Knowledge Progression

Year 5/6 Science Cycle 1

	Evolution and inheritance Y6 TERM: Autumn 1 and 2	Earth and Space Y5 TERM: Spr 1	Living things and their Habitats (Y5&6) TERM: Spr 2 & Sum 1	Properties and changes of materials Y5 TERM: Sum 2
Key Vocabulary	Offspring, sexual reproduction, vary, characteristics, suited, adapted, environment, inherited, species, fossils, offspring, advantages, disadvantages, genes, dominant, recessive	Earth, Sun, Moon, (Mercury, Jupiter, Saturn, Venus, Mars, Uranus, Neptune) spherical, axis, solar system, rotates, star, orbit, planets, movement relative to, day and night in relation to rotation, celestial body, geocentric, heliocentric	Environment, life-cycle, reproduction (sexual and asexual), sperm, fertilises, egg, live young, metamorphosis, asexual, plantlets, runners, bulbs, cuttings seed, stem, root cutting, tubers, bulbs, hatching, rearing, invertebrate (insects, spiders, snails, worms), vertebrates (fish, amphibians, reptiles, birds, mammals)	Thermal/electrical insulator/conductor change of state, mixture, dissolve, solution, soluble, insoluble, conductivity, solid, liquid, gas, insoluble, filter, sieve, reversible/non-reversible change, burning, rusting, new material
Previous knowledge/ Learning	In KS1, children will have: 1. identified that most living things live in habitats to which they are suited and described how different habitats provide for the basic needs of different kinds of animals and plants. 2.noticed that animals, including humans, have offspring. In LKS2, children will have: 1. explored the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. 2. described in simple terms how fossils are formed when things that have lived are trapped within rock. 3. recognised that environments can change and that this can sometimes pose dangers to living things. If they have already undertaken Cycle 2 UKS2, they will have: 1. describe the life process of reproduction in some plants and animals. Children, in geography, will also have studied how rocks and soils are unique to their local environment. Furthermore, they will have contrasted localities and explored Biomes affording them an understanding of the conditions living things have to adapt to.	In KS1, children will have observed changes across the four seasons and observed and describe weather associated with the seasons and how day length varies.	In Year 2, children will have: 1. Explored and compared the differences between: living, dead and never been alive. (Is a flame alive? Is a deciduous tree dead in winter?) 2. Identified that most things live in habitats to which they are suited and that plants and animals depend on each other. 3. Identified and named a variety of plants and animals in their habitats, including microhabitats. 4. Described how animals obtain their food from plants and other animals, using simple food chains. 5. Understood the term 'habitat' and 'microhabitat'. They will compare animals in familiar habitats to those in less familiar (seashores, woodlands, oceans and rainforests.) In Year 4, children will have, 1. Categorised living things. (vertebrates could be organised into groups: fish, amphibians, reptiles, birds and mammals; invertebrates could be: snails, slugs, worms, spiders and insects) 2. Recognised that environments can change and that this poses dangers to living things. 3. Explored examples of human impact on environments (positive – nature reserves, garden ponds; negative – litter and deforestation)	In Year 1, children will have: 1. Learnt to distinguish between an object and the material it is made from. 2. Described the physical properties of everyday materials (hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not; waterproof/not; absorbent/not; opaque/transparent.) In Year 2, children will have: 1. Correlated materials (plastic, bricks, glass) with their suitability for use. 2. Investigated how the shapes of solid objects can be changed by squashing, bending, twisting and stretching. 3. Learnt that certain materials have multiple uses (metal = coins, cars, cans) or that objects can be made of different things (spoon = wood, metal, plastic) In Year 3, children will have: 1. Investigated polarity and discovered which materials are magnetic. In Year 4, children will have: 1. Compared and grouped materials according to whether they are solids, liquids or gases 2. Observed how some materials change state when they are heated or cooled, measuring this using degrees Celsius. 3. Investigated and classified the temperatures at which materials change state (chocolate melts, ice cream, water evaporates from a puddle etc) 4. Identified the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature 5. Investigated which materials provide the best insulation against sound. 6. Investigated which materials can and which cannot be used to connect across a gap in a circuit.
N.C. Objectives	1. Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago 2. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents 1. 3. Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution	1. Describe the movement of the Earth, and other planets, relative to the Sun in the solar system 2. Describe the movement of the Moon relative to the Earth 3. Describe the Sun, Earth and Moon as approximately spherical bodies 4. Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	1. Describe the difference in the life cycles of a mammal, an amphibian, an insect and a bird. 2. Describe the life process of reproduction in some plants and animals. 3. Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. 4. Give reasons for classifying plants and animals based on specific characteristics. 5. Raised questions about their local environments throughout the year.	1. Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets 2. Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution thus exploring reversible changes including: evaporating, filtering, sieving, melting and dissolving. They should also look at changes that are hard to reverse (burning, rusting, vinegar and bicarb reactions). 3. They should learn about how chemists create new materials, for example: Spencer Silver (glue for sticky notes) or Ruth Benerito (wrinkle-free cotton). 4. Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating 5. Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic 6. Demonstrate that dissolving, mixing and changes of state are reversible changes 7. Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.
Resources	***LOCATIONS OF PLANNING/RESOURCE*** Fossil Habitats Investigation – TAPS focused assessments It's not fair? Or is it – book by Millgate House Book – The Molliebird – Jules Pottle Book – Charles Darwin's On the Origin Of Species – Sabina Radeva https://www.stem.org.uk/resources/elibrary/resource/32696/battle-beaks	***LOCATIONS OF PLANNING/RESOURCE*** Solar System Research Investigation – TAPS focused assessments Solar System Scope Hidden Figures by Margot Lee Shetterly - The incredible story of four black women who made vital contributions to space exploration.	***LOCATIONS OF PLANNING/RESOURCE*** Life Cycles Investigation and Outdoor Key Investigation – TAPS focused assessments Carl Linnaeus - https://www.bbc.co.uk/teach/class-clips-video/science-ks2-the-work-of-carl-linnaeus/zhnjf4j	***LOCATIONS OF PLANNING/RESOURCE*** Dissolving Investigation – TAPS focused assessments It's not fair? Or is it – book by Millhouse gate Range of materials – metallic and non-metallic, sand, salt etc for dissolving, wood vinegar, bicarbonate of soda
Enquiry and Working	**PATTERN SEEKING/FAIR OR COMPARATIVE TESTING** **Working Scientifically Skills:** Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate	**FAIR OR COMPARATIVE TESTING** **Working Scientifically Skills:** Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary Reporting and presenting findings from enquiries, including conclusions, causal relationships and	**RESEARCH USING SECONDARY SOURCES/ IDENTIFYING, GROUPING AND CLASSIFYING** **Working Scientifically Skills:** Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs	**FAIR OR COMPARATIVE TESTING** **Working Scientifically Skills:** Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary Using test results to make predictions to set up further comparative and fair tests

Knowledge Progression

Year 5/6 Science Cycle 1

Key Knowledge – what do we want our children to know before they leave our year group? How will we get them there? How is that personalised to Tranmere?

Evolution and inheritance Y6
TERM: Autumn 1 and 2

POWERFUL KNOWLEDGE:

S1 - All living things have offspring of the same kind, as features in the offspring are inherited from the parents. Due to sexual reproduction, the offspring are not identical to their parents and vary from each other.

S2 - Plants and animals have characteristics that make them suited (adapted) to their environment. If the environment changes rapidly, some variations of a species may not suit the new environment and will die. If the environment changes slowly, animals and plants with variations that are best suited survive in greater numbers to reproduce and pass their characteristics on to their young.

S3 - Over time, these inherited characteristics become more dominant within the population. Over a very long period of time, these characteristics may be so different to how they were originally that a new species is created. This is evolution.

S4 - Fossils give us evidence of what lived on the Earth millions of year ago and provide evidence to support the theory of evolution. More recently, scientists such as Darwin and Wallace observed how living things adapt to different environments to become distinct varieties with their own characteristics.

S5 – Darwin formed his Theory of Evolution partly due to a discovery on the Galapagos Islands. Darwin found that finches (which are a species of bird) varied in different ways depending on which island they lived on. One of those differences was beak size. Some finches had fat short beaks and some thinner sized beaks. Charles Darwin found that the seeds available on the islands where the finches lived differed in size and that finch beaks had adapted to the size of seed available. He concluded that the finches' beaks had evolved over time as favourable characteristics were passed down through generations of birds.

COMMON MISCONCEPTIONS

- adaptation occurs during an animal's lifetime: giraffes' necks stretch during their lifetime to reach higher leaves and animals living in cold environments grow thick fur during their life
- offspring most resemble their parents of the same sex, so that sons look like fathers
- all characteristics, including those that are due to actions during the parent's life such as dyed hair or footballing skills, can be inherited
- cavemen and dinosaurs were alive at the same time.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will identify a plant or animal found on our school site. They will research and outline how it is adapted to live in our local habitat. They then, will draw a contrasting habitat card out of a hat and will have to fully explain how that plant or animal would have to adapt.
2. Whilst referencing how certain living things have adapted to survive in extreme conditions: cactuses, penguins and camels, the children will create an alien or mythical creature that is perfectly adapted to an extreme habitat (could link to space work).
3. Children will build on the work done in LKS2 on fossils and will make observations of fossils to identify living things that lived on Earth millions of years ago. (see science resources for selection of fossils and casts).
4. The children will write biographies about Charles Darwin and Alfred Wallace that include models to demonstrate evolution e.g. Darwin's finches bird beak activity. They could also do an investigation into bird beaks (Battle of the Beaks) to cement a understanding of adaptation and evolution.https://www.stem.org.uk/resources/elibrary/resource/32696/battle-beaks
5. ***Today we are going to be palaeontologists.*** Show a picture of a fossilised skeleton/creature and discuss the children's ideas about fossils, what it was, what it ate, where it lived etc. (Could provide only one part to start with, or parts to different groups, to show how we only have part of the information). Discuss strong/weak evidence e.g. strong evidence that has skeleton/teeth etc, place where fossil was found suggests habitat, similarities with modern creatures suggest colour etc. Provide children with photos or real/resin fossils (trilobite, ammonite, ichthyosaurus etc, plus any found locally or linked/displayed at local museums). Ask them to use the fossils and their own research to develop ideas about the creatures e.g. labelled drawing with size, possible appearance, diet, habitat, what other fossils could exist eg what prints could be left behind. Could colour code or star ideas for which there is the strongest evidence. (This could be done as part of a visit to Cliffe Castle Museum).
6. Children will undertake a project about inheritance (Cow Do you Do). They will learn about traits that we inherit from our parents via sexual reproduction and they will survey their parents and grandparents to discover where they inherited certain traits (detached earlobes, tongue rolling). Further to this, we will then collate the data as a class to propose which traits are more likely (dominant vs recessive).
7. Following point 6, children will learn about how breeders favour certain traits (cows, dogs, race horses etc) and will play a breeding game to discover who can pass on the most favourable traits to their 'offspring'. Finally, for fun, the children will create two fictional, 'superpowered' animals, and will then describe the characteristics their offspring would have. Could use The Incredibles films for this or Cows/dogs/horses.

Earth and Space Y5
TERM: Spr 1

POWERFUL KNOWLEDGE:

S6 - The Sun is a star; it is at the centre of our solar system.

S7 - There are 8 planets travelling around the Sun in fixed orbits.

S8 - Earth takes 365¼ days (LEAP YEAR EXPLANATION) to complete its orbit around the Sun.

S9 - 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).

S10 - The Moon orbits the Earth. It takes about 28 days to complete its orbit.

S11 - The Sun, Earth and Moon are approximately spherical.

S12 - Heliocentric and geocentric are two explanations of the arrangement of the universe, including the solar system. The geocentric model says that the earth is at the centre of the cosmos or universe, and the planets, the sun and the moon, and the stars circles around it. The early heliocentric models consider the sun as the centre, and the planets revolve around the sun.

COMMON MISCONCEPTIONS

- the Earth is flat
- the Sun is a planet
- the Sun rotates around the Earth
- the Sun moves across the sky during the day
- the Sun rises in the morning and sets in the evening
- the Moon appears only at night
- night is caused by the Moon getting in the way of the Sun or the Sun moving further away from the Earth.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will use secondary sources to help create a model to show the movement of the Earth around the Sun and the Moon around the Earth. They will complete this on the playground/banks having stepped it out to scale to appreciate the size of the universe.
2. Having done this, they will create news reports (iMovie – there is a template) to explain night and day, the geocentric and heliocentric models of the universe and how Copernicus put science and religion at odds, the length of a year, the length of a day, why we see different phases of the moon and why the moon shines at night (linked to light topic).
3. Using their knowledge of the movement of the sun, the children will create a sundial on the playground that tells the time (Big Challenge and should be introduced this way). Chalk and a rounders post should be all they need.
4. Our children will create video diary links with children in different time zones through internet links and direct communication with students in different places around Earth. They will research who sees new year first, which country experiences the longest, shortest days etc.

Living things and their Habitats (Y5&6)
TERM: Spr 2 & Sum 1

POWERFUL KNOWLEDGE:

S11 - As part of their life cycle, plants and animals reproduce. Most animals reproduce sexually. This involves two parents where the sperm from the male fertilises the female egg.

S12 - Animals, including humans, have offspring which grow into adults. In humans and some animals, these offspring will be born live, such as babies or kittens, and then grow into adults. In other animals, such as chickens or snakes, there may be eggs laid that hatch to young which then grow to adults. Some young undergo a further change before becoming adults e.g. caterpillars to butterflies. This is called a metamorphosis.

S13 - Plants reproduce both sexually and asexually. Bulbs, tubers, runners and plantlets are examples of asexual plant reproduction which involves only one parent. Gardeners may force plants to reproduce asexually by taking cuttings. Sexual reproduction occurs through pollination, usually involving wind or insects.

S14 - Living things can be formally grouped according to characteristics. Plants and animals are two main groups but there are other livings things that do not fit into these groups e.g. micro-organisms such as bacteria, yeast, fungi (not always microorganisms) and viruses. Plants can make their own food whereas animals cannot.

S15 - Animals can be divided into two main groups: those that have backbones (vertebrates); and those that do not (invertebrates). Vertebrates can be divided into five small groups: fish; amphibians; reptiles; birds; and mammals. Each group has common characteristics. Invertebrates can be divided into several groups, including insects, spiders, snails and worms.

S16 - Plants can be divided broadly into two main groups: flowering plants; and non-flowering plants.

S17 - Carl Linnaeus helped to develop crucial theories on biodiversity and the classification of plants and animals. This system, called the 'binomial system', where the genus of a species is named and followed by a specific species type, is still used by people today.

COMMON MISCONCEPTIONS

- all plants start out as seeds
- all plants have flowers
- plants that grow from bulbs do not have seeds
- only birds lay eggs
- all micro-organisms are harmful
- mushrooms are plants.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will use secondary sources and, where possible, first-hand observations to find out about the life cycle of a range of animals. They will compare the life cycle of plants and animals in their local environment with plants and animals from around the world. ***Today we are going to be zoologists.*** Ask children to research the life cycles of two different species (bird, amphibian, insect) using a range of secondary sources. This could be in small groups or individually. Discuss possibilities for presenting their research. This could include zoological diagrams of life cycles. (if possible, provide a purpose e.g. presenting to younger children/parents etc.) For example, different children could choose to make a model, a mime/drama, a rap/song or a poster/book. Agree on criteria for successful presentation of research e.g. clear order to life cycle, comparison between two life cycles, use of scientific vocabulary etc. Children present their research to the intended audience. Groups could peer assess against agreed success criteria.
2. Children will compare the gestation periods for mammals and look for patterns e.g. in relation to size of animal or length of dependency after birth. They may also look for patterns between the size of an animal and its expected life span.
3. Children will revisit classification keys (including dichotomous keys), creating classification systems and keys to identify animals and plants from their immediate environment. ***We are going to be environmental scientists.*** Remind children about how to use/make a classification key e.g. using wildlife from a different habitat, design a branching key (using IT or large sheets of paper). Emphasise the requirement for yes/no questions and scientific language. We do not yet have a classification key specific to our local environment – what living things would we expect it to include? Discuss classification groups (in/vertebrates, flowering/nonflowering plants etc) appropriate to local habitat. Conduct a local wildlife survey of plants and animals in or around the school grounds, collecting plant samples or drawings/photos of animals/plants to help to make a key. Ask pupils to make a key to identify 6-8 local animals and/or plants. Children try others' keys to see it can successfully classify a member of their sample.
4. Children will also use secondary sources to learn about the formal classification system devised by Carl Linnaeus and why it is important. Using this and previous knowledge, children will be able to use information about the characteristics of an unknown animal or plant to assign it to a group and presenting this in a range of ways e.g. Venn diagrams, Carroll diagrams and keys.
5. Children may also create an imaginary animal which has features from one or more groups.
6. Children will dissect gladiolus/lily plants, labelling their parts (petal, sepal, stamen, stigma, ovule, pistil, ovary, filament, style) and discussing the exact function with reference to sexual reproduction and pollination.
7. Children will grow and observe plants that reproduce asexually e.g. strawberries, spider plants, potatoes, growing them from different parts of a parent plant (seeds, stem, root cuttings, tubers, bulbs.) They will also take cuttings from a range of plants e.g. African violet, mint, plant bulbs and then harvest to see how they multiply.

Properties and changes of materials Y5
TERM: Sum 2

POWERFUL KNOWLEDGE:

S17 - Materials have different uses depending on their properties and state (liquid, solid, gas).

S18 - Properties include hardness, solubility, transparency, electrical and thermal conductivity and attraction to magnets.

S19 - Some materials will dissolve in a liquid and form a solution while others are insoluble and form sediment.

S20 - 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.

COMMON MISCONCEPTIONS

Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed.

- thermal insulators keep cold in or out
- thermal insulators warm things up
- solids dissolved in liquids have vanished and so you cannot get them back
- lit candles only melt, which is a reversible change.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will investigate the properties of different materials in order to recommend materials for particular functions depending on these properties. They will classify them based on hardness, solubility, transparency, conductivity and whether they are magnetic/magnets. Children can test waterproofness in trays in the classroom and apply their learning to the creation of boats that we could sail in a stream locally or using water provision from EYFS.
2. Children will investigate creating Alien Soup, making it and then having to separate the mixture by sieving, filtering and evaporation, choosing the most suitable method and equipment for each mixture
3. They will also investigate rates of dissolving by carrying out comparative and fair tests using different solutes and or liquids for the solutes to dissolve in. Sugar, coffee, etc can all be used. Temperature of liquids could also be used as a variable. ***Today we are going to be chemists***. Ask children to think of everyday example of dissolving solids in water (e.g. sugar in tea, salt in cooking water). Ask them to suggest ways of making the sugar dissolve faster (e.g. stirring, temperature of the water, size of sugar grains, volume of water). Ask them to choose a factor to investigate and to plan a fair test. Carry out tests and discuss outcomes. They might then plan further investigations based on the results.
4. Children will explore a range of non-reversible changes e.g. rusting, adding fizzy tablets to water, burning. They will carry out comparative and fair tests involving non-reversible changes e.g. What affects the rate of rusting? What affects the amount of gas produced?
5. Further to this, we investigate thermal insulation by completing an experiment into which material will ensure that ice cubes don't melt within the classroom. Here, we encourage enquiry and the importance of quantitative measure.