Year 6 Progress Booklet:

Name: _____ Class: _____

Science Teacher: _____

Progress Sheet:

In Science this year I would like to _____

_____

_____

Assessment	Date	Score	W / M / E	☺ 😐 ☹
Extended Response – Working in a lab				
Baseline Assessment				
Organisms Assessment				
Lightbulb Investigation				
Energy Assessment				
Keys Extended Task				
Genes and Ecosystems Assessment				
Friction Investigation				
Graph Marking Task				

In Science next year I would like to _____

_____

Contents

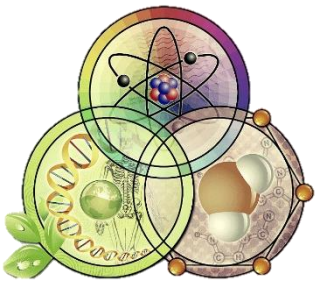
What is Science and why do we study it?

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.







National Curriculum Success Criteria:

By the end of year 6, I am aiming to work towards meeting the national standard in science, to do this I need to be able to do the following:

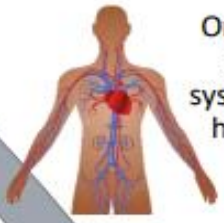
	Evidence 1	Evidence 2	Evidence 3
WS: Describe and evaluate own and others scientific ideas using a range of sources.			
WS: Ask your own questions about scientific phenomena.			
WS: Recognise and control variables and types of enquiry.			
WS: Use a range of scientific equipment and take repeat measurements where necessary			
WS: Record data and results – including keys, tables, graphs.			
WS: Draw conclusions, explain and evaluate your methods.			
WS: Raise further questions that could be investigated based on your data and observations.			
Biology: Name and describe the functions of the main parts of the digestive system.			
Biology: Name and describe the functions of the main parts of the circulatory system.			
Biology: Describe the effects of diet, exercise, drugs and lifestyle on how the body functions.			
Biology: Use observable features to classify and identify organisms.			
Biology: Construct and interpret food chains.			
Biology: Using the ideas of inheritance, variation and adaptation, describe how living things have changed over time and evolved.			
Biology: Describe how fossils are formed and			

provide evidence for evolution.			
Physics: Explain how we see objects.			
Physics: Explain the formation of shape and size of shadows.			
Physics: Use symbols to represent simple series circuit diagrams.			
Physics: Construct and control a series circuit, describe how the circuit is affected by changes made to it.			
Learning from previous years (revisited at the end of Year 6):			
Physics: Describe the effects of simple forces that involve contact, that act at a distance and gravity.			
Chemistry: Describe the characteristics of different states of matter and group materials.			
Chemistry: Describe how materials change state at different temperatures.			
Chemistry: Identify and describe when dissolving occurs in everyday situations.			
Chemistry: Describe how to separate mixtures and solutions into their components.			
Chemistry: Identify with reasons whether changes in materials are reversible or not.			

What will we learn this year?

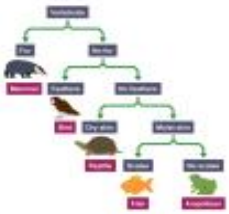
Year 6:

Introduction to science – learn about the lab, the equipment we use and scientific enquiries.



Organisms – learn about the circulatory and digestive systems. Consider how to stay healthy and the impacts of substances on health.

Energy and waves – investigate how to construct electrical circuits, carry out scientific investigations and explore how we see.



Genes and ecosystems – explore the links between different organisms, write your own classification key. Consider the role of variation and adaptation in evolution.

Revisit and prepare – explore the world of forces and scientific enquiry.

Revisit and prepare – what happens when we mix and react different substances?

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: _____

Working Scientifically Learning Journey:

	First School	Year 6	Year 7	Year 8
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
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.
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.			

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.

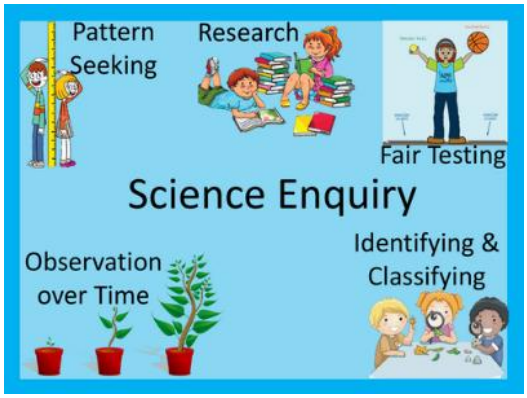
Working Scientifically Knowledge Organiser:

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:

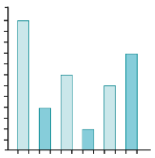
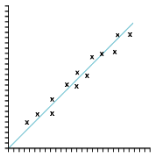
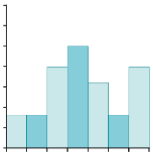
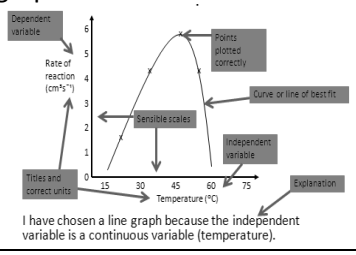
Make sure your method has:

- ☐ 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. 	

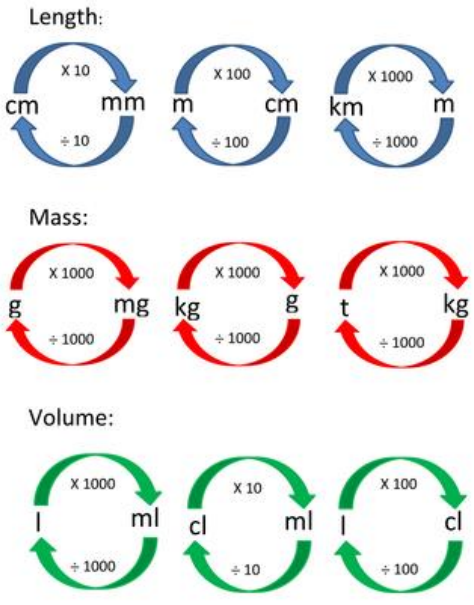
9. ***Conclusion:***

- 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. Were your results reliable?
        i. Did you take enough readings to highlight any anomalous results?
        ii. Were you able to work out a mean average?
        iii. Can you explain any anomalous results? Why might these have been caused?
    b. What went well in your investigation?
        i. Did you keep your control variables the same throughout your investigation?
    c. What could you improve on if you were to complete this experiment again to make your results more reliable and / more accurate?

Measuring:

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



Working Scientifically Target Sheet:

Big Picture: Science involves asking questions, investigating and observing the world around us. What does a scientist need to do to be safe and collect accurate results?

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





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
Safety in a science classroom is important to keep yourself and others safe. • Safety rules include: • Bags should be put in cupboards. • Hair should be tied up. • Safety goggles to be worn at all times during a practical • No eating or drinking in a science classroom. • Practical work to be completed whilst standing up. • If anything is spilt, inform a teacher. • Broken glassware to be swept up and placed in a glass bin. • All equipment to be placed in the middle of the table. • All washing up to be placed in the washing up bowl when clearing away. • Classrooms to be left in the same condition they were found.		
Hazard symbols: explosive, flammable, oxidising, gas under pressure, toxic, corrosive, health hazard, serious health hazard, hazardous to the environment.		
Accuracy the value closest to the true value.		
Precision how close together measurements are.		
A ruler is used to measure the length of an object, in cm and / or mm.		
Volume of a liquid is measured using a measuring cylinder. The units for measuring volume are cm^3.		
Mass is measured using a balance. The units for measuring mass are grams.		
A Bunsen burner is used to heat things using an open flame.		
• The flame on a Bunsen burner can be orange - safety flame or blue - roaring flame. • The safety flame must be used when not using the Bunsen burner. • The blue flame must be used for heating.		
Solid water (ice) melts at 0˚C Liquid water boils at 100˚C		
The volume of water is measured using a measuring cylinder.		
Temperature is measured in ˚C using a thermometer.		
Time is measured in seconds using a stopwatch.		

Knowledge Organiser:

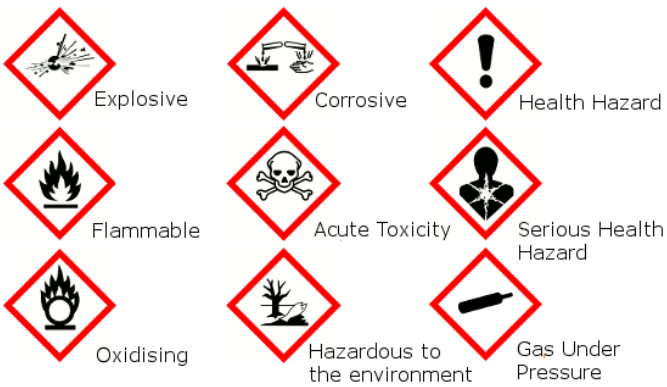
Accuracy	The value closest to the true value.
Precision	How close together measurements are.
Oxidising	Provides oxygen and can cause a fire or explosion.
Explosive	Chemical is unstable and could explode.
Flammable	Catches fire easily.
Gas under pressure	Compressed gas could explode if damaged or heated.
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.

Safety in the lab:

Science labs can be a dangerous place if they are not used sensibly and safely so we have to follow rules in the lab:

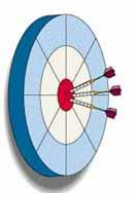
- Do not run around or play in the lab.
- Long hair is to be tied up.
- Safety goggles must be warn.
- Bags to be placed in the racks.
- Stand up, no sitting down.
- Chairs tucked under the desks.
- No eating or drinking.

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



Measuring:

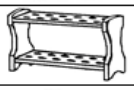
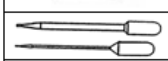
- Accuracy the value closest to the true value.
- Precision how close together measurements are.



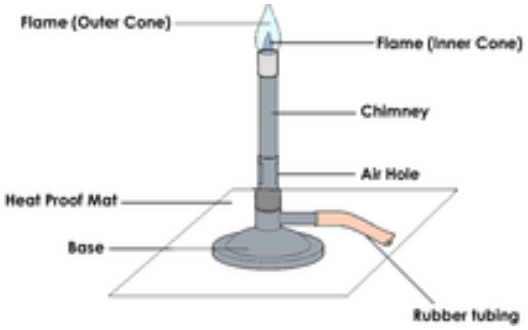
Accurate and precise – accurate = the darts are all on bullseye, precise = the darts are all close together.

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

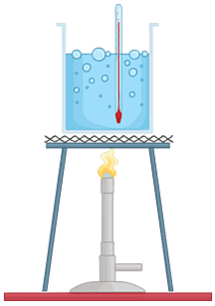
Lab Equipment:

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

Bunsen Burner:



Boiling water:



Solid water (ice) melts at 0°C, liquid water boils at 100°C.

Risk Assessments:

Hazard	Nature of Hazard(s)	Control Measures to Reduce Risk
Glass Beaker	Glass beaker could smash. Broken glass could lead to cuts.	Wear eye protection. Care when handling glassware.
Boiling Water	Care with boiling water as this could cause scalds.	Wear eye protection. Teacher to pour boiling water into flask. Do not have equipment set up to near the edge of the bench, to avoid knocking and spilling boiling water.

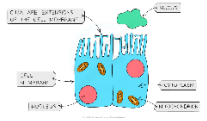
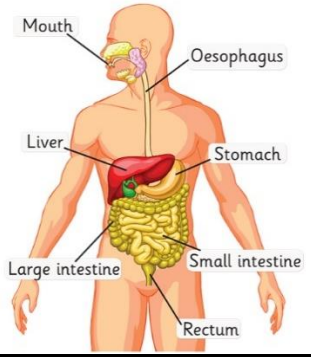
Organisms Learning Journey:

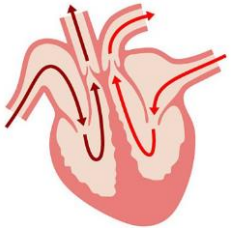
Big Picture: All are made up of cells, the organisation of these cells leads to different organs, organ systems and organisms. How do our circulatory system and digestive systems work?

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.

Physics: respiration is the process of living things releasing energy.

	First School	Year 6	Year 7	Year 8	Year 9
Cells and organisation	• Main body parts head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth. • 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 • A collection of cells working together make tissues. • A collection of tissues working together make organs. • A collection of organs working together make an organ system. • A group of organ systems working together make an 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.
Digestive system	• Teeth are used to break down food. • The digestive system contains mouth, tongue, teeth, oesophagus, stomach, small and large intestine. • Humans have different types of teeth. • Animals including humans need the right types and amount of nutrition, they can't make their own food, their nutrition comes from what they eat.	• The organs in the digestive system are the mouth, oesophagus, stomach, small intestine, large intestine. • The digestive system breaks down large molecules into smaller molecules. • Humans need to have a balanced diet containing carbohydrates, protein, fat, fibre, water, vitamins and minerals to be healthy.	• The organs in the digestive system are the mouth, oesophagus, stomach, small intestine, large intestine, pancreas, gall bladder. 	• Digestion is the break down of large insoluble molecules into smaller soluble ones for absorption. • The organs of the digestive system are adapted to allow for efficient absorption of nutrients, this includes villi to increase the surface area of the small intestine. • Peristalsis is the contraction and relaxation of muscle to move food along. • Bile emulsifies fats increasing their surface area of digestion. • Enzymes are biological catalysts that are found in the digestive system to speed up the break down of large molecules.	• Bacteria are important in the human digestive system. • Enzymes are affected by different factors including temperature, pH and substrate concentration.

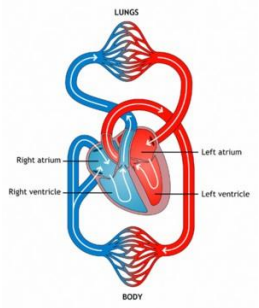
Circulatory System	• The heart is an organ in the body. 	• The circulatory system is made of the heart, blood vessels and blood. The heart has four chambers. • Water and nutrients are transported in animals in the blood. Red blood cells carry oxygen around the body. • White blood cells fight infections. • Platelets help the blood to clot. • Blood vessels carry blood around the body. • There are three types of blood vessel: arteries, veins, capillaries. • Pulse rate is the number of beats per second. • Pulse rate is measured using the first and second finger, placed on the artery in the wrist. Count the number of beats that happen for 30 seconds and multiply the number by 2. • The pulse rate is higher when we exercise as the heart pumps faster to transport the oxygen and glucose round the body to allow increased respiration to release more energy.	• The heart is an example of an organ.	• Small molecules from digestion are dissolved in plasma and travels round the body.	

Food Technology:

- Food is digested through the digestive system.
- Healthy balanced diet.

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.



PSCHE:

Healthy diet is required to keep a healthy body – including maintaining a healthy weight and reducing the risk of cardiovascular disease.

Health Learning Journey:

Biology:
Digestive system, circulatory system, reproduction.

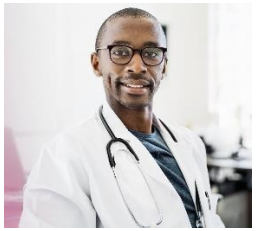
Chemistry:
The chemical compounds in cigarettes, drugs and some food substances can diffuse from the mothers blood to the foetus.

First School	Year 6	Year 7	Year 8
• Hygiene and exercise are important for human survival. • Exercise and nutrition are important for human survival. • Humans get nutrition from the food that they eat and need the right amounts and types of nutrition.	• Diet, exercise, drugs and lifestyle can have negative effects on the body. • A balanced diet contains a variety of food, with all food groups present in appropriate proportions. • A drug is a chemical that has an effect on the body. Drugs that are used to treat an illness are called medicines. • Medicines can be addictive this means feeling you can't stop even when it might be bad for you. • Alcohol is a legal drug but there are restrictions and recommended limits on its use. • Alcohol can have negative impacts on the body, these can include feeling sick, tired, loss of balance, problems with speech, vomiting. • Alcohol can also have long term effects on the body such as cancer, increased risk of heart attack, cirrhosis of the liver, inflammation and bleeding from parts of the digestive system. • Smoking can have long term health effects, is expensive and is extremely addictive. • Smoking can cause cancer, smells and discolouration of the skin, increased risk of heart attack, increased heart rate. • Exercise can help us to: control our weight, reduce the risk of heart disease, improve mood and mental health, improve balance, strengthen muscles and bones, improve sleep	Alcohol and drugs can pass through the mother's blood to a foetus through the umbilical cord and placenta.	• A balanced diet is needed for a healthy body. • A balanced diet involves getting the right proportions of each food group. • A balanced diet should contain carbohydrates, protein, lipids, vitamins and minerals, fibre, water. • Too little food can cause starvation. • Too much food, particularly fatty food, may cause obesity and coronary heart disease. • Malnutrition happens when people do not eat the right amounts of nutrition. • Smoking is addictive due to the presence of nicotine; it also causes the build-up of tar in the lungs which reduces the amount of gas exchange that can happen as it coats the walls of the alveoli. • Asthma is a respiratory disease that when an asthma attack is triggered it causes the restriction of the airways.

PSCHE:
Understanding how to lead a healthy life style, knowing the impact of making healthy choices regarding diet, drugs, alcohol, smoking and exercise.

Food Technology:
Understanding how a balanced diet and food choices can impact on staying healthy.

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


Organisms Target Sheet:

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

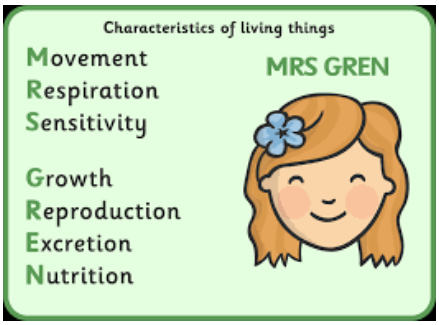
Red = I know nothing **Amber = I know something** **Green = I feel confident with this**

Key Knowledge	Confidence before topic - RAG	Confidence after topic - RAG
The seven life processes are: movement, reproduction, sensitivity, growth, excretion, nutrition.		
Cells --> tissue --> organ --> organ system --> organism		
Blood circulates the body providing nutrients and removing waste substances to the tissues around the body.		
Red blood cells carry oxygen around the body.		
White blood cells fight infections.		
Platelets help the blood to clot.		
Plasma transports dissolved substances such as nutrients and waste substances.		
Blood vessels carry blood around the body.		
There are three types of blood vessel: arteries, veins, capillaries.		
The heart contains 4 chambers		
The circulatory system consists of the heart, blood vessels and lungs.		
There are 5 types of scientific enquiry observing over time, fair testing, research, pattern seeking, sorting and classifying.		
Independent variable - the thing you change.		
Dependent variable - the thing you measure.		
Control variable - the things you keep the same.		
Pulse rate increases after exercise as the body needs more oxygen and glucose, these are pumped round the body in the blood.		
Digestion is the process of breaking down large molecules into small molecules that can move through the intestine wall into the blood stream.		
There are three main types of teeth - incisors, canines, molars.		
Food travels from the mouth through the oesophagus --> stomach --> small intestine --> large intestine.		
A balanced diet contains a variety of food, with all food groups present in appropriate proportions.		
A drug is a chemical that has an effect on the body. Drugs can be legal, such as medicines, or illegal.		
Alcohol is a legal drug but there are restrictions and limits on it's use. Alcohol can short and long term effects on the body.		
Smoking cigarettes can have long term health impacts and it is addictive as it contains the drug nicotine.		
Exercise is important for both our physical and mental wellbeing.		

Knowledge Organiser:

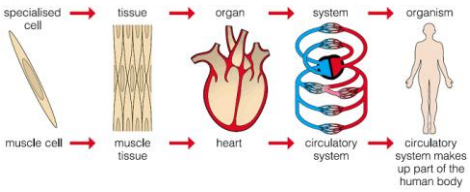
Alcohol	A substance made from the fermentation of grains, fruit or vegetables.
Artery	The type of blood vessel that carries oxygenated blood away from the heart, with thick walls and carrying high pressure blood.
Balanced diet	A diet that contains the appropriate amounts and proportions of each type food group.
Blood vessel	A tube that carries blood around the body as part of the circulatory system.
Capillary	The smallest type of blood vessel that carries blood through tissues.
Carbohydrate	Large molecule required in the diet for energy.
Cell	The basic unit of an organism, contains smaller parts called organelles to carry out life processes**.**
Circulatory system	Organ system responsible for transporting blood around the body.
Digestion	The process of breaking down large molecules into small molecules that can move through the intestine wall into the blood stream.
Digestive system	Organ system responsible for breaking down and absorbing food.
Drug	A chemical that has an effect on the body.
Heart	The organ that pumps blood around the body.
Lipid (fat)	Large molecule required in the diet for insulation and energy storage.
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.
Organism	Any living thing.
Platelet	Small segments of cells that allow the blood to clot forming scabs.
Protein	Large molecule required in the diet for growth and repair.
Red blood cell	The cells found in the blood that carry oxygen round the body.
Tissue	Group of cells of one type.
Vein	The type of blood vessel that carries deoxygenated blood towards the heart, thin walls, low pressure blood and valves to prevent blood flowing backwards.
White blood cell	The cells found in the blood that fight infections.

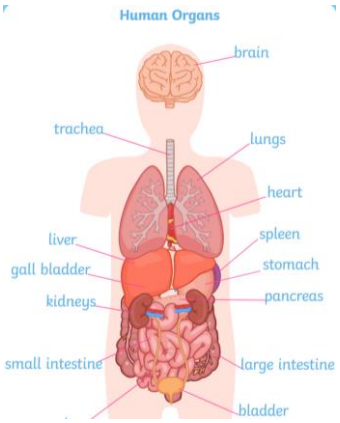
Seven Life Processes:



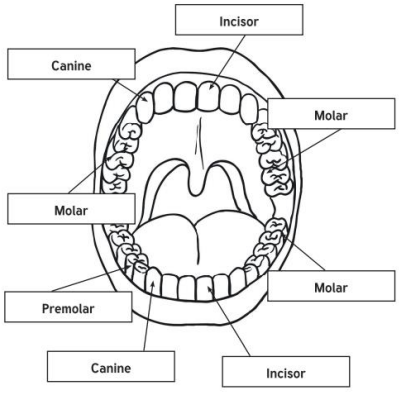
Organisation:

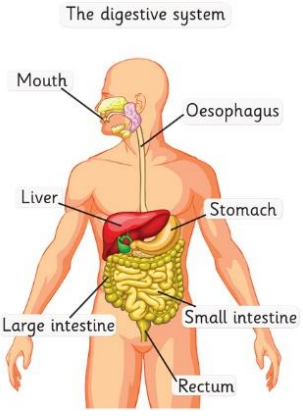
Cells are described as the building blocks of life. Cells can be organised to create multicellular organisms. (multi = many)

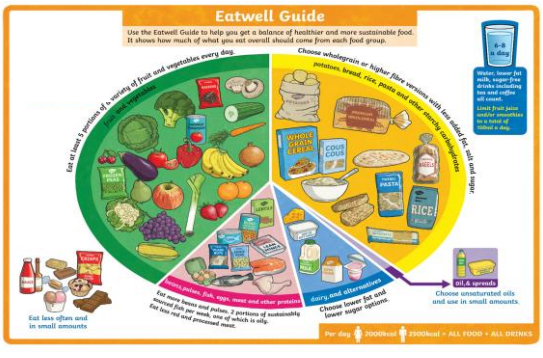




Digestive System:

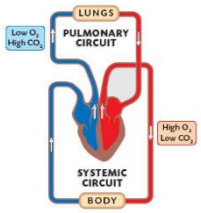






The Circulatory System:

The circulatory system carries blood around the body to deliver oxygen, glucose and nutrients to where they are needed, it then transports waste substances for excretion.

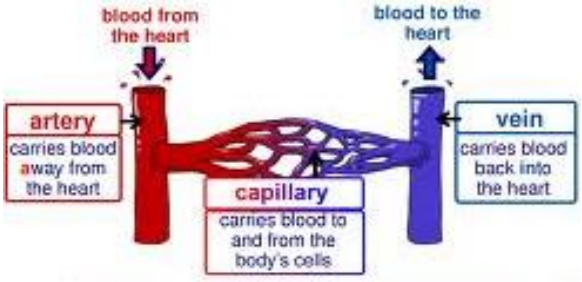


Components of blood:

Blood is made of four main components:

- Red blood cells – carry oxygen around the body.
- White blood cells fight infections.
- Platelets – blood clotting.
- Plasma – the liquid that carries the components and dissolved substances such as nutrients and water.

Blood Vessels:



The Heart and Exercise:

- When we exercise our heart rate and breathing rate increase.
- When we exercise we need more energy in our muscles.
- To release more energy, our muscles need to do more respiration which needs oxygen and glucose.
- The heart pumps faster to transport more glucose and oxygen around the body in the blood.

Health:

Drugs:

- A drug is a chemical that has an effect on the body.
- Drugs can be legal or illegal.
- Legal drugs are medicines such as painkillers, antibiotics, anesthetics.
- Illegal drugs are ones which it is against the law to use or distribute such as cannabis, psychedelics (magic mushrooms, LSD) and stimulants (ecstasy and cocaine).

Alcohol:

Alcohol is made from grains, fruit and vegetables in a process called fermentation. It is a drug with restrictions on limits and age of consumption. Excess drinking can lead to short and long term effects.

Smoking:

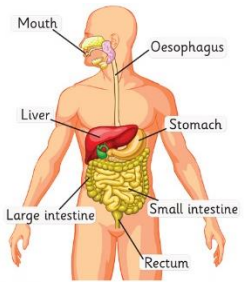
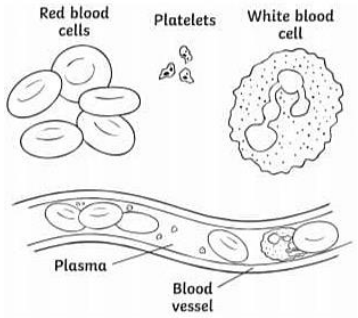
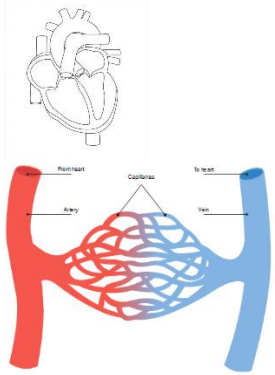
Smoking is bad for health and can cause major damage to the body resulting in cancer and chronic issues with the heart and lungs. Smoking is addictive due to the nicotine found in cigarettes.

Exercise:

Exercise has positive impacts on physical and mental wellbeing, these include:

- Help you control your weight.
- Reduce your risk of heart diseases.
- Improve your mental health and mood.
- Help keep your thinking, learning, and judgment skills sharp as you age.
- Strengthen your bones and muscles.
- Improve your sleep.

Organisms Revision:

Organisation:	*Digestive System:* 
Blood: 	*Exercise:*
Heart and Blood Vessels: 	*Health (diet, drugs, alcohol, smoking):*

Electricity Learning Journey:

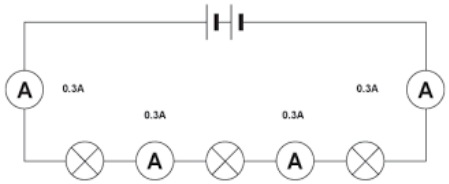
Big Picture: Electricity and light are two fundamental physics ideas that we use in our everyday life. How do circuits and light allow us to live our lives effectively?

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

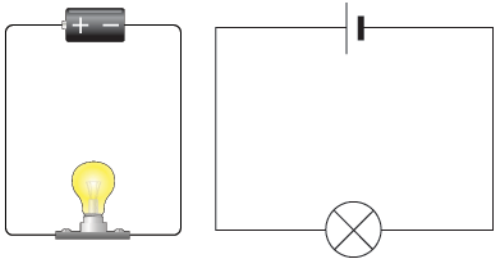
Chemistry:
- Materials – metals are conductors of electricity, insulators do not conduct electricity.
- Atoms contain negatively charged electrons, these freely flow through a metal.

First School	Year 6	Year 7	Year 8	Year 9
• Many appliances in the home run on electricity. • 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.	• Electricity can be dangerous and needs to be used carefully. • Circuits are drawn using standard circuit symbols. • Conductors allow electricity to pass through them - example - metals. • Insulators do not allow electricity to pass through them - examples: rubber, plastic. • 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

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.

Waves Learning Journey:

Biology:

- The cells in the retina of the eye, detect changes in light allowing us to see.
- The structure of the ear allows vibrations to travel through the ear and along the auditory nerve to the brain.

Chemistry:

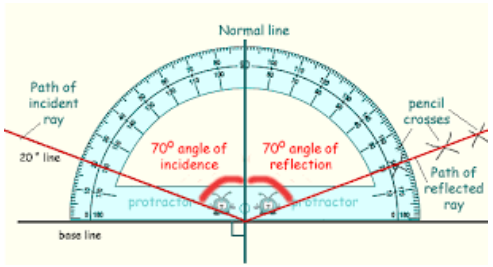
- Solid particles are touching each other, they vibrate. Gas particles are far apart.

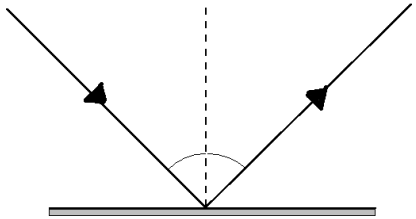
First School	Year 6	Year 7	Year 8	Year 9
• Light is needed to see things in the dark. • Light is reflected from surfaces. • Light from the sun can be dangerous and there are ways to protect your eyes. • Shadows are formed when the light from a light source is blocked by an opaque object. • The size of a shadow changes depending on the distance the light source is from the opaque object. • Opaque objects let no light through.	• Light travels in straight lines. • Light is emitted from a luminous object. • Objects can be seen when light from a light source reflects off a surface, this can be shown using a ray diagram. • Transparent objects let light through. • Translucent objects let some light through. • A shadow forms when light is blocked by an opaque object. • Shadows get bigger if the object moves closer to the light source. • Shadows have the same shape as the objects that cast them. • Reflection is when light bounces off a surface. • The direction of light can be shown on a ray diagram. • The law of reflection states that the angle of incidence is equal to the angle of reflection.		• Light is a transverse wave. • Speed of light is 300, 000, 000 m/s. • Light is reflected off a reflective surface. • Light refracts when it hits objects off a different density. White light Is made from the seven colours of the spectrum. • Objects can be seen when white light hits them, they absorb all the colours of light except for the colour of the object which is reflected. • Light travels in a straight line from a source to and object, it is reflected back to our eyes. • Light waves can travel through transparent and translucent substances. • Light cannot travel through an opaque material. The law of reflection states that the angle of incidence equals the angle of reflection. • The different parts of a rough surface, point in different directions, so the light reflects in different directions - this is diffuse scattering. • Refraction happens when light changes speed causing it to change direction. • A lens is a piece of glass or other transparent material with curved sides for concentrating or dispersing light rays. • Light is refracted when it enters the prism and each colour is refracted by a different amount. • When white light hits a surface, the colour of that surface is reflected, the other colours are absorbed.	

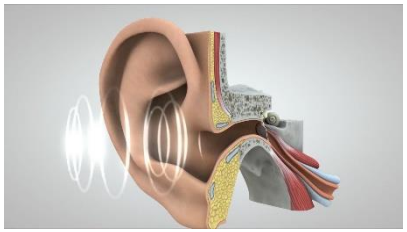
Maths:
Reflection – using a protractor and measuring angles.

Art:
Drawing diagrams to show reflection.

PSHCE:
Health – ensuring that sounds are not too loud and lights too bright that they will damage the ears and eyes.







Waves and Electricity 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
Electricity is dangerous and needs to be used safely. • Electrical appliances need to be kept away from water • Do not put anything inside a plug socket. • Electrical hazard signs are used in areas where there is high voltage electricity.		
Electricity comes into our homes at 230 V.		
Circuits are drawn using a pencil and ruler, to draw 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.		
If there is a gap in a circuit, it is incomplete and the current can't flow.		
A conductor is a material that will allow electricity to pass through it. An example of a conductor is a metal.		
An insulator is a material that will not allow electricity to pass through it. An example of an insulator is plastic.		
Adding more cells to a circuit will make a bulb brighter. Adding more bulbs to a circuit will make the bulbs dimmer.		
Light is emitted from a luminous object. Examples of luminous objects include the sun, electrical lights and fire.		
Non-luminous objects can be seen when light reflects off them and into our eyes.		
Light travels in straight lines.		
Opaque objects do not allow light to pass through them.		
Translucent objects allow some light to pass through them.		
Transparent objects let all the light through them.		
Shadows are formed when an opaque object blocks the light.		
If an opaque object is moved closer to the light source, more light is blocked creating a larger shadow.		
Reflection is when light bounces off a surface.		
The law of reflection states that the angle of incidence is equal to the angle of reflection.		

Careers:

Lighting engineers, health and safety officers, photographers, optometrists, electronic repair technicians, commercial electricians, paramedics.



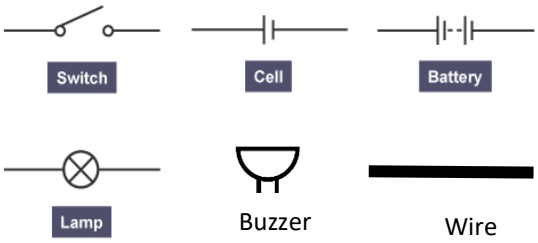



Knowledge Organiser:

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.
Complete circuit	A circuit that has no gaps that will let the electrical current flow round them.
Component	The objects that a circuit provides energy too.
Conductor	A conductor is a material that will allow electricity to pass through it.
Incomplete circuit	A circuit with a gap that will not allow an electrical current to pass through them.
Insulator	An insulator is a material that will not allow electricity to pass through it.
Luminous	An object that emits (gives out) light.
Non-luminous	Objects that can be seen when light reflects off them and into our eyes.
Opaque	Objects that do not allow light to pass through them
Shadow	A shadow forms when an opaque or non-transparent object blocks light from passing through and reaching a surface on the other side.
Translucent	Objects that allow some light to pass through them
Transparent	Objects that let light pass through them
Variable	Something that can be changed and have an effect in an investigation.

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.



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.

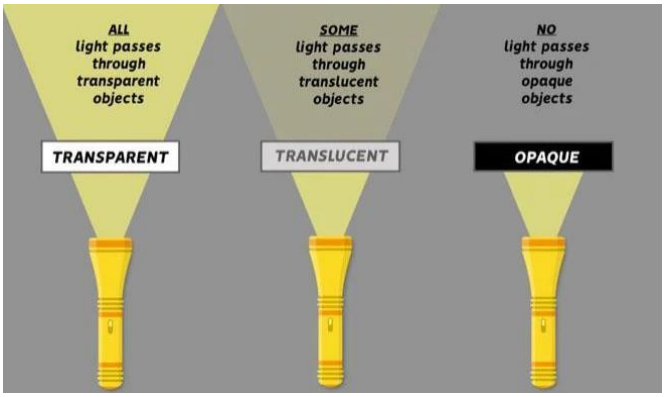
Conductors and Insulators:

A conductor allows electricity to pass through it.

An insulator does not allow electricity to pass through it.

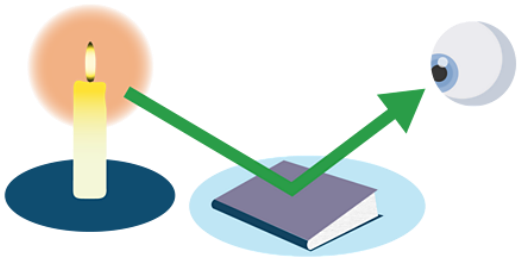
Light:

Light is emitted from **luminous** sources. It can be **transmitted** through, **reflected**, or **absorbed** by non-luminous objects.



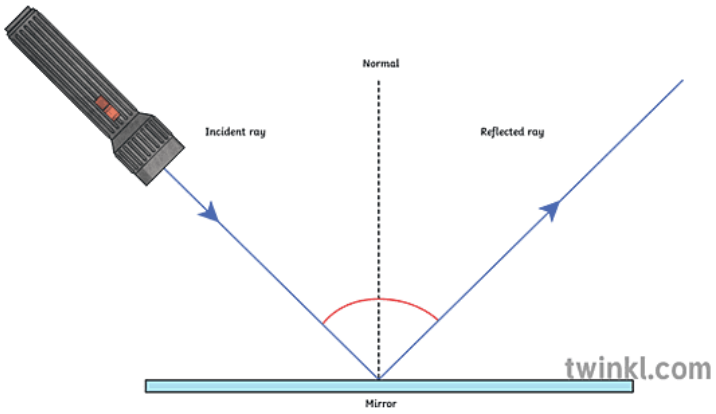
Seeing objects:

To see an object, light travels from the object, hits a surface and reflects off it.



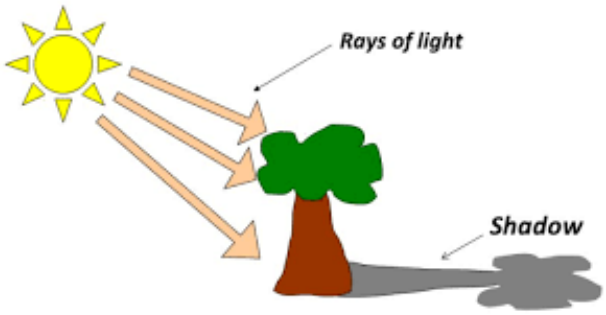
Reflection:

The **law of reflection** says that the angle of **incidence** equals the angle of **reflection**.



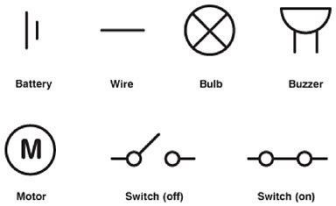
Shadows:

Opaque objects block the light.
The shadow is showing where the light has been blocked by the object.



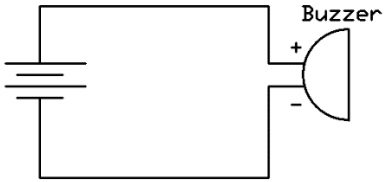
Electricity and Waves Revision:

Circuits:

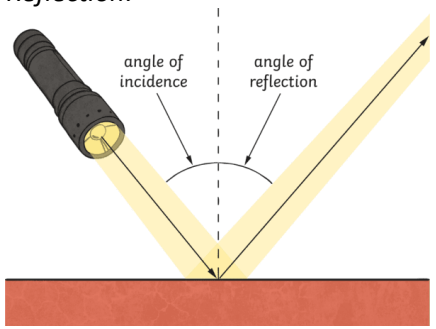


Light:

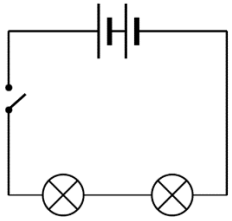
Investigating Buzzers:



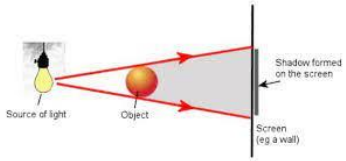
Reflection:



Investigating Bulbs:



Shadows:



Ecosystems Learning Journey:

Big Picture: There are millions of species of plants and animals on Earth, how do we know what they are and how to group them?

	First School	Year 6	Year 7	Year 8
Classification	• There are differences in common animals - fish, amphibians, reptiles, birds, mammals. • Some animals are kept as pets. • Environment changes can change and this can pose a danger to living things. • There are differences in the life cycles of a mammal, an amphibian, an insect and a bird. • Trees can be grouped into deciduous and evergreen trees. • Animals with a backbone are called vertebrates - fish, amphibians, reptiles, birds and mammals. • Animals without a backbone are called invertebrates - slugs, snails, worms, spiders, insects. • Plants can be grouped into categories including flowering plants (including grasses) and non-flowering plants (including ferns and mosses).	• Organisms are classified into groups based on their characteristics. • Linnaeus was the first scientist to systematically categorise all living things. • Organisms can be split into groups including microorganisms, plants and animals. • Animals are split into two groups: vertebrates and invertebrates. • There are 5 groups of vertebrates Amphibians, Birds, Fish, Mammals and Reptiles. • That invertebrates are creatures that do not have a backbone. • There are 5 groups of plants. Flowering plants, conifers, ferns, mosses and algae. • Keys are used to group organisms based on their visible characteristics.		
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.	
Interdependence	• Living things in a habitat depend on each other for survival. • 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. • They are referred to as producers. • 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.

Maths:
Using keys and graphical diagrams for classification.

Food Technology:
Energy moves through the food chain based on what eats what.

History:
Theories change over time based on evidence from a variety of sources.

Geography:
Relationships within ecosystems shows the dependence on each other.

Genes Learning Journey:

Big Picture: How do our physical and behavioural characteristics lead to our survival and the evolution of a species over time?

Chemistry:
DNA is a chemical structure.
Chemicals in the environment can cause environmental variation.

First School	Year 6	Year 7	Year 8	Year 9	GCSE
	• 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 its interaction with the environment influence the development of the phenotype of an organism. • Differences in the characteristics of individuals in a population may be due to differences in genes inherited, environmental conditions or a combination of both. • 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.

Maths:
Different types of graph are used for plotting different types of variation.

Geography:
Variations within human species leads to diversity on Earth.

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**

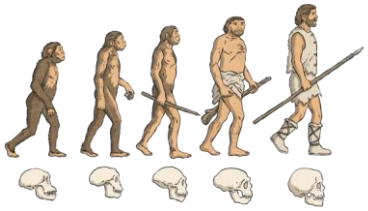
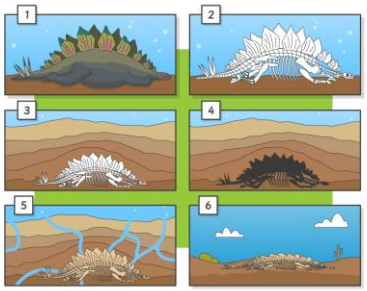
Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
A habitat is the area where a particular organism can get all it needs to survive, shelter, space, resources, mating and nesting sites.		
An adaptation is a characteristic that helps an organism to survive in its habitat.		
Herbivores eat only plants.		
Carnivores eat only meat (other animals).		
Omnivores eat a mixture of meat and plants.		
Predators hunt and eat other animals.		
Prey are hunted by and eaten by other animals.		
Plants are the producers in food chains and get their energy from sunlight, in a process called photosynthesis.		
Arrows in a food chain show the movement of energy from one organism to another when it is consumed.		
Living things are classified based on their characteristics.		
Vertebrates are animals with a backbone.		
There are 5 classes of vertebrate: Amphibians, Birds, Fish, Mammals and Reptiles.		
Amphibians have moist scaleless skin, lay eggs in water and are cold-blooded.		
Birds are covered in feathers, they lay eggs and are warm-blooded.		
Fish are covered in scales, breath under water and are cold-blooded.		
Mammals are covered in fur, feed their young with milk and are warm-blooded.		
Reptiles are covered in scales, lay eggs and are cold-blooded.		
That invertebrates are animals that do not have a backbone.		
Invertebrates can be split into groups including annelids, molluscs, insects, crustaceans, arachnids.		
There are 5 groups of plants. Flowering plants, conifers, ferns, mosses and algae.		
Flowering plants produce seeds and these grow from flowers.		
Conifers produce seeds and these do not grow from flowers		
Ferns do not produce seeds and they have clear leaves and stems.		
Mosses do not produce seeds and they do not have clear leaves and stems.		
Algae live in water have no roots, stems or leaves.		
Keys are used to group organisms based on their visible characteristics.		
Variation is the presence of differences between living things of the same species.		
Inherited characteristics are passed on from mother and father in their DNA.		
Environmental characteristics are a result of the environment and surroundings.		
Members of the same species reproduce to produce fertile offspring.		
Natural Selection is the process by which a species changes over time in response to changes in the environment, or competition between organisms, in order for the species to survive i.e. survival of the fittest.		
Evolution is the process of change to animals and plant species over a long period of time.		
Fossils are the remains of dead plants and animals that take millions of years to form. Fossils can provide evidence of evolution.		

Careers: Conservationist, Genetasist, Zoo Keeper, Geographer, Breeder, Gardener

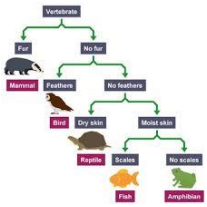
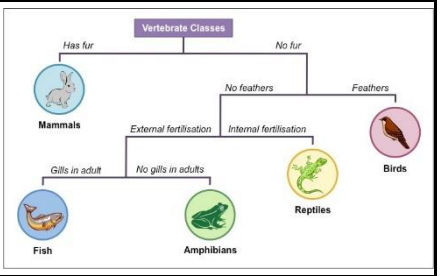
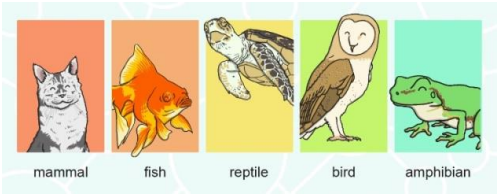


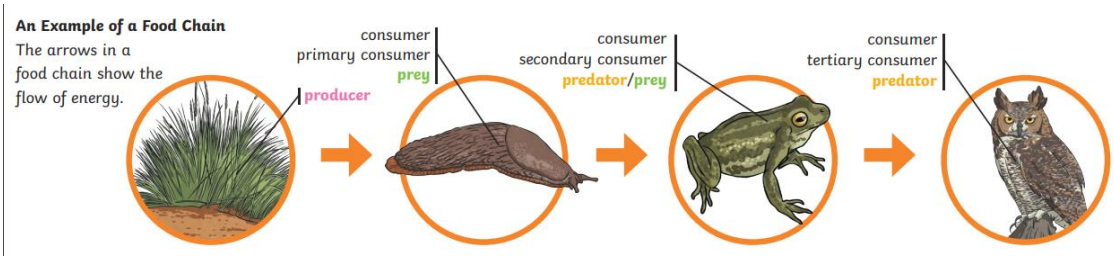

Knowledge Organiser:

Genes:

Adaptation	These are special features that plants and animals develop to suit the place where thy live. 
Environmental Variation	These are differences between individuals that are not inherited but caused by the environment that the organism has lived in, including scars and tattoos. 
Evolution	Is the process by which living things change over time, over many generations and relies on the process of natural selection. 
Fossils	Fossils are imprints of long dead plants and animals found in rocks. They are important because they were formed many millions of years ago. This means they can tells how plants and animals on earth used to look. 
Gene	A gene is a section of DNA that is responsible for a characteristic like eye colour or blood group.
Genetic Variation	These are differences between individuals that are inherited from parents, such as the colour of your eyes, hair and skin. 
Habitat	A place where an organism makes its home. It provides shelter, food, water and space. 
Offspring	Is the product of reproduction.
Survival of the fittest	Individuals with characteristics most suited to their environment are more likely to survive and reproduce
Variation	The differences in characteristics between individuals of the same species.

Ecology:

Carnivore	An animal that feeds on other animals. 
Classification	The arrangement of organisms into groups based on characteristic. 
Ecosystem	All the organisms living in a particular area and the non-living components that the organisms interact with
Herbivore	An animal that inly eats plants. 
Invertebrates	An animal that doesn't have a back bone. 
Keys	A key is a set of questions about the characteristics of living things. You can use a key to identify a living thing or decide which group it belongs to by answering the questions. 
Omnivore	An animal that eats plants and animals. 
Population	All the organisms of one species found in a particular area
Predator	An animal that hunts and eats other animals.
Prey	An animal that get hunted and eaten by another animal
Producer	An organism, such as a plant, that produces it own food.
Species	A group of organisms capable of breeding with each other to produce fertile offspring
Vertebrates	An animal that has a backbone. 



Classifying vertebrates:

Class of vertebrates	Where do they live?	How do they produce young?	What covers their bodies?	Hot or cold blooded?	Extra features	Examples of this group
Fish	In water	Lay soft eggs	Scales and fins	Cold blooded.	Breathe using gills	Cod, salmon
Reptiles	On land	Most lay eggs. Some give birth to live young.	Scales	Cold blooded	Ear holes, dry skin, four or no legs.	Snakes, lizards
Birds	On land	Lay eggs	Feathers and wings	Warm blooded	Ear holes, two legs.	Penguins, sparrows
Amphibians	On land or in water	Soft jelly like eggs	Skin	Cold blooded	Moist skin	Toads, frogs, salamanders.
Mammals	On land	Live young	Hair or fur	Warm blooded	Produce milk to feed young	Humans, dolphins,

Classifying invertebrates:

Class	Characteristics
Insect	Exoskeleton covering their body. Body has three parts. Many have wings. 
Crustacean	Hard, external shell. Mostly live in oceans or other waters. Many have claws. Head and abdomen. 
Mollusc	Live on land or in water. Soft, skin like organ covered with a hard shell. 
Arachnid	4 pairs of legs. Hard exoskeleton. Jointed legs for walking. No antennae. 
Annelid	Bodies divided into segments. No limbs. Some have long bristles, some have shorter bristles and appear smooth. 

Classifying plants:

Seeded or non seeded?	Type of plant	Characteristics
Seeded plant	Flowering plants.	These plants grow specialised parts for reproduction called flowers and from these flowers grow their seeds.  
Seeded plant	Conifer	These plants grow parts for reproduction from their leaves or stems and from these grow their seeds.  
Non-seeded plant	Ferns	These plants have stems and root systems. They release billions of spores instead of seeds. They are different as they are much smaller than seeds.  
Non-seeded plant	Mosses	These plants do not stems and root systems. They release billions of spores instead of seeds. They are different as they are much smaller than seeds.  

Ecosystems Revision:

Variation:	*Classifying Animals: Vertebrates*
Natural Selection:	*Classifying Animals: Invertebrates*
Evolution:	*Classifying Plants:*

Forces Learning Journey:

Big Picture: Forces cause objects to move, change speed and shape. What forces impact your life everyday?

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.

First School	Year 6	Year 7	Year 8	Year 9
• Some forces need contact between two objects, however magnetic forces can act at a distance. • Objects fall to Earth because of gravity. Air resistance slows falling objects. • Water resistance slows objects that are moving through it. • Friction slows down a moving object when two surfaces rub together. • 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

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.

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.		
Friction happens when two surfaces are trying to slide over each other.		
Friction acts in the opposite direction to the movement of the object.		
Rough surfaces create more friction, so more force is needed to move an object.		
Smooth surfaces create less friction, so less force is needed to move an object.		
Drag is created when resistive forces such as air or water resistance slow down a moving object.		
Streamline shapes reduce the effects of drag.		
Smooth fabrics are used by athletes to reduce drag.		
Objects float because the upthrust and weight are balanced.		
Objects sink because the upthrust force is bigger than the weight, these forces unbalanced.		
Air resistance is created when air particles hit an object that is moving through the air, they create a force that slows down the moving object.		
Water resistance is created when water particles hit an object moving through water and slow it down.		

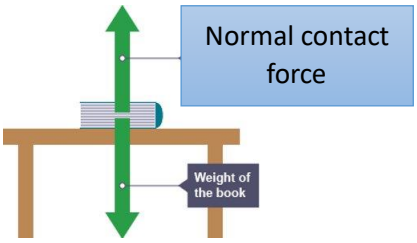
Forces Knowledge Organiser

Air resistance	A force created when air particles collide with a moving object.
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.
Drag	Created when resistive forces such as air or water resistance slow down a moving object.
Floating	An object will sit on top of a liquid – for example a ping pong ball on a cup of water.
Force	Push or pull that arise from the interaction between two objects.
Friction	A force that happens when two surfaces are trying to slide over each other.
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.
Sinking	An object will go under a liquid – for example a heavy weight in water would sink below the surface.
Streamline	An object that is shaped to travel through air or water with as little resistance as possible.
Unbalanced forces	When two forces are different sizes and cause an object to speed up, slow down or change direction.
Water resistance	A force created when water particles collide with a moving object.

Contact and non-contact forces:

Contact forces happen when two surfaces are touching each other.

Example:



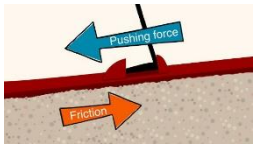
Contact forces include: friction, air resistance, water resistance, normal contact force, tension.

Non-contact forces happen when two surfaces aren't touching.

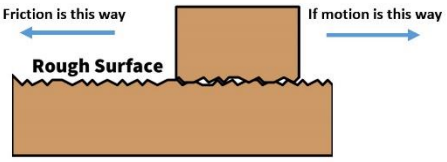
Example:

Friction:

Whenever an object moves against another object, it feels frictional forces. These forces act in the opposite direction to the movement. Friction makes it more difficult for things to move.

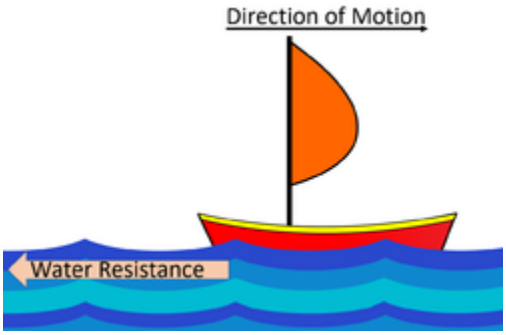


Frictional forces are much smaller on smooth surfaces than on rough surfaces, which is why we slide on ice but not on concrete.



Air Resistance:

Water Resistance:



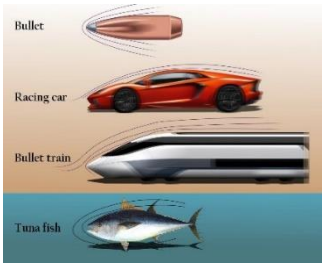
A larger surface area = more air resistance.

A smaller surface area = less air resistance.

Drag:

Drag is created by water or air resistance acting against a moving object.

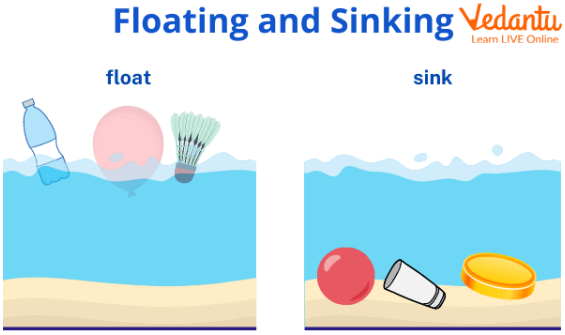
The shape of an object matters when trying to reduce the amount of drag – streamlined shapes reduce the amount of drag experienced.

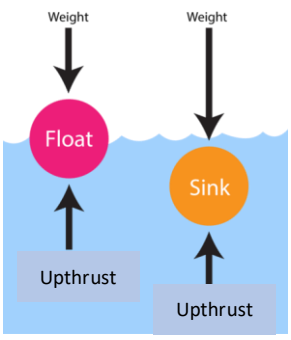


Floating and sinking:

Objects will float, when weight and upthrust are balanced.

Objects will sink, when weight is larger than upthrust.





Forces Revision:

Forces:	*Air Resistance:*
Contact Forces:	*Water Resistance:*
Non-contact Forces:	*Drag:*
Friction:	*Floating and Sinking:*

Matter Learning Journey:

Big Picture: Every material has a number of different properties, that are unique to that material. Why are materials used and how do they interact?

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.

First School	Year 6	Year 7	Year 8	Year 9
• Materials can be grouped based on whether they are solids, liquids and gases. • Solids hold their shape, liquids form a pool, gases escape from an unsealed container. • Water can be a solid, liquid or gas. Ice is solid water. When objects are heated or cooled they change state. • Materials change state when they are heated or cooled. • Evaporation is when a liquid changes from a liquid to a gas. • Condensation is when a gas turns into a liquid. • Solids hold their shapes, liquids form a pool when poured and gases escape from an unconcealed container. • 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.

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.

Materials Learning Journey:

Chemistry:
Materials characteristics arise from the atomic structure and bonding of elements.

Biology:
Materials are used by humans to make shelter, clothes and other resources allowing their survival.

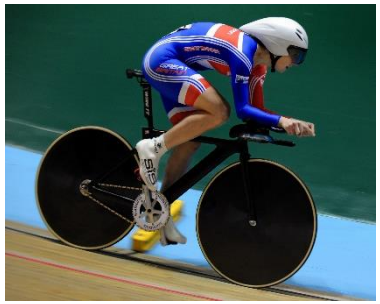
Physics:
Magnetic materials have magnetic fields around them giving rise to magnetic forces.

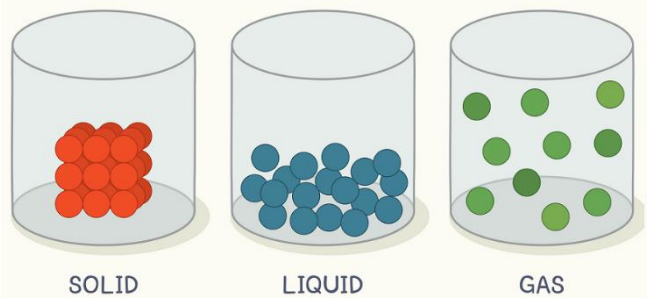
First School	Year 6	Year 7	Year 8	Year 9
• Wood, metal, plastic, glass, brick, rock, paper and carboard all have particular uses depending on their properties. • The shapes of solid objects made from some materials can be changed by squashing, bending, twisting or stretching. • Everyday materials can be grouped based on their properties including their hardness, solubility, transparency, conductivity and response to magnets.	• Materials that are good electrical conductors will be used in electrical equipment such as metals. • Materials with poor electrical conduction will be used as handles of electrical equipment or casings of electrical wiring, for example plastic and rubber. • Materials that are good thermal conductors will be used for pans and radiators for example metals. • Materials with poor thermal conduction will be used as handles of equipment that will become hot or enter hot environments, or to keep heat inside objects, to prevent them cooling. • A transparent material lets all the light through. A translucent material lets some light through. • An opaque material will not let any light through. • Iron, cobalt and nickel are the only magnetic metals. Steel is magnetic because it contains iron.	• 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. • 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).	Iron is a magnetic metal, sulfur is a non-metallic element, iron sulfide is a non-magnetic compound.	

PE:
Sports equipment and clothing is designed with materials that are best suited for the sport.

IT:
Computers are designed with materials that will allow for the conductivity of electricity.

Design Technology:
Materials are chosen and used for specific functions based on their properties.

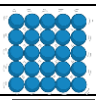




Matter Target Sheet:

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**

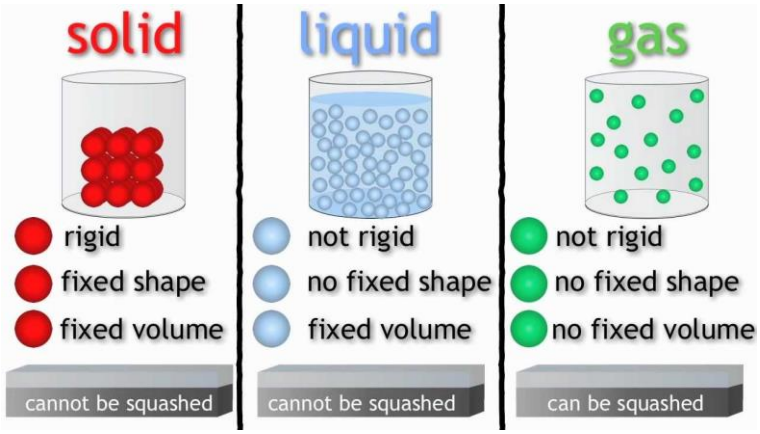
Key Knowledge	Confidence before topic RAG	Confidence after topic RAG
Materials are classified based on their properties.		
• A transparent material lets all the light pass through. • A translucent material lets some light pass through. • An opaque object will not let any light through.		
• An electrical conductor will let electricity pass through. • An electrical insulator will not let electricity pass through.		
Iron, cobalt and nickel are the only magnetic metals. Steel is magnetic because it contains iron.		
There are three states of matter - solids, liquids and gases.		
Solids cannot be compressed, they have a fixed volume and a fixed shape. 		
Liquids cannot be compressed, they have a fixed volume, they take the space at the bottom of the container and can flow. 		
Gases can be compressed, their volume can be changed, they take up the whole container and their shape is not fixed. 		
Changes of state: • Solid to liquid is called melting. • Liquid to gas is called evaporation. • Liquid to solid is called freezing. • Gas to a liquid is called condensation.		
Ice melts at 0˚C.		
Water boils at 100˚C.		
Reversible changes mean that the material can easily be turned back into its original form, for example dissolving and changing state.		
Irreversible changes make something new and cannot be changed back, for example burning.		
Soluble means a substance will dissolve into a liquid.		
Insoluble means a substance will not dissolve into a liquid.		
When a substance dissolves, it might look like it has disappeared, but in fact it has just mixed with the water to make a transparent (see-through) liquid called a solution.		
A solution is a dissolved solute in a solvent.		
Filtration separates the insoluble substance.		

Careers: weather forecaster, ice core analyst, food technologist, nanotechnologist, analytical chemist, chemical engineer, chemical metallurgist, dental technician, materials engineer.

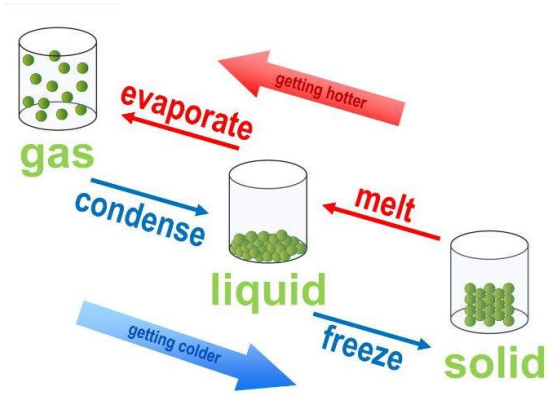
Matter Knowledge Organiser:

Boiling point	The temperature at which a liquid turns into a gas. The boiling point for water is 100°C.
Condensation	When a gas changes to a liquid.
Conductor	Will allow electricity to pass through it.
Dissolving	Some substances dissolve when you mix them with water. When a substance dissolves, it might look like it has disappeared but has in actual fact mixed in with the water particles.
Evaporation	When a liquid changes to a gas.
Filtration	Separating technique to separate an insoluble material from a liquid.
Freezing	When a liquid changes to a solid.
Gas	Can spread and take what ever space you put it in. Volume can change and can be squashed.
Insoluble	Something that cannot dissolve in water.
Insulator	Will not allow electricity to pass through it.
Irreversible	Something that cannot be changed back into its original form.
Liquid	Can flow and take the shape of a container. Volume does not change and cannot be compressed.
Melting	When a solid changes to a liquid.
Melting point	The temperature at which a solid change into a liquid. Different solids melt at different temperatures. Ice melts at 0°C.
Opaque	Will not allow any light through.
Particles	The smallest unit of matter.
Permeable	Will allow water to go into or pass through.
Reversible	Something that can be changed back into its original form.
Solid	Has a fixed shape, volume does not change and cannot be compressed.
Soluble	Something that can dissolve in water.
Translucent	Will allow some light through.
Transparent	Will allow all the light through

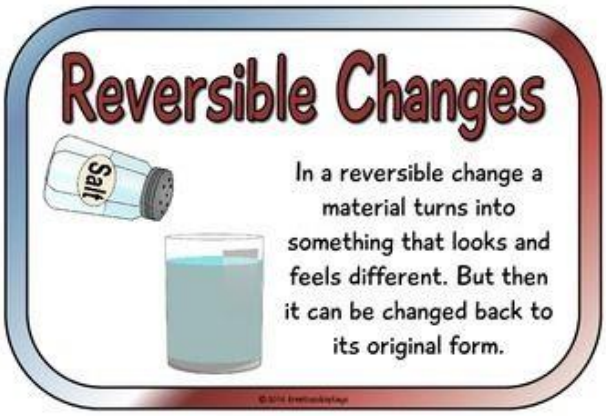
States of Matter:



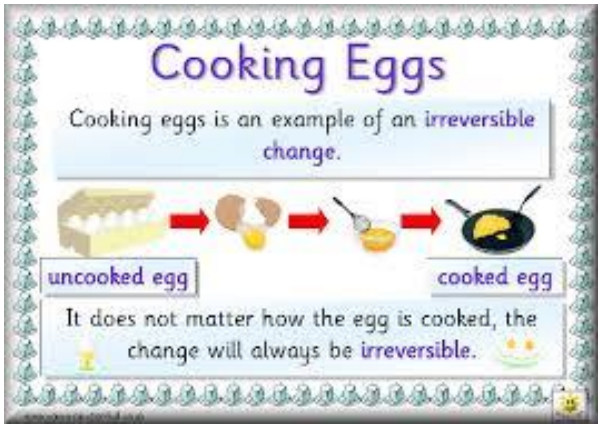
Changes of State:

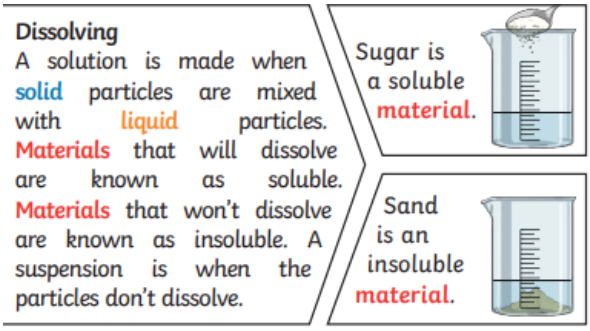


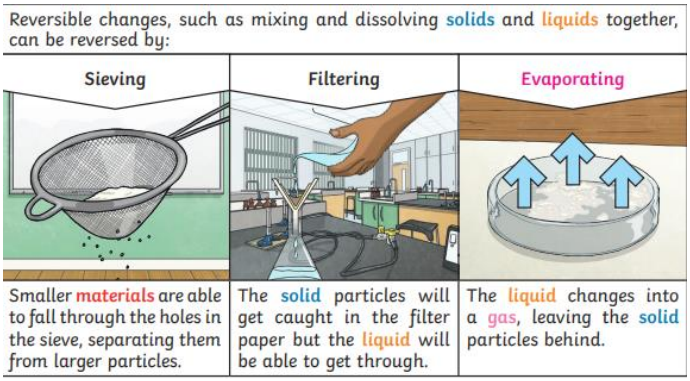
Reversible changes:



Irreversible changes:







Classifying Materials:

Key Knowledge

Different materials are used for particular jobs based on their properties: electrical conductivity, flexibility, hardness, **insulators**, magnetism, solubility, thermal conductivity, **transparency**.

Heating and Burning

Burning is an example of an irreversible change. When you burn wood you get ash and smoke. You cannot change the ash and smoke back to wood again.

Heating most of the time is a reversible change, it involves increasing the temperature of a substance without changing the substances.

Matter Revision:

Reversible and Irreversible:	*Heating and Burning:*
States of Matter:	*Separating Mixtures:*
Changes of State:	*Classifying Materials:*

In Science This Year:

In Science Next Year: