Science Progression Document

Year 4

Topic 1: Chemistry **States of matter** **Key Question: Do I know the difference between solids, liquids and gases? Can I explain how materials change state?**	**Prior learning**: **KS1** – Children will have learnt to compare and group materials on the basis of their simple properties. They will have explored how to change the shape of solids by bending, twisting, squashing and stretching. Future learning **Future Learning:** **UKS2** – Children will use their knowledge of solids, liquids and gases by deciding how materials might be separated, including filtering, sieving and evaporation. They will extend their knowledge and learn about dissolving and mixing and consider if these changes of stateare reversible or irreversible. **KS3** – Children will learn the particulate nature of matter, atoms, elements and compounds. They will learn what pure and impure substances are, including simple techniques of how to separate materials (filtration, evaporation, distillation and chromatology). They will learn about chemical reaction (catalyses, combustion etc) and represent these using formulae andequations.	**Vocabulary:** Change Condensation Evaporation Freeze Gas Heat Liquid Precipitation Property Solid Temperature Thermometer Viscous	**Cross Curricular links:** Geography- the water cycle; the ice caps melting Maths- reading the scale on a thermometer; positive and negative numbers.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
How to distinguish between a solid, liquid and a gas (by identifying key characteristics including how particles are organised).	What are solids, liquids and gases?	What do you know materials – their groups, properties, how they can be changed?	**Create scientific models/diagrams** to explain the difference between a solid, liquid and gas.
How some materials can change state when they are heated or cooled.	How do materials change state?	Solids, liquids, gases	**Observe carefully and describe** how materials can change when heated or cooled. **Explain what happens when a material is heated or cooled using demonstrations.**
The temperatures at which ice, water and water vapour change state.	What is a thermometer used for?	Processes which change state.	**Use a thermometer and data logger** to take accurate measurements of a liquid.

How to use a thermometer to measure temperature and know there are two main scales used to measure temperature (Celsius and Fahrenheit). How to use a data logger to check on the time it takes ice to melt to water in different temperatures.			**Draw graphs** to show how temperature of water changes over time. **Plan, make predictions and carry out fair tests** into the melting point of different chocolate bars.
That evaporation is process of turning from a liquid to a vapour and condensation is the reverse of this.	Does temperature affect the rate of evaporation?	Temperature changes	**Plan, make predictions and carry out fair tests** into relationship between temperature and the rate of evaporation. **Use results to draw simple conclusions.**
The part played by evaporation and condensation in the water cycle.	What is the water cycle?	Evaporation, S,L,G	**Use labelled diagrams and scientific language** to explain the water cycle
Daniel Fahrenheit invented the mercury thermometer and Fahrenheit scale.	Who is Daniel Fahrenheit?	Water Cycle	**Research** the life and work of Daniel Fahrenheit.

Misconceptions:

Children may think that all gases smell. This is not true; some gases do smell but not all. Children may confuse steam with water vapour. Children may also think that clouds are a gas. This is not true; clouds are droplets of water that have condensed around dust particles.
Children find condensation difficult to explain. It is important to point out everyday examples of condensation throughout the school year e.g why is there water on the inside of the windows? How did the water get there?

Stretch and challenge:

- Consider this statement. Only liquids can be poured. Do you agree? Give reasons for your answer.
- Communicate the results of their investigation and draw conclusions.
- Make sensible predictions and match the temperature with the location.
- Explain how to change liquid chocolate to a solid state.
- Explain what happens in the water cycle and consider how old a water droplet might be.
- Explain why some liquids evaporate differently?
- Interpret a line graph showing the rate at which a jumper dries and answer questions.

Key vocabulary to Explain (Pre-Teach):

change - to make different
collection - when water flows back into rivers, streams and lakes and gets carried back to sea
condensation - when water vapour cools and turns back into water
evaporation - when water is heated and turns into water vapour **freeze** - when something is put at a very low temperature
gas - a state of matter that has no defined shape or volume
heat - when something is put at a hot temperature
liquid - a state of matter that flows freely but keeps the same volume
precipitation - when water falls from the clouds in the sky **property** - a characteristic
solid - a state of matter that is firm and stable
temperature - how hot or cold something is
thermometer - an instrument used for measuring temperature

1. Types of rocks and how they created,
2. Friction

Topic 2: Physics **Electricity** **Key Question:** Can I name and describe components of a circuit and how electricity flows through circuits?	**Prior learning:** **KS1** – Electricity is not taught as a discrete topic in KS1 however some children may have looked at which items use electricity in other curriculum areas (e.g. Toys topic in history) **Future learning:** **Y6** – In the Y6 topic on electricity, children will learn to associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. They will compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. They will use recognised symbols when representing a simple circuit in a diagram. **KS3** – Children will study electricity in more depth, including; current and static electricity, parallel and series circuits. They will learn how current is measured and work out potential differences; calculate differences in resistance between conducting and insulating components (quantitative).	**Vocabulary** Appliance Battery Circuit Components Conductor Current Electrical Insulator Mains power Portable Pylon Switch	**Cross Curricular links:** English- write a set of instructions on how to build a circuit. English - Explanation text on how circuits work. History – Invention and development of electricity.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
That electrical appliances either require batteries or mains power to work and how to identify both e.g. battery power – mobile phone; mains power – fridge freezer.	Which appliances use electricity?	What do you know about Electricity? What items use electricity?	Use scientific vocabulary to describe how electrical items work. Sort objects into battery powered and mains powered.
The name and functions of the components in a series circuit (including cells, wires, bulbs, switches, motors and buzzers). How to scientifically draw and construct a working simple series circuit.	How can I make a simple circuit?	Electrical appliances sort.	Use scientific symbols to draw working series circuits. Construct a variety of circuits using different components.
How to predict and test whether a circuit will work.	Why don't some circuits work?	Components of a circuit.	Make accurate predictions about whether a circuit will work. Investigate the uses of a lamp in a series circuit.
That a switch controls the flow of electricity and how to use it in a circuit	How do switches affect a circuit?	Which circuits will work/will not work? Why?	Investigate and make predictions into how switches affect a circuit; record findings.

That a conductor allows electricity to flow through it and an insulator prevents electricity from flowing through it; giving examples of each • that most conductors of electricity are metals but not all metals conduct electricity well e.g. copper is a conductor • which materials make effective conductors and insulators of electricity.	What is a conductor? What is an insulator?	Why will these circuits not work? Switches	Plan, make predictions and carry out fair tests into which materials are conductors and insulators within a series circuit. Make comparisons between the properties of materials that are insulators and conductors. Explain how conductors and insulators are used in everyday life.
That Michael Faraday invented the first electric motor and how he contributed to the development of electricity.	Who is Michael Faraday?	Conductors and insulators	Research the life and work of Michael Faraday.

Misconceptions:

When making their own circuits, it is a common error that the arms of the split pins touch at the back therefore allowing electricity to flow around the circuit. This would mean you wouldn't be able toturn the bulb on and off using the paper clip as a switch. It would just be constantly on.
Children may confuse thermal conductors and insulators with electrical conductors and insulators. Thermal means relating to heat.
Some children may think that electricity is only bought from a shop. Although batteries are, children need to be taught that mains electricity comes to our homes in cables from a PowerStation.
Children may think that the bigger the battery, the more electricity is contained in it and will make a bulb shine brighter. Although it is true to say a battery's voltage does affect the brightness of a bulb, the size of the battery isn't always related to the voltage e.g. a 1.5V battery can come in 4 different sizes.

1. Parts of a plant and function
2. Skeleton and muscles

Key vocabulary to Explain (Pre-Teach):

appliance – a device or piece of equipment that has been made to perform a specific task
battery – a small item used to power small appliances
circuit – a route through which electricity flows
components – the parts of a circuit
conductor – allows electricity to flow through it
current – the rate of flow of electricity measured in amps
electrical – something that uses electricity to work
insulator – doesn't allow electricity to flow through it
mains power – electricity provided by power stations
portable – can be easily carried around
pylon – a tower used for keeping electrical wires above the ground
switch – a device for controlling the flow of electricity in a circuit

Stretch and challenge:

- Look at the A-Z list of appliances that they compiled during the lesson and sort them into the table to show what they use electricity for (movement, heating or cooling, light or sound). Which appliances would be in two or more categories?
- Children are presented with a diagram of two circuits and asked – "Which circuit do you thinkwill make the bulb shine the brightest?"
- Children are asked to make up two of their own circuits. They predict if they will work and thentest them.
- Explain how the properties of electrical insulators and conductors are used in everyday life.
- Write a set of instructions to explain how to make a switch.

Topic 3: Biology **Animals including humans** **Key Question:** **Why do we need food and how does our body digest it?**	**Prior learning:** Class F – Name parts of the body Year 1 - Identify and name a variety of common animals that are carnivores, herbivores and omnivores Year 2 - Find out about and describe the basic needs of animals, including humans, for survival (water, food and air) Show an understanding as to why exercise, balanced diet are important for humans. Year 3 - Understand the importance of a nutritious, balanced diet **Future Learning:** **UKS2 –** Children will learn to describe the changes as humans develop to old age, extend their understanding of the human body to incorporate the circulatory system and describe ways in which nutrients and water are transported around the body. **KS3 –** Children will learn more about the importance of a healthy diet and how different foods are absorbed and used in the human body. They will learn more about gas exchange systems in the lungs of the human body. They will also look at the effects of recreational drugs including substance misuse.	**Vocabulary** Canines Carnivore Digestion Herbivore Incisor Large intestine Molars Oesophagus Omnivore Peristalsis Predator Prey Producer Saliva Small intestines Stomach	**Cross Curricular links:** PSHE- the importance of a balanced diet and exercise for maintaining a healthy body. English- Explanation text: How the digestive system works.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
By the end of this lesson, children will be able to name different teeth and relate the shape of the teeth to the function. The different parts of the tooth and how to describe them.	Why are teeth shaped different?	Basic human needs? Balanced diet.	**Use labelled diagrams** to explain the different parts of a tooth. **Use scientific vocabulary** to describe functions of the teeth.
By the end of this lesson, children will be able to plan and conduct a fair test investigation to answer the question; which drink causes the most tooth decay? They will make accurate observations and use this information to communicate their results in the form of a text, letter or email message.	Which drink causes the most tooth decay?	Teeth types and job.	**Observe and present findings** about what happens when 'teeth' are exposed to different materials.

			Explain what happens when 'teeth' are exposed to different materials and **draw conclusions.**
By the end of this lesson, children will be able to name twelve main parts of the digestive system and describe their basic functions. They will be able to label a diagram and use scientific vocabulary for description.	What happens to the food we eat?	Foods that cause damage to teeth and why.	**Label** the different parts of the digestive system using **scientific vocabulary to describe** the function.
By the end of this lesson, children will be able to construct and interpret a variety of food chains. They will be able to use the terms herbivore, carnivore and omnivore accurately and identify animals in each of these groups. They will construct food chains and be able to identify the producer, prey and predator in each chain.	What does a food chain tell us?	Digestive system	**Research** producers, predators and prey to construct food chains. **Use diagrams** to present different food chains and orally explain them.
That William Beaumont was the first person to observe and study human digestion and be able to talk about his work.	Who is William Beaumont?	Food Chain and key vocabulary.	**Carry out research** into the work of William Beaumont.

Misconceptions:

Children may think that their stomach is where their belly button is and that all food is digested there. However, although some simple foods such as sugar are digested, most foods travel to the small intestine for further digestion and to be absorbed into the blood. Children may think that food goes down one tube and liquids go down another. They may also think that the air we breathe goes down the same tube as the food and water. When drawing food chains, children may get confused by the direction of the arrow.

Key vocabulary to Explain (Pre-Teach):

Canines – ripping teeth
Carnivore – animals that only eat other animals
Digestion – the process of breaking down food into simple chemicals for the body to absorb
Herbivore – animals that only eat plants
Incisor – cutting teeth
Large intestines – where water is absorbed into the blood
Molars – grinding teeth
Oesophagus – food and water pipe
Omnivore – animals that eat both plants and animals
Peristalsis – muscular action to move food along the digestive tubes **Predator –** an animal that hunts, kills and eats other animals for food **Prey –** a term used to describe organisms that predators kill for food **Producer –** a plant in a food chain
Saliva – a lubricating digestive juice produced in the mouth
Small intestines – where food is broken down and nutrients are absorbed into the blood
Stomach – a rounded vessel in the body where acid and digestive juices break down food

1. Lifecycle of plant/seed dispersal
2. Balanced diet

Stretch and challenge:

Children could:

- Write a short explanation of what happens when you eat food.
- Compare the teeth of a lion (carnivore) with a cow (herbivore). Answer the questions using knowledge of diet and the specific function of each type of tooth.
- Explain which ingredient in drinks causes tooth decay and explain how it affects teeth. Use the internet to research your answer.
- Children use a Venn diagram to sort living things into predators and prey.
- Create labels for their own version of the 'Food Chain Game'.

Topic 4: Physics **Sound** **Key Question:** How are sounds made and how do they travel?	**Prior learning:** Class F – name different parts of the body. Year 1 – say which part of the body is associated with each sense Sound is not taught as a separate topic in KS1 science however children may have some knowledge of pitch and volume through their music lessons. KS2 – children continue to explore sound through music (in their music lessons) and in the topic on light, children may compare how fast sound travels compared to light. **Future learning:** KS3- children will extend their understanding of sound by exploring frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound. They will build upon knowledge of how sound travels through a medium and explore the auditory range of humans and animals	**Vocabulary** Vibrate Vibrations Volume Pitch Pinna Cochlea Ear drum	**Cross Curricular links:** English – newspaper article about the invention of the cochlea implant Music-pitch, tempo, volume
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
that sound is made by vibrations • that stronger vibrations create louder sounds and weaker vibrations create quieter sound	How are sounds made?	What do you know about sound?	**Explain** how sound is made using model, diagrams and oral explanations.
that a sound source vibrates which then vibrates gas/liquid/solid particles until they reach the ear. • Sounds travel more quickly through solids than gases • that as the sound travels away from its source the vibrations get weaker and the sound becomes fainter	What is a sound vibration?	How sounds are made.	**Make observations** of the different sounds produced by different objects/instruments. **Use labelled diagrams to explain** how sound travels.
the names of the different parts of our ear(outer, middle and inner), and how they work in order for us to hear. e.g. the cochlea turns the vibrations into electrical impulses which are sent to our brain	How does the ear work?	Sound vibrations	**Use diagrams and scientific vocabulary** to label the different parts of the ear and their functions.
how to identify a high pitch or low pitch sound • the correlation between pitch and the object producing the sound e.g. a triangle created a high-pitched sound, a drum creates a low-pitched sound.	What is pitch?	Parts of the ear	**Make predictions and observe/record** the sounds made by different instruments. **Make comparisons** between the properties of instruments that create high and low pitches.
The relationship between volume and strength of vibrations (the bigger the	What is volume?	Pitch	**Plan, predict and carry out a fair test** to find relationship between volume and strength of vibrations.

vibrations, the larger the sound waves transmitted).			**Use a data logger** to record volume in decibels. **Investigate** how the volume of sound is affected by the size of the pinna and **draw conclusions.**
that William. F. House invented the cochlea implant and that this enabled deaf people to hear.	Who is William F. House?	Volume/ Key vocabulary	**Research** the life and work of William F House – **present findings in different ways.**

Misconceptions:

Children will often confuse volume with pitch. The vocabulary needs to be exemplified carefully (and frequently) to ensure correct usage.
You can see and hear a distant event at the same moment – this in not true. Light travels faster than sound (hence you see lightning then hear thunder even though they have occurred at the same time). Hitting an object harder gives a higher pitch – this is not true; hitting an object harder will produce a louder sound as the vibrations created are stronger but won't affect the pitch.
Sound moves faster in air than in solids (air is "thinner" and forms less of a barrier) - this is not true. Sound moves faster through solids as the particles are closer to one another. As sound waves move, the air moves along with them. This is not true. The vibration is passed from air particle to the next air particle.

Key vocabulary to Explain (Pre-Teach):

Vibrate/vibrations - forward and backward movement of an object (usually rapidly).
volume - how loud or quiet a sound is.
pitch - how high or low a sound is.
pinna - the outer portion of the ear (ear flap).
cochlea - the sound reception part of the inner ear.
ear drum - the membrane which collects sound from the pinna and passes it to the inner ear.

1. Forces (Year 3)
2. Fossils

Stretch and challenge:

Identify what vibrates to make a sound in the picture of an orchestra.

- Children are asked to write and explain why it would be a problem if objects didn't vibrate.
- Match the part of the ear with its description (easy) or write a description for each part of theear (medium).
- Children use the 'communicate' sheet sheet to draw conclusions from their investigation.
- How can you change the pitch of the sounds produced on a violin?
- Complete a cloze passage with the correct scientific vocabulary to explain the relationshipbetween energy and volume.

Design a pair of ear muffs that would effectively muffle sound. Label the design and explain why the material chosen would be effective at muffling sound using scientific vocabulary

Topic 5: Biology **All living things and their habitats** **Key Question:** **Can I classify living things in different ways?**	**Prior learning:** **Year 1** – during the topic on plants, children will have learnt to describe the basic structure of a variety of common flowering plants. They will have compared differences between living and non-living things. **Year 2** – children will have explored the differences between living and non-living things; identified that most living things live in habitats that they are suited to and understand how living things in that habitat depend on each other. They may have learnt to name some of the living things in their local area and construct basic food chains. **Year 3** – children will have learnt to identify and describe the function of various parts of a plant. They will have explored the part flowers play in the life cycle including pollination, seed fertilisation and seed dispersal. **Future Learning:** **UKS2** – Children will have studied life cycles of plants and animals and looked at how reproduction plays a vital part of those life cycles. They will further extend their understanding of classification to include single celled organisms. KS3 – children extend their knowledge of reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilsation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta. They extend their knowledge of reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.	**Vocabulary** Environment Classify Vertebrate Invertebrate Exoskeleton Key Adaptation Pollution	**Cross Curricular links:** Geography: Human impact on the world we live in
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
the 7 characteristics of living things (MRS GREN). that living things can be grouped in a variety of ways e.g. land/sea animal, number of legs	How can you tell if something is a living thing?	What do all livings things do? What habitats do you recall?	**Observe** a range of different living things in their natural environments **Classify** animals according to observable differences
There are 5 main animal groups: birds, fish, mammals, reptiles and amphibians and they are grouped according to certain characteristics.	How can we group animals?	MRS GREN	**Use labelled diagrams and scientific language to present findings** about living things. **Use tables to compare and contrast** animals from different groups

The terms herbivore, omnivore and carnivore and that animals can be sorted according to their diet			
The difference between an invertebrate and an invertebrate and name some of the common invertebrate groups	What is the difference between a vertebrate and invertebrate?	Groups of animals	**Use scientific vocabulary to define** vertebrates and invertebrates. **Classify** a range of animals into these two groups
how to use identification keys to help group, identify and name a variety of living things found in their local environment (including minibeasts)	What can find living/growing in our area?	Identify vertebrates and invertebrates	**Observe** plants and animals in local area and **record and present findings**
How to use a classification key to identify living things and how to construct their own key to identify living things in the local area	How can we identify a living thing if we don't recognise it?	Habitats and keys	**Use secondary sources** (reference books, apps, websites) to construct classification keys
how an environment may change both naturally and due to human impact and the affect this has on living things	How are humans changing the environment?	Keys	**Explain** why environments change over time. **Report and present findings from research and observations**
David Attenborough is a British naturalist know for his many documentaries about the planet's wildlife and plants.	Who is David Attenborough?	Human impact	**Carry out research** into the life and work of David Attenborough

Misconceptions:

Snakes have exoskeletons that they shed. This is not true; snakes are vertebrate animals that shed their skin (not an exoskeleton).
Children may think fish breathe in water; however, it is not water that the fish take in when they breathe but the oxygen mixed in with the water.
Children may assume that all changes to habitats are negative.
Children may find it difficult to distinguish the difference between reptiles and amphibians.

Key vocabulary to Explain (Pre-Teach):

- **environment** – the conditions (both living and non-living) that surround an organism
- **classify** – to arrange a group of people or things in classes or categories according to shared qualities or characteristics
- **vertebrate** – an animal that has a backbone
- **invertebrate** – an animal without a backbone
- **exoskeleton** – a rigid external covering for the body in some invertebrate animals
- **key** – a questioning device that allows the progressive narrowing down of the classification of an unknown living thing based on observable or testable features
- **adaptation** – the way in which an organism is particularly suited to its environment
- **pollution** – the introduction into the environment of a substance which has harmful effects

1. Light producers and meaning of opaque, transparent, translucent.
2. Solid, liquids and gases

Stretch and challenge:

- Explain the differences in how plants and animals get their nutrition, excrete waste and respire.
- Children are given a table in which animals have been sorted into two groups. The criteria used is missing. They are asked to work out the criteria used and label the columns in the table.
- Explain the difference between an invertebrate and a vertebrate using scientific vocabulary.
- Design their own minibeast. It could have features from a minibeast that is already alive, or it could be a combination of a number of different minibeast e.g. a butter-bee could have wings like a butterfly and a sting like a bee! Think about its habitat, how it moves, how it feeds and how it survives.
- Check a classification key to see if it works.
- Draw a persuasive poster to encourage people not to litter in the local area.