Science Progression Document

Year 5

Topic 1: Chemistry **Properties and changes in materials.** **Key Question:** **Do I know the properties of everyday materials?** **Can I describe and understand the difference between reversible and irreversible reactions?**	**Prior learning**: **Year 1** – Children may have been taught to distinguish between an object and the material from which it is made. They may have had experience identifying, grouping and naming everyday materials, including wood, plastic, metal, glass androck and learnt to describe the simple physical properties of these materials. **Year 2** – Children may have consolidated knowledge gained in year 1 and learnt to identify and compare the use of a various materials for particular uses. They may have investigated how the shape of solid materials can be changed by squashing, bending, twisting and stretching. **Year 4** – Children may have learnt to compare and group materials according to whether they are solids, liquids or gases. They may have observed that some materials change state when heated or cooled and measured or researched the temperature at which this happens in degrees Celsius. They may have identified the part played by evaporation and condensation in the water cycle and associated the evaporation rate with temperature. **Future Learning:** **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 for separating materials (filtration, evaporation, distillation and chromatology. They will learn about chemical reactions (catalyses, combustion, etc.) and represent them using formulae and equations.	**Vocabulary:** evaporation condensation conductivity flexibility, hardness, insulators, magnetism, soluble insoluble saturation solution filtration dissolving, reversible, irreversible, chemical change physical change carbon dioxide	**Cross Curricular links:** Maths- Measuring liquids using mls.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
Materials have different uses depending on their properties and state (liquid, solid, gas). Properties include hardness, flexibility, transparency, electrical and thermal	What is a material?	Solids, liquids, gases?	**Use tables** to record and compare different materials and state their uses.

conductivity and attraction to magnets. These properties can be tested fairly.			• **Make comparisons** between different materials. • **Plan, make predictions and carry out fair tests** into properties of materials e.g. magnetism, flexibility
Some materials are soluble and so will dissolve in a liquid to form a solution while others are insoluble and form sediment.	What happens when a material dissolves?	Properties of materials	**Investigate** soluble and insoluble materials and **record Findings.** **Plan, make predictions and carry out fair tests** into the variables the affect the rate of dissolving.
Mixtures can be separated by filtering, sieving, using magnets and evaporation.	How do we separate materials?	Dissolving Key vocab: solution, soluble, insoluble etc..	**Choose the most suitable method** to separate different materials.
Some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda result in the formation of new materials and these are not reversible	What makes a reaction irreversible?	Separating materials Key vocab: sieving, filtration etc..	**Observe and explain** what happens when different materials are mixed together. **Use diagrams** to record what happens when materials are mixed, heated or burned.
Stephanie Kwolek invented the material Kevlar that is used in bullet proof vests worn by police officers	Who is Stephanie Kwolek?	Reversible/irreversible reactions.	**Carry out research** into the work of Stephanie Kwolek.

Misconceptions: Misconceptions
Children often use the word 'disappear' when describing dissolving, and teachers often think this is a misconception. However, children may be using the word 'disappear' to describe that they can no longer see it BUT understand that the substance is still in the liquid. It is important to ask the children what they mean by using the word 'disappear'. Whether they think that the soluble substance has gone (i.e. no longer in the water; this is a misconception) or they realise the substance is still in the liquid but, we can't see it. They need to be encouraged to use the word dissolved to accurately describe what happened.

Key vocabulary to Explain (Pre-Teach):
soluble - a substance that will dissolve in water
insoluble - a substance that will not dissolve in water **saturation -** the point at which no more solute can be dissolved **solution -** a soluble solid is dissolved in liquid to form a solution
filtration - the collection of larger particles in a mixture
boiling - the process by which molecules of a liquid change to vapour (much faster change than evaporation)
condensing - the change of vapour into a liquid
evaporation - change from a liquid to a vapour
freezing - the change of a liquid to a solid
melting point - the point at which a solid substance liquefies
chemical change - one where the molecular structures of the combined substances are broken down and recombined to make a new substance
physical change - where the molecular structures of the combined substance stay separate, allowing separation to occur
reversible change - a physical change that we can undo
irreversible change - a physical change that we cannot undo

Stretch and challenge:
- In small groups, produce a short drama piece to demonstrate how you would be arranged if you were a gas, a solid or a liquid.
- Suggest materials with the following properties: durable, flexible, waterproof and magnetic.
- After planning and conducting a fair test investigation, children will draw a conclusion based on their scientific knowledge of thermal insulation.
- Children are given two opposing opinions about the magnetic properties of metals and asked to explain which they agree with and why.
- Write definitions of the terms soluble and insoluble and explain how these types of solids behave when mixed with water.
- Children are asked to suggest the best method to separate a mixture of raisins and paper clips in a sugar and water solution.
- True or false - heating a material always leads to irreversible change? Children explain whether they think this is true or false, giving reasons for their answer.

1. Circuit symbols
2. Animal groups

Topic 2: Physics **Earth and Space** **Key Question:** **Can I name and describe the different bodies of the solar system? Do I know their movements relative to the Sun?**	**Prior learning:** KS1 – As part of the seasonal change topic, children may have observed changes across the seasons and observed/described weather changes. They may have learnt that the Sun is a light source. Earth and Space is not taught at KS1 as a discrete topic. Year 3 – Children may have learnt about the Sun as a light source (in the Light topic); they may have observed that shadows are formed when an opaque object blocks out light and that the Sun's position in the sky appears to change through the day. **Future learning:** KS3 – Children extend their knowledge of gravity as a force (learning formulae) and that gravity is different on other planets and stars. They consolidate knowledge that the Sun is a star, and that there are other stars in our galaxy and other galaxies. They will extend their knowledge of seasons and the Earth's tilt, day length at different times of year, in different hemispheres and learn that a light year is a unit of astronomical distance.	**Vocabulary** spherical satellite planet orbit axis rotate Northern hemisphere Southern hemisphere time zone Solar System	**Cross Curricular links:** Geography- time zones; Northern and Southern hemisphere History- what ancient civilisations believed about the Earth, Moon and Sun.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
The sun is a star. It is at the centre of our solar system. There are 8 planets of which some have moons. The planets travel around the Sun in fixed orbits.	What is the Solar System?	What do you know about our solar system/light/night and day/seasons?	**Create scientific models/diagrams** to represent the composition of the Solar System. **Research** the 8 planets and **make comparisons.**
The Sun, Earth and Moon are approximately spherical.	How do we know what shape the Earth, Moon and Sun are?	Name the 8 planets	**Consider the views of scientists in the past and how evidence was used to deduce** the shapes and movements of the Earth, Moon and planets before space travel. **Use diagrams** to show how the Earth, Moon and Sun move relative to each other.
How night and day are created: The Earth rotates (spins) on its axis every 24 hours. As Earth rotates half faces the Sun (here it is day) and half is facing away from the Sun (night).	Why do we have night and day?	Sun, Earth, Moon	**Explain** how might and day are created **using demonstrations.** **Draw graphs** to show how hours of sunlight varies throughout the year.

As the Earth rotates the Sun appears to move across the sky. (Link to timezones).			
Why we have seasons: Earth takes 365¼ days to complete its orbit around the Sun. The Earth is tilted on its axis. The Earth has a northern hemisphere and southern hemisphere.	Why do we have seasons?	How do we get night and day?	**Explain why** we have seasons using diagrams to support explanations.
The Moon orbits the Earth. It takes about 28 days to complete its orbit and appears to change shape as it orbits (phases of the Moon).	Why does the Moon change shape?	Recall how we get seasons	**Observe and describe** how the appearance of the moon changes over time – present using models and IT.
Mai Jemison was the first black woman to go into space.	Who is Mai Jemison?	Moon shape/Key vocab/previous lessons quiz.	**Research** the life and work of Mai Jemison.

Misconceptions:

When learning about the order of the planets based on the distance from the Sun, it is important that the children understand that the planets are orbiting around the Sun (they don't stay in a line from the Sun as often depicted) but the distance away from the Sun stays the same. When considering day and night, some children may think that the Sun disappears or goes behind a cloud. This is not true; day and night occur as the Earth is rotating on its axis. Because the Sun appears to move across the sky, it can be difficult for the children to comprehend that it is the Earth moving NOT the Sun.

Another common misconception by children is that the Moon actually changes shape (as this is what they observe from Earth) and that there is no gravity on the Moon (The Moon's mass is about 1.2% of the mass of the Earth which makes the gravity on the Moon 83.3% lower than that of the Earth). Some children may also think that the Moon 'disappears' in the daytime however it is still in the sky but the sunlight is too bright (much of the time) to see it. It is useful to have a globe in the classroom to reinforce the fact that the Earth is a spherical body.

Key vocabulary to Explain (Pre-Teach):

orbit – the rotation that one body in space takes around another when under gravitationalinfluence

axis – an imaginary line going through a central body that most bodies in space rotate around

day – length of time the Earth takes to rotate on its axis once

month – the length of time the Moon takes to complete one orbit around the Earth (not exactlyequal to a calendar month)

planet – a non-luminous body that orbits a star

solar system – the name given to the Sun and all the bodies orbiting around it

year – the period the Earth takes to complete one orbit of the Sun

gravity – the force of attraction between two masses

1. Food chains
2. Teeth – Types and function

Stretch and challenge:

- invent their own mnemonic to help them order the planets based on their distance from the Sun
- use information books or the internet to research information about the Greek philosopher and create a passport for him
- be given a partially completed table. They use the information given to work out which planet is which; order the planets; round the number of days taken for each planet to complete 1 orbit of the Sun to the nearest full Earth day and then convert that time to Earth years.
- use the internet and/or non-fiction texts to complete a fact file about the Moon
- create a line graph and plot the results of the investigation.
- predict what the Moon would have looked like on the two nights that it couldn't be seen, using John's diary and their knowledge of the phases of the Moon

Topic 3: Biology **Animals including humans** **Key Question:** **How do we change as we grow older?**	**Prior learning:** **KS1 –** Children will have studied humans and other animals and their young.They may have studied life cycles such as butterfly or frog to show how animals change as they grow. **LKS2** – Children will have studied life cycles of plants which could be linkedto the life cycle of humans. **Future Learning:** **KS3 –** Children will study reproduction in more detail in humans and otheranimals.	**Vocabulary** Conception Foetus Prenatal Gestation Reproduce womb infancy adolescence puberty hormones	**Cross Curricular links:** PSHE- the importance of a balanced diet and exercise for maintaining a healthy body. RHE - Puberty
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
The different stages of the human lifecycle: gestation, infancy, childhood, adolescence, adulthood, old age.	What are the stages of human development?	What is a life cycle? What do you think the stages are of a human life cycle?	• Use diagrams to show the different stages of the human lifecycle • Use tables to document key features of different stages • Make observations of humans at different stages
An embryo becomes a foetus inside the womb and the gestation period is 9 months. The changes that occur from new-born to the toddler phase (focus on skills and abilities acquired e.g. crawling, learning to walk, first words, eating solids, grow teeth).	What can you do now that you could not do when you were a baby?	Stages of human life cycle.	• Use graphs to compare data relating to growth of babies • Make comparisons between the different stages (baby and toddler)
The changes that occur during childhood and the key features of an adult human. Puberty happens during adolescence and is the process of a child's body turning into an adult's body in preparation for reproduction.	What is puberty?	Key vocab/ Changes from newborn	• Use scientific vocabulary to describe the changes that take place from childhood to adulthood
The changes that occur during old age.	How might the body change during old age?	Puberty	• Explain and evaluate why the human body changes over time • Use labelled diagrams to describe the changes that occur

The key work carried out by Professor Robert Winston (reproduction and child development).	What is a biologist?	Old age changes	• Research the life and work of Robert Winston

Misconceptions:

Children may have misconceptions about being an adult and that you stop learning as well as stop growing.

Children will need to understand that ourbodies can still change when we are an adult.

Children may know what will change with their body during puberty but may not know about the opposite sex.

Children may also think that a baby grows inside its mother's stomach where food goes

Key vocabulary to Explain (Pre-Teach):

birth – when your life starts as a physically separate being
conception/fertilisation – when the egg and the sperm meet to begin the developmentof a foetus
death – when the life cycle ends
develop – to grow to become more mature or advanced
egg – the female sex cell
foetus – a baby that is still developing in the womb
puberty – a time in the human life cycle when the body goes through changes to become an adult
sperm – the male sex cell
womb – an organ in which the foetus grows and develops

1. Digestive system – parts and functions
2. Water cycle

Stretch and challenge:

- make their own model of the stages of the human life cycle
- research the gestation periods of different animals
- compare gestation periods of different animals (mammals, reptiles,amphibians, birds and fish)

Topic 4: Physics **Forces** **Key Question:** **Are there different types of forces?**	**Prior learning:** **Year 2** – During the topic 'materials', children may have explored different materials and discovered which ones can change shape when they are squashed, bent, twisted or stretched. They may be able to make the link between those movements and simple pushes and pulls. Magnets are not studied at all in Key Stage 1. However, children may have come across magnets in everyday life and seen that they 'stick together' (attract) in objects such as bags, toys or kitchen appliances. **Year 3** – Children may have explored simple pushes and pulls as an introduction to forces. They may have explored how the texture of an object, or the surface it is on, can affect the way the object moves. They may have further investigated pushes and pulls by experimenting with different magnets and exploring how they can pull (attract) and push (repel) too, but at a distance with no contact. **Future Learning:** **KS3** – Children will extend their understanding of forces by describing motion (speed = distance ÷ time) and use time and distance graphs. They will use force arrows in diagrams, adding forces in one dimension. They will further explore balanced and unbalanced force; opposing forces and equilibrium e.g. weight held by stretched spring or supported on a compressed surface. They will also extend their understanding of the difference between weight and mass and how gravity affects weight.	**Vocabulary** Force Friction Gravity Push Pull Repel Resistance Streamline Upthrust/buoyancy Newton Gear Lever pulley	**Cross Curricular links:** DT: Pulleys, gears and levers.
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
I can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and falling objects.	What is gravity?	What is a force? What do you know about forces?	I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. I can take measurements, using a range of scientific equipment, with increasing accuracy and precision,

			taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs.
I can identify the effect of friction between moving surfaces.	What is friction?	Gravity	I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs.
I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables. I can take measurements using a range of scientific equipment.	Whose shoe has the greatest friction?	Friction	I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs.
I can identify the effect of air resistance.	What is air resistance?	What shoe had greatest friction? Why?	I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs. Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree

			of trust in results, in oral and written forms such as displays and other presentations.
I can identify the effect of water resistance.	What is water resistance?	Air resistance	I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs.
I can recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect.	What are gears, pulleys and levers?	Water resistance	I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and graphs.

Misconceptions:

The word 'force' can have different meanings in the English language e.g. may the force be with you… a forceful character. Many common uses of the word 'force' may give children the impression that it is intrinsic to human activity rather than a concept in physical science. Children may also think that an object needs a constant force to keep it moving; this is true but only because of friction. Children may think that forces only act in one direction.

1. Sound
2. Will this circuit work? Why/why not?

Stretch and challenge:

- Children are presented with three statements about gravity and asked if they are true or false.
- Children are given statements to read about friction. They must decide if the statement is true or false.
- Children are encouraged to think about why certain shoes create the most friction.
- Children are asked to reflect on the design of their plane and make suggestions to improve its performance.
- Children are given two statements to read about water resistance. They must decide if they agree with the statements and explain why/why not.
- Children are asked to design their own machine that would help them complete a daily task. They must include at least one lever, gear or pulley.

Key vocabulary to Explain (Pre-Teach):

Force – a push or pull that acts upon an object that can cause it to move, change shape or change direction.
Friction – the force that acts upon one surface when it moves against another.
Gravity – a pull force that acts at a distance.
Pull – to move something towards.
Push -– to move something away.
Repel – to push away.
Resistance – an opposing or slowing force.
Drag – the frictional force experienced by an object moving through a fluid or air.
Streamlined – a shape which minimises the profile presented by an object in order to minimise the resistance it encounters when moving through a liquid or gas.
Upthrust or buoyancy – the upward force exerted on a body by a fluid that surrounds it, equal and opposite to the weight of the water displaced.
Newton (N) – the unit used to measure force.
Gear –two wheels with serrated or notched rims that mesh together to transfer movement.
Lever – usually a rigid bar with a pivot point close to one end, allowing movement at one end of the lever to be converted into a smaller movement at the other, which effectively magnifies the force applied.
Pulley – a wheel with a grooved rim that allows the transfer of movement via a belt or band.

Topic 5: Biology **All living things and their habitat** **Key Question:** How do living things reproduce and why is this important in a life cycle?	**Prior learning:** **KS1** – 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. **LKS2** – 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:** **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, fertilisation, 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** reproduction, gestation life cycle, metamorphosis pollination, fertilisation germination womb offspring mammal stamen pistil	**Cross Curricular links:**
Children should know…	**Key Questions:**	**Recap:**	**I am thinking like a scientist…**
the names of the reproductive parts of a flowering plant e.g. anther, filament, ovary	What's inside a flower?	Structure of plants/flowers and function.	• **Make observations** of real-life plants/flowers • **Use diagrams** to label the reproductive parts of a flowering plant
each stage of a flowering plants lifecycle: pollination, fertilisation, seed dispersal, germination, growth and flowering (this is sexual reproduction)	How do flowering plants reproduce?	Inside of a flower: parts and function	• **Explain** the life cycle of flowering plants using **diagram**s to support
some plants reproduce asexually by growing bulbs, tubers or runners. the differences between asexual and sexual reproduction of plants	What is cloning?	Flower life cycle	• **Grow and observe** plants that reproduce asexually • **Make comparisons** between plants that reproduce sexually and asexually

Different animal groups (Birds, Fish, Reptiles, Amphibians, mammals) reproduce in different ways (either internally in the womb or externally i.e. lay eggs). How each animal group reproduces and cares for their young (abandon or nurture)	Do all animals reproduce in the same way?	Cloning	• **Observe and present findings** about how different animal groups reproduce and care for their young
Different mammals have different gestation periods (also look at different types of mammals- sea, land, marsupials)	Are all mammals pregnant for the same amount of time?	How do different animals reproduce?	• **Use graphs to compare data** on gestation periods and **draw conclusions**
Metamorphosis is a transformation from an immature form to an adult form that occurs in some insects and amphibians (e.g. butterfly and frog). the differences between life cycles of animals from different groups (e.g. compare a penguin with a rattlesnake)	How do the life cycles of different animals compare?	Gestation periods: graph questions?	• **Research** into life cycles to investigate a scientific concept • **Make comparisons** between different lifecycles and animal groups using drawings and descriptions
Malaika Vaz is a National Geographic explorer and environmental conservationist	What does a naturalist do?	Life cycles/key vocab	• **Research** the life and work of Malaika Vaz and present findings visually and orally

Misconceptions:

Children may confuse mating and reproduction. Reproduction is the combining of genetic material from a male and female part to produce new life. Both animals and plants reproduce sexually however animals have to mate in order for them to reproduce. Children may think that the first stage of each life cycle is the egg; every life cycle begins with the egg. Labelling the 'egg' as the first stage would beincorrect as the stages in a life cycle are repeated and there is no first or last stage.
When discussing how mammals reproduce (and humans in particular) children may think that babies are conceived in the stomach. It is important that the children understand that stomachs are for food, not babies. Fertilisation takes place naturally in the fallopian tube (oviduct) of the female reproductive system and the fertilised egg, which develops into a ball of cells over time, develops in the uterus (womb) of the female to become a baby.

1. Conductors and insulators
2. Life processes

Key vocabulary to Explain (Pre-Teach):

fertilisation – the point at which the sperm from the pollen meets the egg in the ovary
pollination – the process by which the pollen reaches the stigma
pollen – granule that delivers the male genetic material to the female seed
stamen – the male part of the flower, comprising of the anther and filament
pistil – the female part of the flower consisting of the stigma, style and ovary
seed dispersal – the method used by a plant to spread out its seeds (usually by wind, water or animals)
reproduction – the combining of genetic material from two individuals to produce new life

Stretch and challenge:

- Draw a graph to show the gestation period of different mammals.
- Explain the difference in how plants and animals get their nutrition, excrete waste and respire.
- Classify a new species from a description of its characteristics and how it reproduces.
- Research another animal life cycle. Draw it and explain each stage.
- Children are given statements that describe each stage of the flower life cycle, but they are inthe wrong order! Write the numbers 1 – 7 to show the correct order.
- Explain why plants need to disperse their seeds.