles. • Density is the amount of matter per unit volume. Solids are more dense than gases. • Water is an anomaly as solid water (ice) is less dense than liquid water therefore ice floats on water.	• Density = mass ÷ volume • Changes of state are physical changes which differ from chemical changes because the material recovers its original properties if the change is reversed. • Energy is stored inside a system by the particles (atoms and molecules) that make up the system. This is called internal energy. • The specific latent heat of a substance is the amount of energy required to change the state of one kilogram of the substance with no change in temperature. energy f or a change o f state = mass × specific latent heat. • The molecules of a gas are in constant random motion. The temperature of the gas is related to the average kinetic energy of the molecules. • Changing the temperature of a gas, held at constant volume, changes the pressure exerted by the gas.

Design Technology:
Materials are chosen based on their properties, the density and state of matter of a substance will impact what it can be used for.

Food Technology:
Heating and cooling are used during cooking – ensuring that energy is transferred between changes of state.

Maths:
Plotting graphs.

Geography:
The water cycle is explained using changes of state.

Compounds and Mixtures Learning Journey:

Chemistry:
Periodic table allows atomic structure to be determined, therefore how reactive the elements are.

Biology:
Chemical formulations are used to make medicines.

Physics:
Atomic structure, electrostatic forces between ions hold compounds together.

Year 6	Year 7	Year 8	Year 9	GCSE
• Some materials will dissolve in liquid to form a solution. • Dissolved substances can be recovered using evaporation. • Sieving separates solids of different sizes. • Evaporating separates a soluble (dissolved) solid from a liquid. • A mixture of soluble and insoluble materials can be separated by using filtration. • Evaporation works as a separation method as the liquid part (solvent) will evaporate leaving behind the dissolved solid part (solute). • Insoluble means that a substance will not dissolve in a solvent. • Soluble means that a substance can dissolve in a solvent.	• An element is a substance made of one type of atom. • A compound is a substance made of two or more types of atom that are chemically joined together. • A mixture is a substance made of two or more types of atom or compound that are not chemically joined together. • A molecule is two or more atoms that are chemically joined together. • A pure substance only contains one type of element or compound. • Solute is the substance that dissolves to make a solution. • Solvent is the substance that does the dissolving – it dissolves the solute. • Solution the mixture of a solute and solvent. • Dissolving is when particles of solvent collide with particles of solute. • They surround the particles of solute, gradually moving them away until the particles are evenly spread through the solvent. • Crystallisation is used to produce solid crystals from a solution. Filtration is used to separate an insoluble solid from a solvent. • Chromatography is a separating technique used to separate mixtures of soluble substances. These are often coloured substances such as food colourings, inks, dyes or plant pigments. • Distillation is a separating technique used to separate two or more liquids with different boiling points.	• Balanced equations show the number of atoms in the reactants and the products. • The number of atoms in the reactants is equal to the number of atoms in the products. • When balancing equations, only the big number at the front of a compound can be changed. The small numbers show the number of each type of atom in a compound. • Iron is an element, sulfur is an element, iron sulfide is a compound. Elements and compounds have got different properties.		• Compounds are formed from elements by chemical reactions. • Compounds contain two or more elements chemical combined in fixed proportions and can be represented by formulae using chemical symbols. • Compounds can only be separated into elements in chemical reactions. • A mixture consists of two or more elements or compounds not chemically combined together. The chemical properties of each substance in the mixture are unchanged. • Mixtures can be separated by physical processes such as filtration, crystallisation, simple distillation, fractional distillation and chromatography. • Pure elements and compounds melt and boil at specific temperatures. • Melting point and boiling point data can be used to distinguish pure substances from mixtures. • A formulation is a mixture that has been designed as a useful product. • Formulations are made by mixing the components in carefully measured quantities to ensure that the product has the required properties.

Food Technology:
- Salt and sugar are examples of soluble compounds and dissolve.
- Flour is insoluble and will not dissolve.
- Chromatography can be used to see the components of food dyes.

Maths:
Balancing equations.

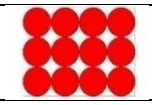
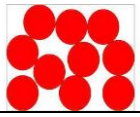
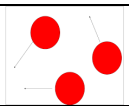
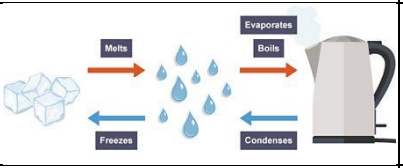
Careers: medical scientist, weather forecaster, analytical chemist, food technologist, nantechnologist, forensic technician, perfume chemist.



Matter Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Solids have particles that are very close together and are held in place by strong forces. Solid particles are able to vibrate but do not move. Solids can't be compressed. Solids do not flow.		
Particle model for a solid: 		
Liquid particles are close together and touching, however they are in a random arrangement. Liquid particles are able to move over each other, so liquids flow. Liquids have a fixed volume, but not a fixed shape. Liquids can't be compressed.		
Particle model for a liquid: 		
Gas particles are free to move and have no fixed arrangement. Gases are able to take the shape of their container. Gases can be compressed.		
Particle model for a gas: 		
Changes of state happen when energy is added or removed from the particles. 		
A cooling curve can be used to determine the temperatures at which changes of state occur. A cooling curve is produced by measuring the temperature of a substance as it cools and then plotting a graph of temperature against the amount of energy transferred.		
A heating curve can be produced by heating a substance at a constant rate and measuring its temperature.		
The Periodic Table is made of all of the known elements arranged in groups and periods based on their properties.		
Atoms are made of a nucleus containing protons and neutrons, and electrons that move round the outside of the nucleus in shells.		
Electrons have a negative charge.		
A compound is two or more types of atom chemically joined together.		

A mixture is two or more atoms/molecules that are not chemically joined together.		
A molecule is two or more atoms chemically joined together.		
A pure substance only contains one type of element or compound.		
Chemical formula use the symbols from the periodic table to tell you how many of what type of atom make a compound.		
The number in a chemical formula identifies the number of atoms of each type of element.		
Some elements naturally occur as diatomic molecules such as oxygen, nitrogen and chlorine.		
An element (usually metal) and another element in a compound, the second element has the ending –ide for example - NaCl sodium chlor**ide**.		
An element (usually metal) and another element + oxygen in a compound, the second element has the ending –ate for example – $NaSO_4$ sodium sulphate.		
Properties of metals include: shiny, solid at room temperature, high density, strong, malleable, good conductors of heat and electricity, sonorous.		
Properties of non-metals include: dull, solids and gases at room temperature, low density, weak, brittle, poor conductors of heat and electricity (they are insulators).		
Diffusion is the movement of particles from an area of high concentration to low concentration.		
Filtering is a separating technique used to separate a solution and an insoluble solid.		
Sieving is a separating technique that is used to separate different size solids.		
Distillation is a separating technique used to separate liquids with different melting points.		
Chromatography is a separating technique used to separate soluble inks and dyes.		

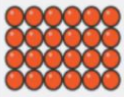
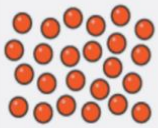
Knowledge Organiser:

Aqueous	A solution formed from a liquid and dissolved solid (solute and solvent).
Atom	The smallest particle of an element that can exist.
Boiling point	The temperature at which a liquid turns into a gas.
Brittle	A substance will break if it bent.
Chemical Formula	Shows the elements present in a compound and their relative proportions.
Chromatogram	The result of chromatography showing the result of separating soluble substances. This can be seen on chromatography paper.
Chromatography	A separating technique used to separate mixtures of soluble substances.
Compound	Pure substances made up of two or more elements strongly joined together.
Compressed	When particles are pushed closer together.
Concentration	The amount of solute that is dissolved in a solvent (the amount of solid dissolved in a liquid).
Condensation	The process of a gas turning into a liquid.
Condenser	A piece of equipment that is used to cool a gas down so that it condenses into a liquid.
Conductor	A substance that will allow heat or electricity to pass through it.

Crystallisation	Separating technique used to produce solid crystals from a solution.
Density	The amount of matter within a certain volume.
Diffusion	The process by which particles in liquids or gases spread out through random movement from a region where there are many particles to one where there are fewer.
Dissolving	Particles of solvent collide with particles of solute. They surround the particles of solute, gradually moving them away until the particles are evenly spread through the solvent.
Distillation	Separating substances by boiling and condensing liquids
Ductile	A substance can be pulled into a thin wire.
Element	What all substances are made up of, and which contain only one type of atom.
Evaporating	The process of a liquid turning into a gas
Filtration	Separating technique used to separate an insoluble solid from a solvent.
Group	The vertical columns in the periodic table.
Insoluble	Substance will not dissolve in the solvent.
Insulator	A substance that does not allowed heat or electricity to pass through it.
Irreversible	Something that can not be changed back into its original form.
Malleable	A substance can be shaped / bent.
Melting point	The temperature at which a solid turns into a liquid.
Mixture	Two or more molecules or atoms not chemically joined together.
Mixture	Two or more molecules or atoms not chemically joined together.
Molecules	Two to thousands of atoms joined together. Most non-metals exist either as small or giant molecules.
Particle	Small piece of matter, this could be an atom, molecule, proton, electron or neutron.
Period	The horizontal rows in the periodic table.
Periodic table	A table arranged by increasing atomic number that contains all known elements.
Products	The things that are made during a chemical reaction. (e.g. the cake)
Pure substance	Only contains one type of element or compound
Reactants	The things put in to a chemical reaction. (e.g. the ingredients)
Reversible	Something that can be changed back into its original form.
Soluble	Substance will dissolve in the solvent.
Solute	A substance that can dissolve in a liquid to form a solution
Solution	The mixture of a solute and solvent
Solvent	A substance, normally a liquid, that dissolves another substance
Sonorous	When hit will produce a deep, ringing sound.
State of matter	Collective term used to describe whether something is a solid, liquid or gas.
Subliming	Change from a solid to a gas.
Surface area	The total area on the surface of a 3D object.

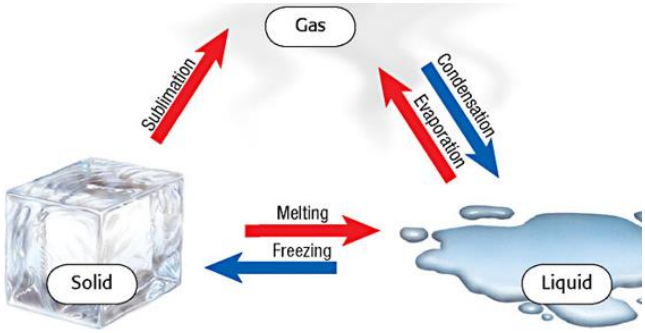
States of Matter:

- Materials are made up of tiny particles.
- There are three states of matter- solid, liquid and gas.

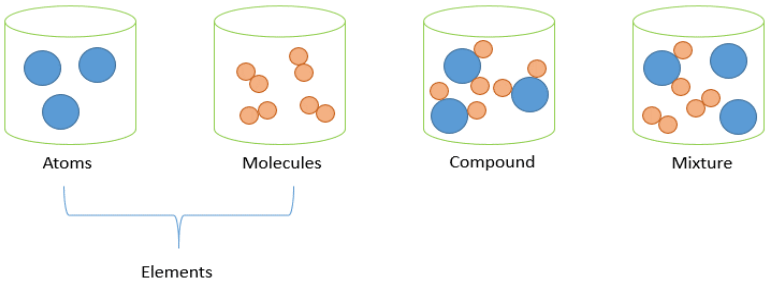
State	Solid	Liquid	Gas
Diagram			
Arrangement of particles	Regular arrangement	Randomly arranged	Randomly arranged
Movement of particles	Vibrate about a fixed position	Move around each other	Move quickly in all directions
Closeness of particles	Very close	Close	Far apart

Changes of State:

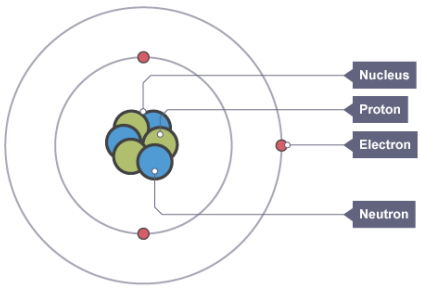
- For melting, boiling and sublimation to occur that particles need to gain energy. This gain in energy will cause the forces between molecules to break and particles to move more.
- For condensation and freezing to occur the particles need to reduce the amount of energy that they have, this reduces the movement of the particles.



Atoms, elements, compounds and mixtures:



Atomic Structure:



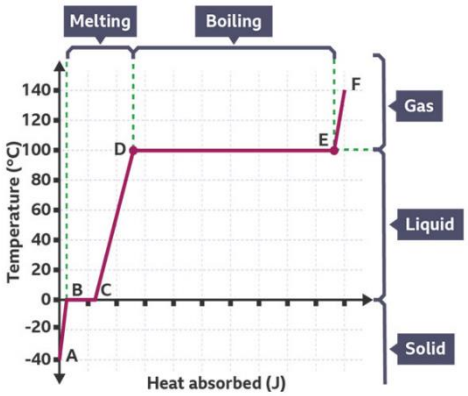
Each particle has its own charge and its own mass.

	Relative electric charge	Relative mass
Proton	+1	1
Neutron	0 (neutral)	1
Electron	-1	1/1840

Heating Curves:

A heating curve can be produced by heating a substance at a constant rate and measuring its temperature.

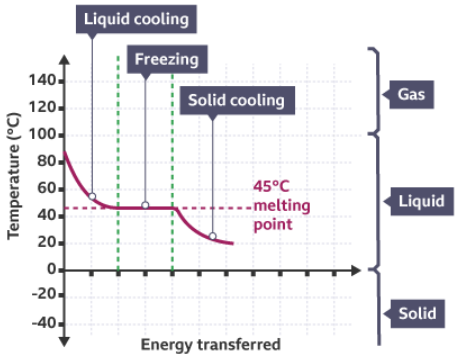
The diagram shows a heating curve for water.



Cooling Curves:

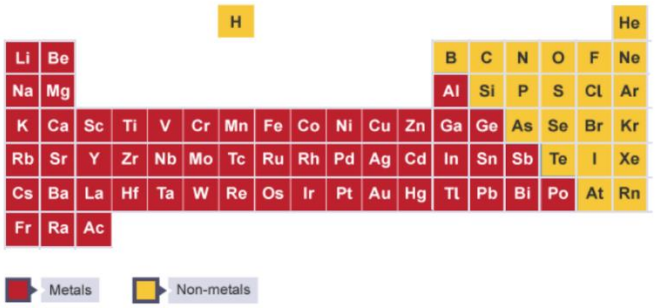
A cooling curve can be used to determine the temperature at which changes of state occur.

A cooling curve is produced by measuring the temperature of a substance as it cools and then plotting a graph of temperature against the amount of energy transferred.



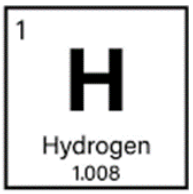
Periodic Table:

The periodic table shows every element that has been discovered. Periods go across and groups go down.

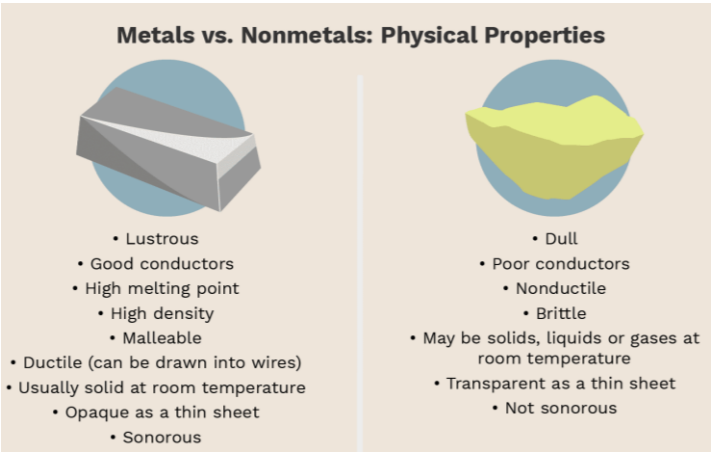


Chemical Symbols and Formula:

All **materials** are made up of one or more **elements**.
Every element has its own chemical **symbol**.



Metals and Non-metals:



Naming simple compounds

What is the name of each compound formed by these metal and non-metal elements?

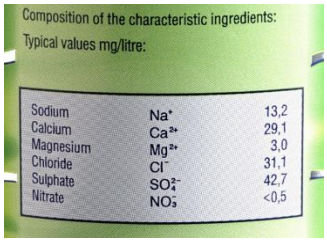
element 1	element 2	compound
iron (Fe)	sulfur (S)	iron sulfide (FeS)
magnesium (Mg)	nitrogen (N)	magnesium nitride (Mg_3N_2)
sodium (Na)	chlorine (Cl)	sodium chloride (NaCl)
tin (Sn)	oxygen (O)	tin oxide (SnO)
aluminium (Al)	bromine (Br)	aluminium bromide ($AlBr_3$)
nickel (Ni)	iodine (I)	nickel iodide (NiI_2)
zinc (Zn)	sulfur (S)	zinc sulfide (ZnS)
lithium (Li)	nitrogen (N)	lithium nitride (Li_3N)

Physical and Chemical Changes:

- Physical changes have a change of state and are reversible.
- Chemical changes make new substances and are often non-renewable.

Pure Substances:

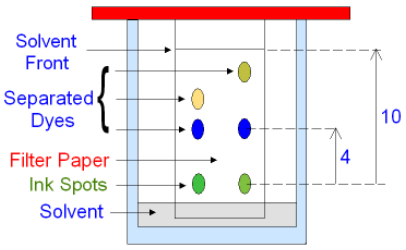
- The chemistry definition of a pure substance is that is contains only one element or compound.
- Mineral water is mostly water but it contains other substances mixed in with it, therefore it is not a pure substance.
- Impurities in a substance will affect its properties, for example it may change a substances boiling point.

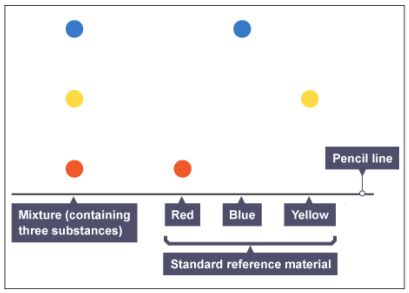


Diffusion is the movement of particles from an area of high concentration to an area of low concentration.

Chromatography:

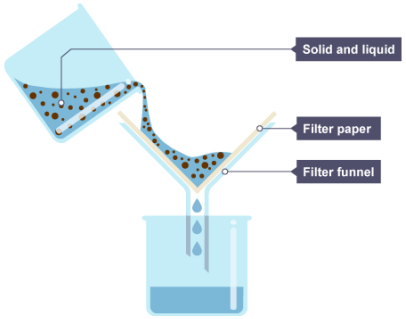
- Chromatography is a separating technique used to separate mixtures of soluble substances. These are often coloured substances such as food colourings, inks, dyes or plant pigments.
- The line on the chromatography paper must be drawn with a ruler and pencil.
- The start line must be above the solvent.





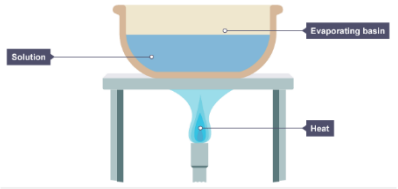
Filtration – separating substances using a filter to produce a filtrate (solution) and a residue.

- The mixture is poured into the funnel containing filter paper.
- The insoluble solid remains in the filter paper and the solvent passes through.
- Filter paper contains small holes that will let small particle through. A particle that is small enough to fit through the holes in the filter paper will pass through, those that are too large will be held by the filter paper.



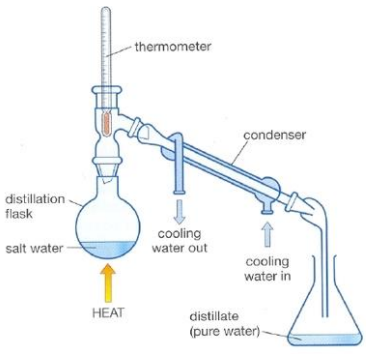
Crystalisation:

- Crystallisation is used to produce solid crystals from a solution.
- When the solution is warmed, some of the solvent evaporates leaving behind a more concentrated solution.
- The concentrated solution is left in an evaporating dish until the remainder of the solvent evaporates, leaving solid crystals.

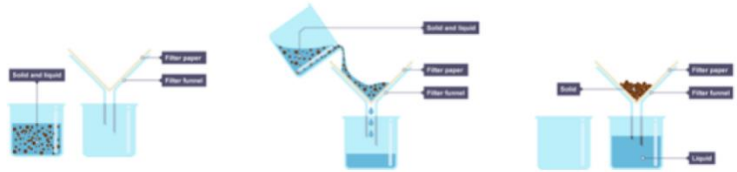
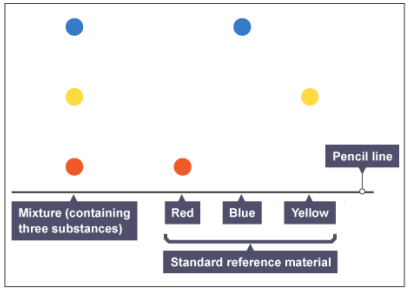
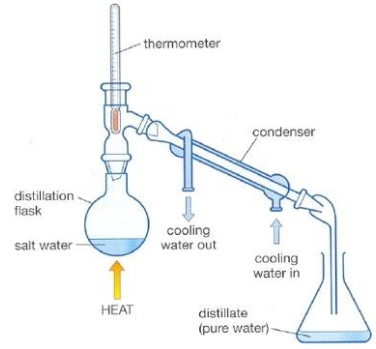


Distillation:

- Distillation is a separating technique that can be used to separate liquids with different boiling points.
- Distillation involves the processes of evaporation and condensation.



Matter Revision:

Periodic Table and Atomic Structure:	*Filtering and Crystallisation:* 
Chemical Formula and Names:	*Chromatography:* 
Elements, Compounds and Mixtures:	*Distillation:* 

Energy - Electricity Learning Journey:

Big Picture: How can electricity be used in everyday life, within circuits and in magnetism?

Biology:
- Nerve cells transmit electrical signals along the axon.
- Dangers of electrical circuits can impact human life.

Chemistry:
- Materials – metals are conductors of electricity, insulators do not conduct electricity.
- Atoms contain negatively charged electrons, these freely flow through a metal.

KS2	Year 7	Year 8	Year 9	GCSE
• Cells are made of components, they can be constructed using cells, wires, bulbs, switches and buzzers. • For a lamp to light the circuit needs to be complete. • If the switch in the circuit is open the circuit is incomplete, if the switch in a circuit is closed the circuit is complete. • Electrical insulators do not allow electricity to pass through them - these include wood, plastic, rubber. • Electrical conductors allow electricity to pass through them - these include metals. • Circuits are drawn using standard circuit symbols. • If the number of cells in a circuit are increased, the bubs become brighter or the buzzers are louder.	• Series circuits of made of one continuous loop. • Parallel circuits are made of multiples branches. • Current is the flow of charge round a circuit. • Current is measured using an ammeter, the units for current are amps (A). • Current in a series circuit is the same at all points. • Current in a parallel circuit is split between branches.		• When some objects are rubbed together, electrons can be transferred creating positively and negatively charged objects. • Electrostatic forces occur between these objects. • Electrostatic forces create an electric field, these forces are non-contact. • Potential difference is measured using a voltmeter in parallel, the units are volts. • Potential difference is equal across all components in a parallel circuit, the potential difference is split across components in a series circuit. • Resistance is measured in ohms. • Resistance = potential difference ÷ current	• Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. • Charge flow = current × time • The current through a component depends on both the resistance of the component and the potential difference across the component. • The greater the resistance of the component the smaller the current for a given potential difference across the component. • Potential difference = current × resistance • The current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor. This means that the resistance remains constant as the current changes. • Mains electricity is an ac supply. In the United Kingdom the domestic electricity supply has a frequency of 50 Hz and is about 230 V. • Most electrical appliances are connected to the mains using three core cable. • The insulation covering each wire is colour coded for easy identification: live wire – brown neutral wire – blue, earth wire – green and yellow stripes.

Maths:
Calculating the current in series and parallel circuits – numerical patterns.

Art:
Drawing accurate diagrams.

IT:
Complete and incomplete circuits, conductors and insulators – needed to ensure that computers are working.

Careers: Electric vehicle mechanic, electronic repair technician, health and safety consultant, commercial electrician, paramedic, electrical project managers.






Electricity and Electromagnets Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

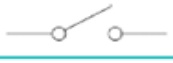
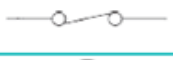
Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Circuits are drawn using straight lines and right-angled corners. The components are represented by circuit symbols.		
For components in a circuit to work, the circuit needs to be complete so the current can flow.		
A series circuit is one continuous loop and increasing the number of bulbs in a series circuit will cause the light bulbs to become dimmer.		
A parallel circuit is a circuit that contains branches and increasing the number of bulbs in parallel does not affect the brightness of a bulb.		
Current is a measure of how much electric charge flows through a circuit. The more charge that flows, the bigger the current.		
Current is measured in amps (A).		
Current is measured using an ammeter connected in a circuit in series.		
An electromagnet is created when an electric current flows in a wire creating a magnetic field around the wire. A simple electromagnet has a core, coil of wire and current.		
An electromagnet can be made stronger by: Increasing the number of coils. Increasing the size of the core or changing the material. Increasing the current through the coil.		

Knowledge Organiser

Amps	The unit used to measure the current.
Ammeter	The piece of equipment used to measure current in a circuit.
Cell	What provides push for the current in the circuit and energy to the components the circuit powers. Often referred to as a battery
Circuit	The loop of wires needed to allow electrical current to flow and the components that this flow provides energy to.
Component	The objects that a circuit provides energy too.
Current	The flow of charges around a circuit.
Electromagnet	A temporary magnet, powered by the flow of current. Turning off the flow will turn off the magnet.
Magnetic field	The area within which a magnetic object can imparts a magnetic force.
Parallel	A parallel circuit is a circuit with more than one route for charges around it.
Series	A series circuit is a circuit with only route for the current to flow

Electricity

Electricity is essential for modern life. Electricity must flow around a circuit. Circuits are made of conductors and form a loop that allows electrical current to flow around in one direction and form a complete circuit.

switch (open)	
switch (closed)	
bulb	
cell	
battery	
ammeter	
voltmeter	
resistor	
motor	

How to draw a circuit

Circuits are represented using circuit diagrams. When drawing a circuit its essential that; -

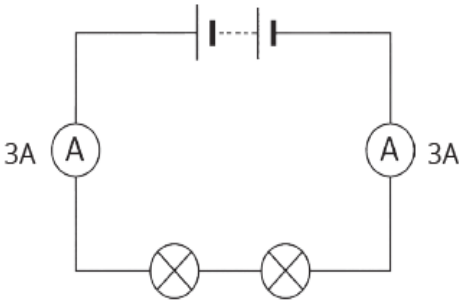
- symbols are used to represent the components
- straight lines are used for the wires
- right angles for the corners
- Components are placed in the middle of lines.

Current:

Current is the flow of charge in a circuit, measured by an ammeter (connected in series) and measured with the units amps (A).

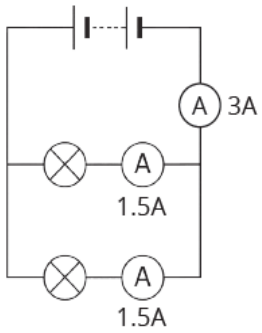
Series and Parallel Circuits:

In a **series circuit** the components are connected end to end in a loop. If one bulb breaks, none of the bulbs will be lit as the circuit is no longer complete.



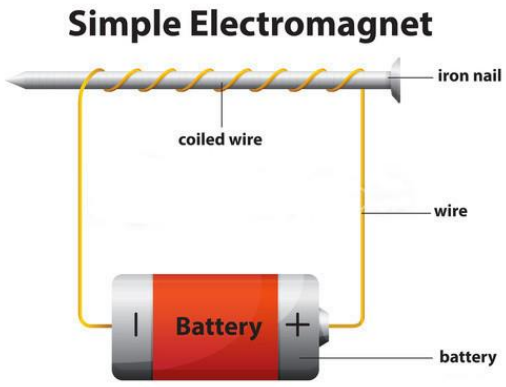
The current is the same everywhere in a series circuit as the current is not used up. The more cells are in the circuit the higher the current will be.

In a **parallel circuit**, the components are connected on separate branches. This gives the current several different paths to flow down. If one bulb stops working, the other bulbs will remain lit



The current is split between the branches in a parallel circuit.

Electromagnets



Current flowing through a wire produces a weak magnetic field. This can be made stronger by wrapping a wire around a magnetic metal core. These are called electromagnets and their main advantage over permanent magnets is that they can be turned on and off.

Electromagnets can be made more powerful by increasing the number of times the wire is wrapped around the core, or by increasing the current flow through the wire.

Electricity and Electromagnets Revision:

Circuits:	*Electromagnets:*
Series and Parallel:	*Investigating Electromagnets:*
Current:	

Forces Learning Journey:

Big Picture: A force is a push or a pull that acts on an object due to the interaction with another object. What happens to objects when a force is applied?

Chemistry:
Electrostatic forces hold oppositely charged ions together in a bond.

Biology:
Forces can impact the movement of an object – affecting how it behaves in an environment.

Physics:
Forces impact on the movement of objects, the energy within a system and the movement of electrons in circuits.

Year 6	Year 7	Year 8	Year 9	GCSE
• Objects fall to Earth because of gravity. • Levers, pulleys and gears allow a smaller force to have a greater effect. • Forces are measured using a newton meter. • The units for measuring a force are Newtons. • Contact forces occur when two surfaces are touching. • Examples of contact forces are: air resistance, friction, upthrust, normal contact force. • Non-contact forces occur between two objects when the two surfaces are not touching. • Examples of non-contact forces are: gravity, magnetism, electrostatic. • Frictional forces are created when two objects move against each other. • Air resistance is the force caused by particles in the air hitting an object. • Water resistance is the force caused by particles of water hitting an object as it moves through it. • The larger the surface airer, the more air resistance there is because there is more surface for the air particles to hit, leading to a greater force. • When an object floats the forces of upthrust and weight are equal or balanced. • When an object sinks the forces of upthrust and weight are not equal - unbalanced.	• A force is a push or pull that acts on an object due to the interaction with another object. All forces between objects are either: contact forces – the objects are physically touching or non-contact forces – the objects are physically separated. • Examples of contact forces include friction, air resistance, tension and normal contact force. • Examples of non-contact forces are gravitational force, electrostatic force and magnetic force. • Weight is the force acting on an object due to gravity. • The force of gravity close to the Earth is due to the gravitational field around the Earth. • The weight of an object can be calculated using the equation: weight = mass × gravitational field strength	• A number of forces acting on an object may be replaced by a single force that has the same effect as all the original forces acting together. This single force is called the resultant force. • Drag is a force that acts on object causing it to slow down as it moves through a liquid or gas. • Terminal velocity is the maximum speed a falling object can reach, as the forces become balanced. • An object with a larger surface area will experience more air resistance than an object with a smaller surface area, because more air particles come in contact with the surface. • The extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that the limit of proportionality is not exceeded. • Directly proportional means as one variable increases, the other variable increases at the same rate. For example, if you double variable one, variable two will double.	• Moment is the turning effect of a force. • Moment = force x perpendicular distance	• Scalar quantities have magnitude only. • Vector quantities have magnitude and an associated direction. • Spring constant: force = spring constant × extension • A force that stretches (or compresses) a spring does work and elastic potential energy is stored in the spring. • Provided the spring is not inelastically deformed, the work done on the spring and the elastic potential energy stored are equal. • Newton's third law: whenever two objects interact the forces they exert on each other are equal and opposite.

Maths:
Using and manipulating mathematical formula.
Drawing a line graph.

Design Technology:
Designing machines for specific purposes, the effects of forces needs to be considered for example vehicles, falling objects, cogs etc.

PE:
Forces impact the movement of cars due to the forces between tires, friction between shoes and the ground.

Speed and Motion Learning Journey:

Chemistry:
Determining the rate of reaction.

Biology:
- Muscles and joints, exercise – how do we move faster?
- Increased speed when moving needs more energy which we get from respiration.

KS2	Year 7	Year 8	Year 9	GCSE
Objects move differently on different types of surface.	• Speed = distance / time Distance time graphs show the distance an object moves over time. • The speed of an object can be calculated from the gradient of its distance–time graph. • Scientists describe an object's motion as a change in its position relative to an object or a place that is not moving. • If you are stationary and another object is moving, it can feel like you are moving backwards. • Relative motion can be calculated by adding or subtracting the speeds of the objects.	• If the forces on an object are balanced the object will with stay stationary or continue moving at a constant speed in the same direction. • If the forces acting on an object are unbalanced the object can start moving, change speed or direction. • Newton's First Law: If the resultant force acting on an object is zero and: the object is stationary, the object remains stationary, the object is moving, the object continues to move at the same speed and in the same direction.		• The speed at which a person can walk, run or cycle depends on many factors including: age, terrain, fitness and distance travelled. • Typical values may be taken as: walking- 1.5 m/s, running, 3 m/s cycling, 6 m/s. • The velocity of an object is its speed in a given direction. Velocity is a vector quantity. • The average acceleration of an object can be calculated using the equation: acceleration = change in velocity ÷ time taken • The acceleration of an object can be calculated from the gradient of a velocity–time graph. • Newton's second law: the acceleration of an object is proportional to the resultant force acting on the object and inversely proportional to the mass of the object: resultant force = mass x acceleration. • Newton's third law: whenever two objects interact the forces they exert on each other are equal and opposite. • The stopping distance of a vehicle is the sum of the distance the vehicle travels during the driver's reaction time (thinking distance) and the distance it travels under the braking force (braking distance). For a given braking force the greater the speed of the vehicle, the greater the stopping distance.

Maths:
Using and manipulating mathematical formula.
Drawing a line graph.

PE:
Using forces to move an object / ball. For example kick a ball during football, hitting a ball during tennis.

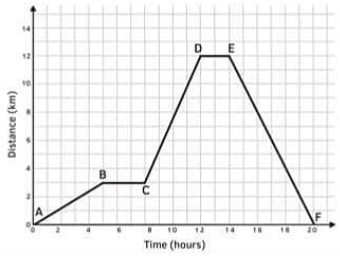
Careers: Materials engineers, lorry drivers, mechanic, design and maintenance engineers, aircraft maintenance staff, sports engineers, F1 engineer.




Forces Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Forces are pushes or pulls that arise from the interaction between two objects.		
When a force is placed on an object it can change: speed, direction of movement or shape.		
Contact forces occur when two objects touch each other to exert a force. Examples of contact forces are friction, air resistance, normal contact force, upthrust.		
Non-contact forces occur where objects do not have to each other to exert a force. Examples of non-contact forces are gravity, magnetic, electrostatic.		
Forces are measured using a newton meter.		
The units to measure a force are Newtons (N)		
Forces act in pairs. Force arrows should be labelled with the name and size of the force.		
When two forces acting on an object are equal in size but acting in opposite directions, these forces are balanced.		
If the forces on an object are balanced the object will with stay stationary or continue moving at a constant speed in the same direction.		
When two forces acting on an object are not equal the forces are unbalanced.		
If the forces acting on an object are unbalanced the object can start moving, change speed or direction.		
Mass is the amount of matter than an object contains. It is measured in kilograms (kg) or grams (g).		
All objects with mass have a gravitational field around them. Gravitational field is the area around an object that will allow another object to feel gravitational attraction. Larger mass = larger gravitational force		
Weight is the force an object has based on its mass and the gravitational field strength. It is measured in Newtons (N)		
Weight can be calculated using the equation: weight (N) = mass (kg) x gravitational field strength (N/kg)		
Speed is a measure of how fast an object is moving and can be calculated using the equation: Speed = distance / time		
Units for speed depend on the units of the distance and time e.g. Meters per second written: ms^{-1} or m/s.		
Relative motion: When two cars are passing each other on a motor way, they look like they are moving slowly past you even though the speeds are high. This concept is relative motion.		
Distance-time graphs show the distance moved from a starting point changes over time. Time taken is plotted on the x axis. Distance travelled is plotted on the y axis.		
 The gradient of a line on a distance time graph is equal to the speed. If the line on the graph is horizontal the object is stationary. If the line on the graph is straight diagonal the object is moving at a constant speed. The steeper the line, the greater the gradient therefore the greater the speed.		

Forces Knowledge Organiser:

Balanced forces	When two forces are the same size and cause an object to move at a constant speed or remain stationary.
Contact Force	A force that occurs when two objects touch each other to exert a force.
Distance – time graph	Graphical representation of the motion of an object. Time taken plotted on the x-axis, distance plotted on the y axis.
Force	Push or pull that arise from the interaction between two objects.
Friction	Force opposing motion which is caused by the interaction of surfaces moving over one another. It is called 'drag' if one is a fluid.
Gradient	The steepness of a line.
Gravitational Field	The area where other objects feel the effect of gravitational force.
Gravitational field strength, g	The force from gravity on 1kg (N/kg) On Earth gravitational field strength is 9.8 N/kg.
Mass	The amount of matter an object contains (kg)
Newton	Unit for measuring forces (N).
Newton meter	Piece of equipment used to measure the force exerted.
Non-contact Force	A force that occurs when two objects do not have to touch to exert a force.
Relative motion	When two cars are passing each other on a motor way, they look like they are moving slowly past you even though the speeds are high. This concept is relative motion.
Resultant force	If forces are unbalanced, the difference in these forces is the resultant force – it is the overall force that would be acting on the object.
Speed	Measure of how fast an object is moving.
Unbalanced forces	When two forces are different sizes and cause an object to speed up, slow down or change direction.
Weight	The force of gravity acting on an object (N)

Forces:

Forces are **push**es or **pull**s, measured in **newtons** (**N**) using a Newton Meter.

Contact and Non-Contact Forces:

When two objects or materials need to be touching for a force to have an effect, it is a **contact** force.

Examples:
- **friction**
- **air resistance**

When two objects or materials do not need to be touching for a force to have an effect, it is a **non-contact** force.

Examples:
- **gravity**
- **electrostatic**
- **magnetic**

Non-contact forces act over a distance.
Are these non-contact forces attractive, repulsive or both?

Force diagrams:

Force diagrams show the direction and size of the force.

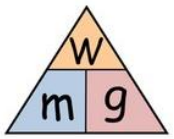
The arrows need to be proportional to the size of the force – the larger the force, the larger the arrow should be.

Weight and Gravity:

- Mass (kg) is a property of an object. It tells us how much of it there is.
- Weight (N) depends on the mass of an object, AND the gravitational field strength.
- Weight (N) = mass (kg) x gravitational field strength (N/kg)

$$W = m \times g$$

Weight (N) = Mass (kg) x Gravitational field strength (N / kg)



Speed:

Speed is a measure of how fast an object is moving.

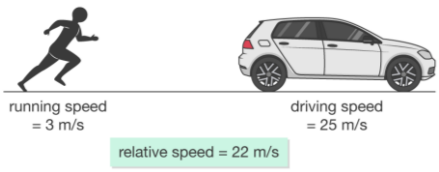
average speed = distance ÷ time

Units for speed are determined by the units used for distance and time.

Example: distance is measured in meters, time is measured in seconds, speed will be measured in meters per second.

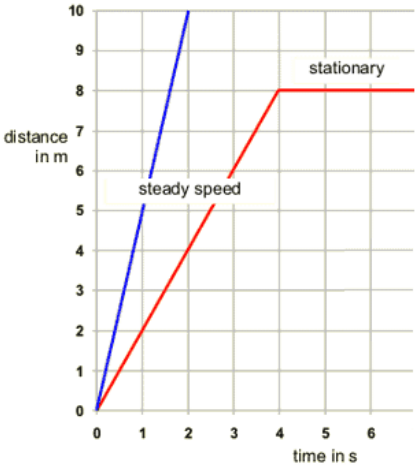
Relative Motion:

- **Same direction:** Relative speed = fastest speed – slowest speed
- **Opposite directions / past each other:** Relative speed = train A + train B



Distance time graphs:

- Distance time graphs represent the motion of an object.
- A distance time graph shows how an object has moved from a starting point.
- Time taken is plotted on the x axis.
- Distance is plotted on the y axis.
- Gradient of line = speed
- To calculate the gradient: $\frac{Change\ in\ y}{change\ in\ x}$
- The steeper line, the faster the object is moving.
- A horizontal line shows the object is stationary.



Forces Revision:

Contact and Non-Contact Forces:	*Speed*
Force Diagrams:	*Relative speed:*
Weight and gravity:	*Distance time graphs:*

Genes and Ecosystems Learning Journey:

Big Picture: What happens when a species becomes extinct? Do organisms just rely on one food source. Why are organisms interdependent?

Biology:
- Adaptations and variation allow organisms to survive within their habitats.
- All living things depend on each other for survival.

Chemistry:
- Chemicals in the environment can cause environmental variation.
- Non living factors such as temperature, humidity, soil pH can affect biodiversity and population sizes.
- Bioaccumulation is the build up of toxic chemicals in a food chain such as mercury and DDT.

Physics:
- Earth's resources can effect the populations within a habitat.
- Energy is stored in the plants and prey of a food chain. The arrows in the food chain show the movement of energy.

	KS2	Year 7	Year 8	Year 9	GCSE
Variation	• Variation is caused by inheritance or the environment. Inherited characteristics are passed on from mother and father. • Environmental characteristics are a result of the environment and surroundings.	• Variation is caused by inheritance and the environment. Inherited characteristics are passed in genes from parents to their offspring they include eye colour, blood group, hair colour. • Environmental characteristics are characteristics affected by the environment a child grows up in they include accent, tattoos and scars. • Some characteristics such as weight and height are a combination of environmental and inherited characteristics. • Variation can be continuous or discontinuous. Continuous variation can taken any value within a range. • Discontinuous variation takes a specific number of values. • Discontinuous variation is plotted on a bar chart. • Continuous variation is plotted on a line / scatter graph or histogram.			• The genome and it's interaction with the environment influence the development of the phenotype of an organism. • Mutations occur continuously, very rarely this will lead to a new phenotype. • If a new phenotype is suited to an environmental change it can lead to a relatively rapid change in the species. • Selective breeding is the process by which humans breed plants and animals for particular genetic characteristics. • Genetic engineering is a process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.
Ecosystems and communities	• Most living things live in habitats to which they are suited. • Habitats provide for the basic needs of different kinds of animals and plants. • Habitats can have smaller sections with different features - these are called micro-habitats.A habitat is the area within a particular organism can get all it needs to survive, shelter, space, resources, mating and nesting sites.	• Quadrats are used to estimate the size of a population within a habitat. • Place the quadrat at a random co-ordinate, count the number of a species within the quadrat. • Take an average of number of the species counted and multiply by the size of the field.			• An ecosystem is the interaction of a community of living organisms and the non-living parts of their environment. • Biotic factors (living organisms) and abiotic factors (non-living) can affect a community. • A stable community is one where all the species and environmental factors are in balance so that population sizes remain constant. • Adaptations may be structural, behavioural or functional. • A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem. • Biodiversity is the variety of all the different species of organisms on Earth or within an ecosystem. • Human activity is reducing biodiversity, measures must be taken to try to stop this reduction.

Interdependence	• Plants are a food source and a source of shelter for animals. • Food chains start with a producer. • Predators hunt and kill their prey. • Prey are hunted and killed by predators. • Herbivores eat only plants. • Carnivores eat only meats (other animals). • Omnivores eat a mixture of meat and plants. • Animals eat other animals to gain the energy that is contained within them. • Plants get their energy from sunlight, in a process called photosynthesis. • Arrows show energy passed from one organism to another when it is consumed.	• Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers. • Consumers that kill and eat other animals are predators, and those eaten are prey. • In a stable community the numbers of predators and prey rise and fall in cycles. • Food webs, show the relationships between food chains in an ecosystem. • Bioaccumulation is the build up of toxins in a food chain, the toxins don't break down therefore they pass to other organisms in the food chain, increasing the concentration at each stage.	Plants are important for the survival of the world because they take in carbon dioxide and release oxygen, plants are at the producer in all food chains.		• Plants compete for light, space, water and mineral ions. • Animals compete with each other for food, mates and territory. • Interdependence is the dependence on each species from another for conditions or resources they need. • Photosynthesis organisms are the producers of biomass for life on Earth.

Maths:

- Different types of graph are used for plotting different types of variation.
- Using mean, median and mode to calculate averages of population sizes.

Food Technology:

Energy moves through the food chain based on what eats what.

Geography:

- Variations within human species leads to diversity on Earth.
- Taking a sample of a population using field work techniques.
- Biodiversity is maintained through the care of the Earth and habitats.
- Relationships within ecosystems shows the dependence on each other.

Careers: Bee keepers, environmental toxicologist, wildlife population modellers, nature conservation officers, organic farmers, rare breed farmers, veterinary epidemiologist.





Ecosystems Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Variation can be caused by genetics, the environment or both.		
Inherited variation is caused by DNA being passed from parents to their offspring. For example: eye colour, hair colour, blood group.		
Environmental variation is caused by our environment / surroundings. For example: accent, tattoos, scars.		
Some characteristics can be caused by a combination of inheritance and environment for example height and weight.		
Continuous variations are characteristics which can be any value between the largest and the smallest such as your height.		
Discontinuous variations are characteristics which only have certain values. For example, eye colour has categories like blue, brown, green, or hazel		
Discontinuous data is plotted as a bar chart. Continuous data can be plotted as a line graph or as a histogram.		
Predator is an animal which hunts and eats other animals.		
Prey is an animal that is hunted and eaten by a predator.		
Producer is an organism which makes its own food from the sun.		
Consumer is an organism that eats other plants and / or animals.		
A primary consumer is the animal that eats the producer. Secondary consumer is the animal that eats the primary consumer. Apex/Top consumer is not eaten by anything else.		
A food chain shows how plants and animals get their energy.		
The arrows in a food chain show the movement of energy.		
A food web shows all the food chains within an ecosystem joined together.		
Herbivore is an organism which only eats plants. Omnivore is an organism which eats both plants and other animals.		
Carnivore is an organism that eats other animals.		
Predator prey cycles show the relationship between the numbers of predators and prey – when the number of predators increases, it causes the number of prey decreases, this causes the number of predators to decrease due to lack of food – this cycle continues.		
Toxic materials are poisonous, some quickly break down into harmless substances in the environment. Some toxic substances do not break down and stay in the environment.		
Persistent toxic substances accumulate in the food chain and damage the organisms in it and can't be excreted.		
Bioaccumulation is the build up of toxins in a food chain, the first organism takes in a toxin, the consumer eats multiple organisms, increasing the concentration of toxin, the next consumer eats multiple organisms, increasing the concentration of toxin.		
A quadrat is used for sampling plants in different ecosystems.		
Populations are sampled to give an estimate of the size of a population as it is more efficient than counting every member of a species.		

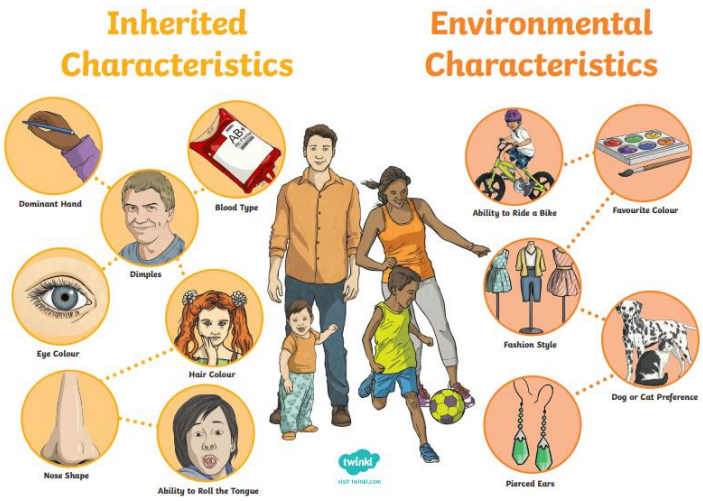
Ecosystems Knowledge Organiser:

Adaptations	Adaptations are features of living organisms that help them survive.
Bioaccumulation	The build up of these toxins is called bioaccumulation .
Characteristic	A characteristic is a feature of an organism. It can be something we can see (like hair colour) or something we can't see (like blood group).
Consumer	An Animal which eats another animal and /or plants
Continuous Variation	Continuous variations are characteristics which can be any value between the largest and the smallest such as the your height.
Discontinuous Variation	Discontinuous variations are characteristics which only have certain values. For example eye colour has categories like blue, brown, green or hazel.
Ecosystem	An ecosystem is an area, within which plants and animals interact with each other and their non-living environment
Food Chain	a series of organisms each dependent on the next as a source of food.
Food Web	A group of food chains interlocking together to show how different organisms feed
Predator	An animal which hunts and eats other animals.
Prey	An animal that is hunted and eaten by a predator
Producer	An animal that eats (consumes) other plants and/or animals.
Quadrats	A quadrat is a square shape placed at random locations in an ecosystem to count the number of a particular plant within the square.
Species	Organisms with lots of common characteristics, that can mate to produce fertile offspring
Toxins	Toxins are poisonous chemicals which harm organisms in their habitat
Variation	Differences in characteristics within a species

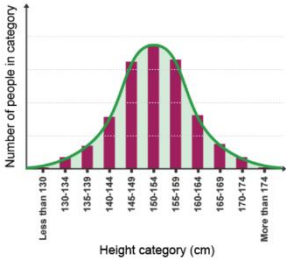
Variation

Variation is all the differences that exist in a population of the same species. These differences are caused by:

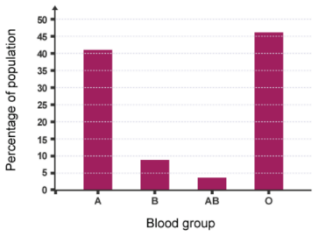
- **Genetic variation** - these are differences between individuals that are inherited from parents, such as the colour of your eyes, hair and skin.
- **Environmental variation** - these are differences between individuals that are not inherited but caused by the environment that the organism lives in, including scars and tattoos.
- **Genetic and environmental variation** - differences between individuals that are caused by both genetic and environmental factors, such as height and weight.

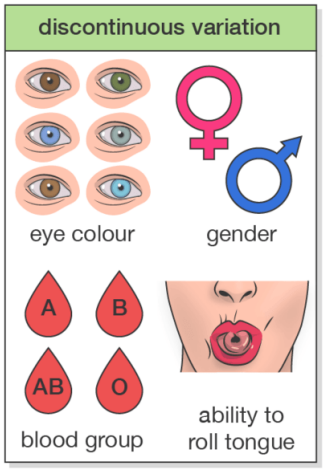


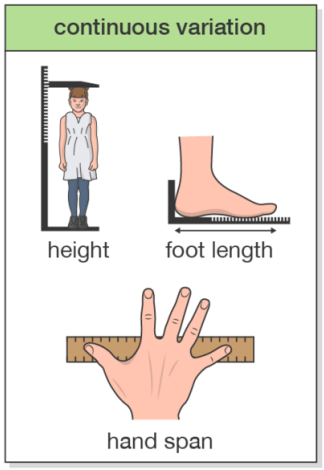
Continuous Variation
Results from surveys of continuous variation are presented in line graphs or bar charts with a drawn through them.



Discontinuous Variation
Surveys of discontinuous variation give us values that come in groups rather than a range. Human blood groups are an example of discontinuous variation.

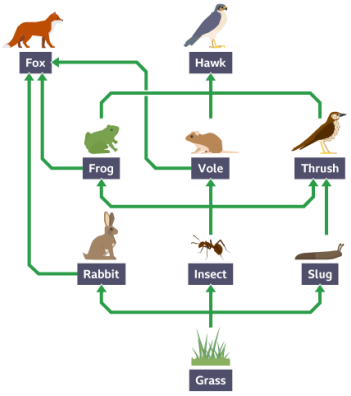


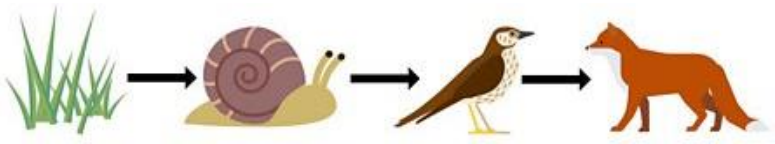




Food chains and webs:

Most populations of organisms that live in a habitat usually have more than one food source. They usually consume more than one organism from the trophic level below. This means that there are almost always more than one food chain and these are interlinked into a food web.

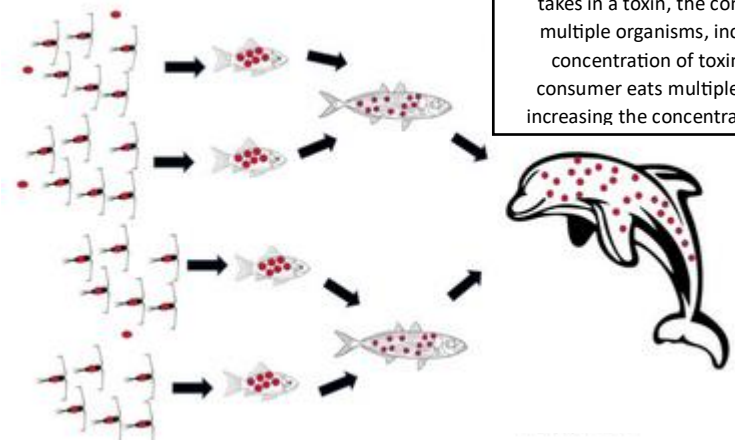




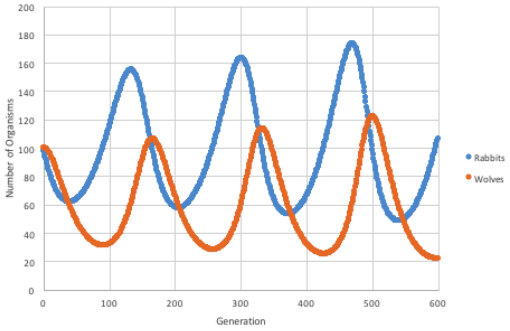
Producer → Primary consumer → secondary consumer → tertiary consumer

Bioaccumulation:

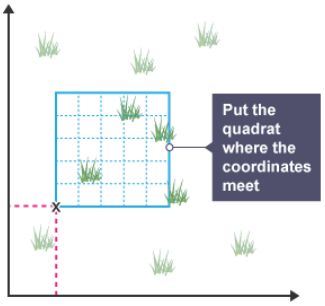
Bioaccumulation is the build up of toxins in a food chain, the first organism takes in a toxin, the consumer eats multiple organisms, increasing the concentration of toxin, the next consumer eats multiple organisms, increasing the concentration of toxin.

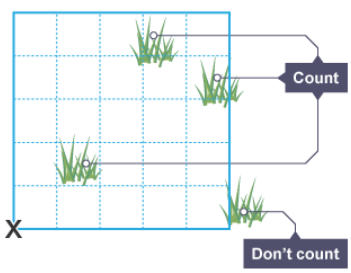


Predator, Prey, Relationships:



Population sampling: Sampling is used to estimate a population that would be too difficult to count, a quadrat is used to do this.





A quadrat is usually a 1 m^2 frame made of wood. It may contain wires to mark off smaller areas inside, such as 5 × 5 squares or 10 × 10 squares. The organisms underneath, usually plants, can be identified and counted.

$$\text{Total grass plants found in sample} \times \frac{\text{Total area } (m^2)}{\text{Total area sampled } (m^2)}$$

Genes and Ecosystems Revision:

Inherited and Environmental Variation:	*Predator Prey Relationships:*
Continuous and Discontinuous Variation:	*Bioaccumulation:*
Food Chains and Food Webs:	*Observing Ecosystems:*

Reactions Learning Journey:

Big Picture: When chemicals are mixed together and make something new, a chemical reaction has happened. Where are acids and alkalis found in everyday life and why are their reactions important?

Chemistry:
Naming chemical compounds relates to naming salts in neutralisation reactions.

Biology:
Alkalis are used to neutralize stomach acid during indigestion. Bile is an alkali that neutralizes stomach acid.

Physics:
Conservation of mass relates to the conservation of energy. Matter and energy cannot be created or destroyed only transferred from one place to another.

	Year 6	Year 7	Year 8	Year 9	GCSE
Physical and chemical changes	• Dissolving, mixing and changes of state are reversible changes. • When new materials are made, they are not usually reversible for example burning. • Some changes are reversible and the material can be easily returned to it's original form - nothing new is made. • Some changes to materials are irreversible and cannot be returned to their original form - something new is made.	• A physical change changes the state of matter but does not involve the formation of a new substance. • A chemical change forms a new compound or element.			• Chemical reactions always involve the formation of one or more new substances, and often involve a detectable energy change. • Chemical reactions follow the law of conservation of mass which states that no atoms are lost or made during a chemical reaction so the mass of the products is equal to the mass of the reactants. • In some chemical reactions, the products of the reaction can react to produce the original reactants. Such reactions are called reversible reactions.
Acids and Bases		• A base is a substance that can react with an acid and neutralise it. • An alkali is a base that will dissolve in water. • An indicator is a substance that changes colour when it is added to acidic or alkaline solutions. • Litmus indicator turns red in acidic solutions and blue in alkaline solutions. • Universal indicator turns a range of colours in acids and alkalis. • pH is a measure of how strongly acidic or alkaline a solution is. • A neutralisation reaction is a chemical reaction that happens if you mix an acid and a base together. • Acid + base --> salt + water • Naming salts: 1) Name of the metal, 2) take the name from the acid, 3) hydrochloric acid - chloride, sulfuric acid - sulfate, nitric acid - nitrate.			• Acids react with some metals to produce salts and hydrogen - these happen in redox reactions. • Acids are neutralised by alkalis and bases to produce salts and water. • Soluble salts can be made from acids by reacting them with solid insoluble substances. • Acids produce hydrogen ions in aqueous solutions. • Aqueous solutions of alkalis contain hydroxide ions. • In neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water.

Design Technology:
Physical changes are made when changes are made to materials but nothing new is made.

Food Technology:
When cooking chemical changes happen as new substances are made.

Maths:
Scaling and reading number lines.

Careers: Chef, soil scientist, builder, industrial cleaner, doctor, marine biologist, farmer.





Reactions Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

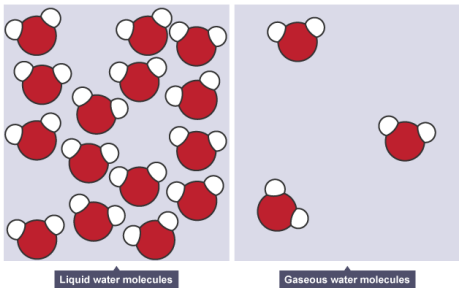
Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
During a chemical change a new substance it made. A change of colour, gas given off, temperature changes are all signs of a chemical reaction		
During a physical change nothing new is made, it is usually a change of state or dissolving. Physical changes are often reversible.		
Word and symbol equations show the products and reacts during a chemical change. They are written on 1 line.		
In a chemical equation: Gases = (g) Liquids = (l) Solids = (s) Aqueous = (aq)		
Acids are substances with a pH under 7. They are sour in taste and can be found in the lab and at home. Examples are sulfuric acid, nitric acid and hydrochloric acid.		
Alkalis and bases are substance with a pH over 7. They feel soapy and can be found to lab and at home. Examples are Sodium bicarbonate, Sodium hydroxide and Calcium carbonate.		
An alkali is a base that can dissolve in water. Many bases are insoluble.		
Concentration is measure of how many particles of solute are in a solution. More concentrated acids and alkalis are more corrosive. Dilute acids and alkalis are irritants.		
There are many hazard symbols such as flammable (catches fire easily), explosive, health hazard, Serious health hazard etc. These need to be considered when using different chemicals.		
An indicator is a substance that changes colour in acids and alkalis. Litmus is blue in alkalis and red/pink in acids.		
The pH scale is a measure of how strongly acidic or alkaline a substance is. Closer to pH 0 is stronger acid, closer to pH 14 is stronger alkali.		
Universal indicator changes colour for each pH level. Red (pH1) to Purple (pH 14). Neutral (pH7) is green.		
Neutralisation reactions occur when and acid and base react together in the correct amounts.		
Acid + alkali → salt + water e.g hydrochloric acid + sodium oxide → sodium chloride + water When the alkali is a carbonate, carbon dioxide is also made. e.g. hydrochloric acid + sodium carbonate → sodium chloride + water + carbon dioxide		
When making salts, they are named by using the name of the metal in the alkali and changing the name of the acid. Hydrochloric acid = chloride salts Nitric acid = nitrate salts Sulfuric acid = sulfate salts		
Neutralisation can used in everyday life. For example indigestion remedies, neutralising soil etc.		
Copper sulfate can be made by heating copper oxide and sulphuric acid.		

Reactions Knowledge Organiser:

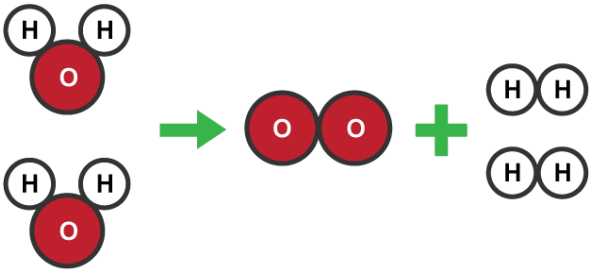
Acid	A substance with a pH less than 7.
Alkali	A base that will dissolve. A substance with a pH greater than 7.
Base	A substance with a pH greater than 7.
Copper sulfate	A salt made from copper oxide and sulfuric acid
Indicator	A substance that will change colour based
Indicator	Substances used to identify whether unknown solutions are acidic or alkaline.
Litmus	Red litmus turns blue in an alkali, blue litmus turns red in an acid.
Neutral	A substance with a pH of 7.
Neutralisation reaction	A reaction of an acid and alkali to produce a neutral solution containing a metal salt and water.
pH scale	Scale of acidity and alkalinity from 0-14
Salt	The product of a neutralisation reaction consisting of a metal (from the alkali) and non-metal (from the acid).
Universal indicator	Indicator will change colour when in an acid or alkali based on the colour of the pH scale.

Chemical changes and physical changes:



Physical changes: Physical changes do not lead to new chemical substances forming. In a physical change, a substance simply changes physical **state**, e.g. from a solid to a liquid.
For example: Liquid water becoming steam (when water boils) is a physical reaction:

Chemical changes: Chemical changes happen when something new is made. For example liquid water **decomposing** into hydrogen and oxygen, e.g. when an electric current is passed through water, is a chemical reaction:



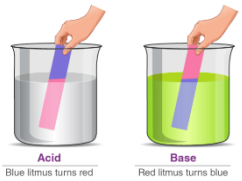
Acids and Bases:

- Examples of acids: hydrochloric acid (HCl), sulphuric acid (H_2SO_4), nitric acid (HNO_3).
- Examples of bases: copper oxide (CuO), sodium hydroxide (NaOH), calcium carbonate ($CaCO_3$).
- An alkali is a base that will dissolve. Many bases are insoluble.

Indicators will change colour depending on whether they are in an acid, alkali or neutral solution.

Litmus paper:

- Red litmus – stays red in acid, turns blue in bases.
- Blue litmus – stays blue in bases, turns red in acids.

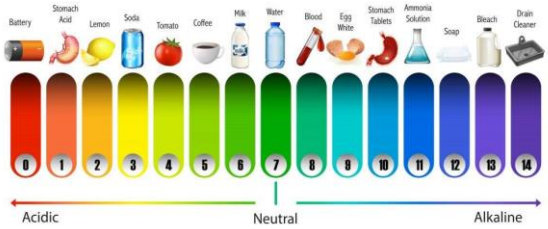


Universal indicator:

Changes colour that corresponds with the pH scale.

Strong acids: hydrochloric acid, nitric acid, sulphuric acid.

Weak acids: ethanoic acid, citric acid.



Neutralisation:

A chemical reaction happens if you mix together an acid and a base. The reaction is called neutralisation.

metal oxide + acid → a salt + water

metal hydroxide + acid → a salt + water

metal carbonate + acid → a salt + water + carbon dioxide

Rules for naming salts:

1) The METAL name from the base always comes first

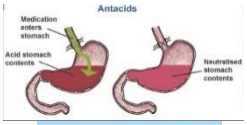
2) The ACID name always comes second

3) The Acids changes it's name

Hydrochloric Acid + Sodium Hydroxide → Sodium Chloride + Water

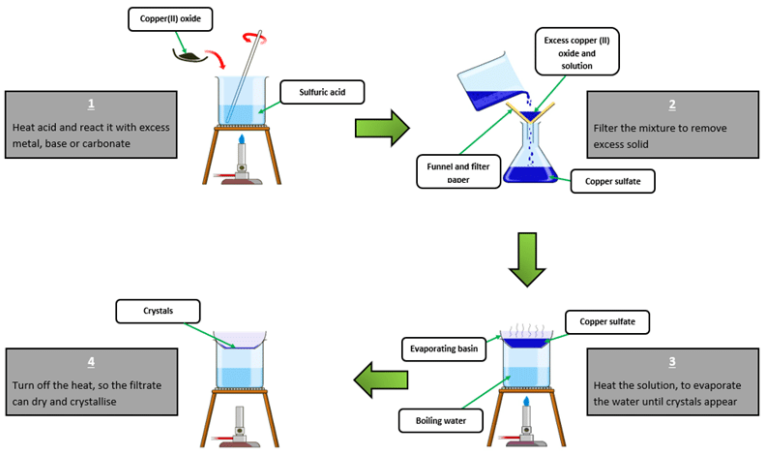
Sulphuric Acid → Sulphate Nitric Acid → Nitrate Hydrochloric Acid → Chloride

Uses of neutralization reactions:



- Bee strings are acidic – they can be neutralized using a basic compound such as baking powder which contains sodium hydrogen carbonate.
- Indigestion is caused by too much stomach acid, antacid tablets are made using bases that react with the acid in the stomach forming a salt and water. Examples of bases in antacid tablets include: magnesium hydroxide and magnesium carbonate.
- Farmers use neutralization reactions to neutralize acidic soil – lime (calcium oxide) is used to neutralize soil.

Making Copper Sulfate:



Reactions Revision:

Physical and Chemical Changes:	*Neutralisation Reaction:*
Acids:	*Using neutralisation:*
Alkalis and bases:	*Making Copper Sulfate:*

The Earth and Beyond Learning Journey:

Big Picture: Humans use the Earth for survival, however, we are one tiny part of much larger systems. What is our place within the universe and what is the Earth made of?

Biology:
- Plants take in carbon dioxide and release carbon dioxide for photosynthesis.
- Respiration takes in oxygen and releases carbon dioxide.
- The remains of organisms are buried, over millions of years become crude oil.

Chemistry:
- The Earth's atmosphere is made of a variety of gases.
- All resources that humans used are found in the Earth or atmosphere.
- Reactions happen inside stars to produce larger chemical elements.

Physics:
- Gravity keeps the Earth in orbit around the Sun.
- Stars are made due to the forces acting on the gases inside the star in fusion reactions.

	KS2	Year 7	Year 8	Year 9	GCSE
Earth Structure and Atmosphere	• The Earth has four seasons - spring, summer, autumn, winter. • There are different types of rocks, they can be grouped based on their appearance and physical properties. • Fossils are formed when things that have evolved are trapped within the rock. • Soils are made from rocks and organic matter. • Fossils are formed from the dead remains of plants and animals. • Fossils are evidence for evolution.	• A day is the time it takes for a planet to turn once on its axis. • A year is the length of time it takes for a plant to make one complete orbit around the Sun. • The seasons are caused by the tilt of the Earth on it's axis. • When the Northern Hemisphere of the Earth is tilted towards the Sun, it is in the summer. • When the Northern Hemisphere of the Earth is tilted away from the Sun it is winter. • When the Northern Hemisphere of the Earth is tilted away from the Sun it is winter. • There are three main types of rock: igneous, sedimentary and metamorphic. • Sedimentary rocks are formed from broken remains of other rocks. • Igneous rocks are formed from molten rock that has cooled and solidified. • Metamorphic rocks are formed from other rocks that are changed because of heat or pressure. • Rocks can all change into different forms depending on the conditions they are in, this is the rock cycle. • Fossils are the remains or traces of plants or animals that lived many years ago.	The three most abundant gases in the atmosphere are: nitrogen (78%), oxygen (21%) and argon (0.9%).		• The Earth's atmosphere has evolved over time - evidence suggest that the early atmosphere was mainly carbon dioxide and water vapour. • Over time, the Earth cooled forming liquid water, this dissolved the carbon dioxide. • Algae and plants produce oxygen.

Beyond the Earth	• The Earth and other planets move in an orbit around the Sun. • The moon moves around the Earth. • The Sun, Earth and Moon are approximately spherical bodies. • Day and night happen as the Earth rotates.	• Galaxy a cluster of billions of stars held together by gravity. • Our solar system is in the Milky Way galaxy. • Solar system consists of a star, planets and smaller objects such as asteroids. • Planet an object orbiting a star that is large enough to be rounded by its own gravity. • Star is a large mass at the centre of a solar system that produces heat and light. • The planets in our solar system are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus.			
Earth's Resources	• The water cycle involves the evaporation or condensation of water. The rate of evaporation depends on the temperature.	• Polymers are very long chain molecules made from small repeating units called monomers. • Composite materials are made from two or more different types of material. • Ceramics are made from soft substances, which when heated become hard and brittle.	• Seed banks are used as a conservation measure for plants, they carefully store seeds so that new plants may be grown in the future. • The storage of seeds in banks helps maintain biodiversity.	Earth has a limited amount of resources, we need to take measures to ensure these don't run out including reducing, reusing and recycling.	• The water cycle provides fresh water for plants and animals on land before draining into the seas. • The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis. • Rapid growth in the human population and an increase in the standard of living means that more resources are being used and more waste is being produced. • Crude oil is a finite resource found in rocks. • Water of appropriate quality is essential for life. Water that is safe to drink is called potable water. • Life cycle assessments (LCAs) are carried out to assess the environmental impact of products in each of these stages: extracting and processing raw materials, manufacturing and packaging, use and operation during its lifetime, disposal at the end of its useful life, including transport and distribution at each stage.

Maths:
Earth is tilted at an angle of 23°.

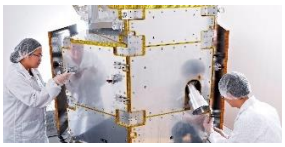
Design Technology:
Ceramics, composites and ceramics are used as materials.

History and RE:
Models of the solar system have changed over time due to changes in evidence and religious beliefs.

Geography:
Structure of the Earth and the atmosphere.

Careers: Aerospace engineer, data scientist, Earth observation engineer, astronomer, material scientist





Earth Science Target Sheet:

Circle how confident you feel at the start of the topic and the end of the topic.

Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

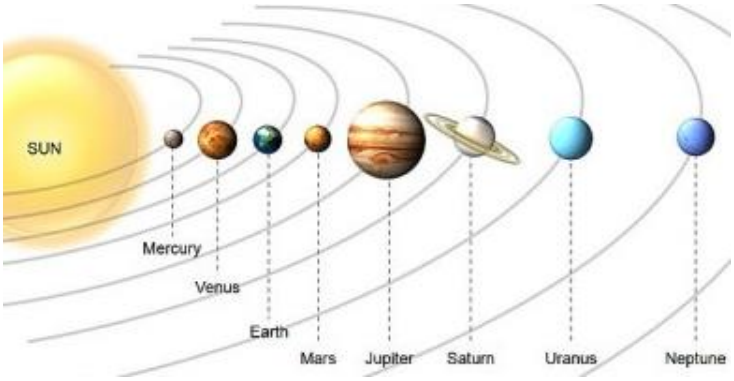
Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
The solar system contains Earth and 7 other planets. The Sun is a star at the centre. It also includes smaller objects such as asteroids. The solar system is held together by gravity.		
The order of the planets is Mercury, Venus, Earth, Mars (inner rocky planets) and Jupiter, Saturn, Uranus and Neptune (gaseous outer planets).		
The solar system is part of the Milky Way galaxy. There are billions of galaxies, each containing billions of stars.		
The path taken by one object as it moves around another object is called the orbit.		
A satellite is any orbiting object, such as the Moon is Earth's natural satellite.		
Stars emit (give out) their own light whereas planets are seen when they reflect light from the Sun.		
Universe contains all space, time and matter.		
Distances in space are vast. A light year is the distance that light travels in 1 year.		
The Earth spins on it's axis once every 24 hours – this causes day and night. The side of the Earth facing the Sun has day. The side facing away from the Sun has night.		
The Earth orbits the Sun every 365.25 days. The tilted axis causes the Earth to have seasons.		
The axis is an imaginary line passing through the centre of the Earth between the North and South poles. It is tilted at an angle of 23.4 degrees from vertical.		
The Northern hemisphere is the half of the Earth above the equator. When the Northern hemisphere tilts towards the Sun it is summer in these areas.		
The Southern hemisphere is the bottom half of the Earth below the equator. When the Southern hemisphere tilts away from the Sun it is winter in those areas.		
The Earth has four main layers: inner core, outer core, mantle and crust. The crust is the rocky outer layer of the Earth, it is about 5 - 7 km thick.		
The mantle is a layer about 300km thick made of semi-solid rock.		
The total core is about 5000km thick and made of metals.		
Rocks in the Earth's crust contain chemical compounds and elements that can be extracted and used. The composition of elements is different in different parts of the Earth.		
There are three main types of rock in the Earth's crust: igneous, sedimentary and metamorphic. Rocks are made of grains or crystals that fit together.		
Igneous rocks are formed from molten rock that has cooled and solidified. Examples of igneous rocks are basalt and granite.		
Polymers are very long chain molecules made from small repeating units called monomers.		
Composite materials are made from two or more different types of material.		
A material formed from a soft substance that is heated to make a hard material.		

Earth Science Knowledge Organiser:

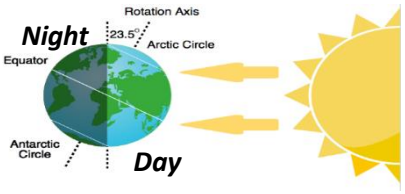
Axis	An imaginary line through the center of the Earth between the North and South poles.
Cementation	The water is squeezed from between the layers of rock, crystals form and the crystals stick the piece so of rock together.
Crust	Outer layer of the Earth made of solid rock.
Day	Length of time it takes for a planet to make one rotation on its axis.
Deposition	Grains and rock fragments that are transported by rivers are deposited on the banks or beds of lakes.
Extrusive igneous rocks	Igneous rocks that are formed when magma erupts to the surface and cools slowly. Forms rocks with small crystals.
Fossil	The remains or traces of plants or animals that lived many years ago.
Galaxy	Cluster of billions of stars held together by gravity
Igneous rock	Rock made from the cooling of molten rock
Inner core	The layer of the Earth's structure in the center of the Earth, made of liquid metal.
Intrusive igneous rocks	Igneous rocks formed from magma that has cooled slowly, deep underground. Forms rocks with large crystals.
Light year	Measure of astronomical distance – distance travelled by light in one year.
Magma	Molten rock found within the Earth
Mantle	Semi-molten, 3rd layer from the center.
Metamorphic rock	Rocks made from the heating and pressure applied to other rocks.
Northern Hemisphere	The top half of the Earth (anywhere above the equator
Orbit	The path taken by a satellite
Outer core	The second layer from the center of the Earth, liquid.
Planet	An object orbiting a star that is large enough to be rounded by its own gravity
Satellite	Any object that orbits around a planet
Season	A length of time with different climates. Spring, summer, autumn and winter.
Sediment	Rock grains and fragments of rocks.
Sedimentary rocks	Rocks made of compacted grains.
Solar system	Consists of a star, planets and smaller objects such as asteroids.
Southern Hemisphere	The bottom half of the Earth (anywhere below the equator)
Star	Large mass at the center of a solar system that produces heat and light.
Telescope	An object that is used to see objects that are far away
Universe	Contains all space, time and matter
Year	The length of time it takes for a planet to do one full orbit of the sun.
Polymer	Polymers are very long chain molecules made from small repeating units called monomers.
Composite	Composite materials are made from two or more different types of material.
Ceramic	A material formed from a soft substance that is heated to make a hard material.

The Universe:

Our solar system is part of the Milky Way galaxy and contains 8 planets.



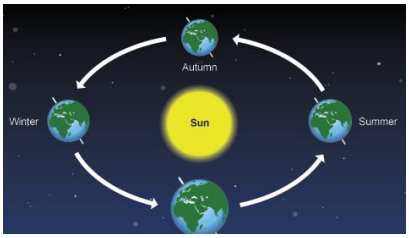
Lengths of time on Earth:



A day – 24 hours – the time it takes for the Earth to rotate once on it's axis.

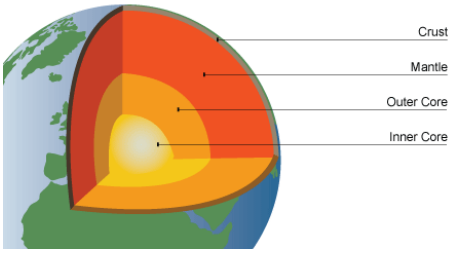
A year – 365 ¼ days – the time it takes for the Earth to complete one full orbit of the Sun.

Seasons:



The seasons happen because of the Earth's tilt on its axis. When the Northern hemisphere is tilled towards to the sun, it is summer, when it is tilted away it is winter.

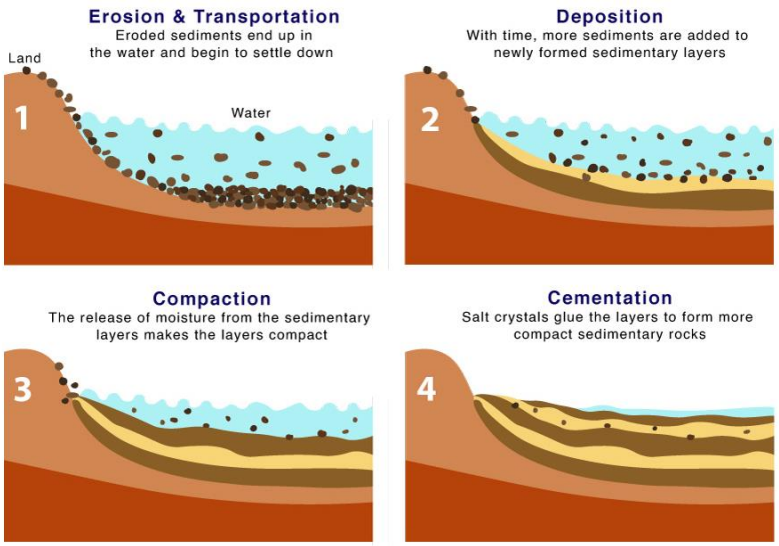
Structure of the Earth:



The Earth is made of 4 layers.

- The inner core of the Earth is 5,500°C. It is a very dense solid made from iron and nickel.
- The outer core is 2,000 km thick and is liquid.
- The mantle is semi-molten and is about 3,000 km thick.
- The crust is the rocky outer layer of the Earth, it is about 5 - 7 km thick.

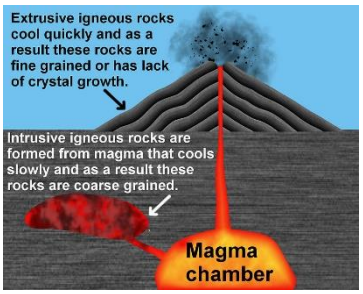
Sedimentary Rocks:



Examples: chalk, limestone, sandstone.

Igneous Rocks:

- **Igneous** rocks are formed from molten rock that has cooled and solidified.
- The inside of the Earth is very hot - hot enough to melt rocks. Molten (liquid) rock is called **magma**. When the magma cools enough, it solidifies and igneous rock forms.



	Extrusive	Intrusive
Where the magma cooled	On the surface	Underground
How fast the magma cooled	Quickly	Slowly
Size of crystals	Small	Large
Examples	Obsidian and basalt	Granite and gabbro

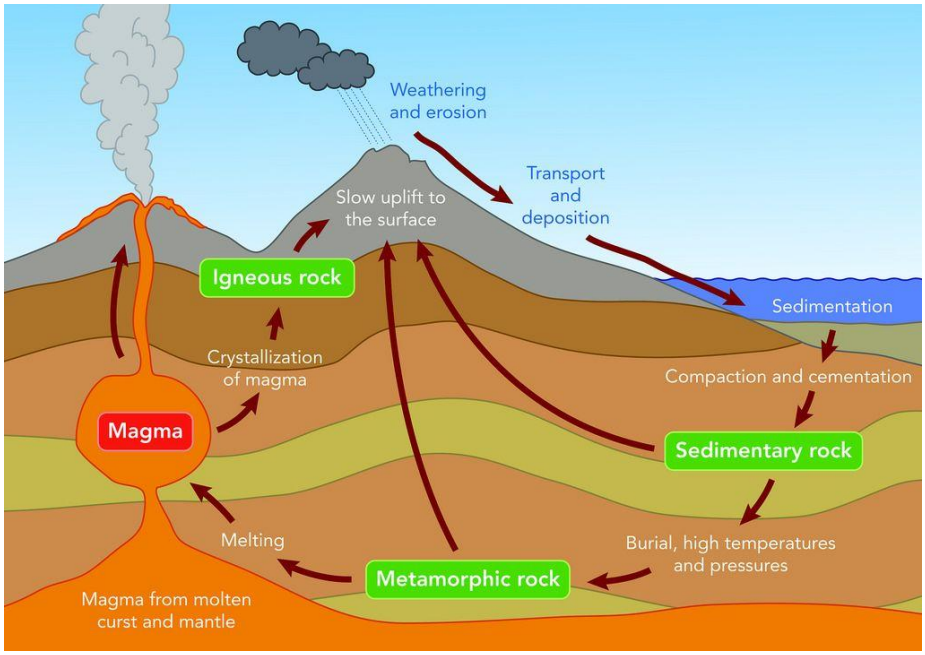
Metamorphic Rocks:

Metamorphic rocks are formed from other rocks that are changed because of heat or pressure. They are not made from molten rock – rocks that do melt form igneous rocks instead.

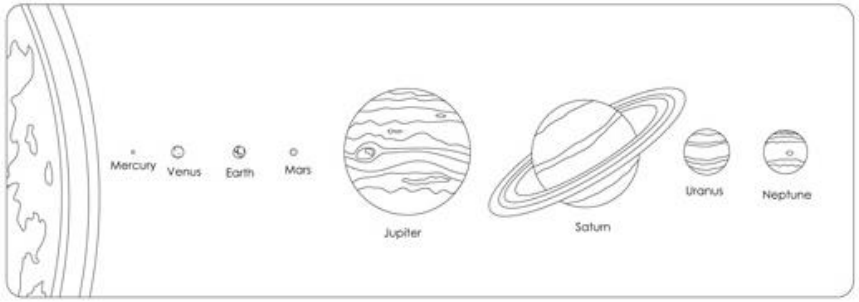
Earth movements can cause rocks to be deeply buried or squeezed. As a result, the rocks are heated and put under great **pressure**. They do not melt, but the minerals they contain are changed chemically, forming metamorphic rocks.

Examples: Slate and marble.

Rock Cycle:



Earth Science Revision:

Solar System:  	*Types of Rock:*
Day, Night and Seasons:	*Rock Cycle:*
Structure of the Earth:	*Polymers, Composites, Ceramics:*

In Science This Year:

In Science Next Year: