



Knowledge Progression

Year 3/4 Science Cycle 2



	Animals including Humans (Y3 & Y4) TERM: Spr 1 & 2	States of Matter Y4 TERM: Aut 1 and 2	Light Y3 TERM: Sum 1	Electricity TERM: Sum 2
Key Vocabulary	nutrition, nutrient, fruit, vegetables, dairy, fat, sugar, carbohydrate, vitamin, mineral, fibre, balanced diet, skeleton, muscles, support, protection, movement, skull, ribs, spine, vertebrate, invertebrate, joint, socket, bone, tendon, digestive system, oesophagus (gullet), stomach, small intestine, large intestine, rectum, anus, faeces (poo), mouth, teeth, canine, incisor, molar, pre-molar, saliva, tongue, rip, tear	state, matter, solid, liquid, gas, air, oxygen, ice, water, water vapour, steam, heated, cooled, temperature, degrees Celsius, melt, melting point, freeze, freezing point, solidify, boil, boiling point, evaporate, evaporation, condense, condensation, water cycle, precipitation, infiltration	light, light source, dark, darkness, absence of light, reflect, reflective, rays, mirror, shadow, block, direction, opaque, transparent, translucent, shiny, matt, surface, sunlight, torch, lamp, flame, light bulb, dangerous	electricity, appliance, device, mains, plug, electrical circuit, cells, battery, component, wires, bulbs, switches, buzzers, conductor, insulator, series circuit, Positive, negative, connection, short circuit, wire, crocodile clip, motor, metal, non-metal, short circuit
Previous knowledge/ Learning	<ol style="list-style-type: none"> In KS1 children were taught to identify and name a variety of common animal, describing and comparing the structure of them, including fish, amphibians, reptiles, birds and mammals and identify and name them as carnivores, herbivores and omnivores. They were also taught to identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. They understand that animals have offspring which grow into adults. They know about the basic needs of animals, including humans, for survival and the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. 	<p>In KS1, children will have:</p> <ol style="list-style-type: none"> Learnt to distinguish between an object and the material it is made from. Described the physical properties of everyday materials Correlated materials (plastic, bricks, glass) with their suitability for use. Investigated how the shapes of solid objects can be changed by squashing, bending, twisting and stretching. Learnt that certain materials have multiple uses (metal = coins, cars, cans) or that objects can be made of different things (spoon = wood, metal, plastic) Children will have developed some further understanding of materials in the Rocks unit. 	<ol style="list-style-type: none"> In KS1 children began to describe, compare and group materials based on their simple physical properties which will allow them to build up to identifying properties such as reflective, opaque, transparent and translucent. <p>1. In the Electricity unit children will have identified appliances that run on electricity, some of which will generate light.</p>	<p>In KS1 children began to describe, compare and group materials based on their simple physical properties which will allow them to build up to identifying conductors and insulators.</p>
N.C. Objectives	<ol style="list-style-type: none"> Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat Identify that humans and some other animals have skeletons and muscles for support, protection and movement Describe the simple functions of the basic parts of the digestive system in humans Identify the different types of teeth in humans and their simple functions Construct and interpret a variety of food chains, identifying producers, predators and prey 	<ol style="list-style-type: none"> Compare and group materials together, according to whether they are solids, liquids or gases Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature 	<ol style="list-style-type: none"> Recognise that they need light in order to see things and that dark is the absence of light Notice that light is reflected from surfaces Recognise that light from the sun can be dangerous and that there are ways to protect their eyes Recognise that shadows are formed when the light from a light source is blocked by an opaque object Find patterns in the way that the size of shadows change 	<ol style="list-style-type: none"> Identify common appliances that run on electricity Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit Recognise some common conductors and insulators, and associate metals with being good conductors
Resources/ Assessment	<p><u>LOCATIONS OF PLANNING/RESOURCE</u></p> <p>Skeleton Questions and Teeth in Liquid Investigations – TAPS focused assessments</p> <p>A ROLLER-COASTER RIDE AROUND THE BODY by Gabby Dawnay – great for remembering what happens – rhyming.</p>	<p><u>LOCATIONS OF PLANNING/RESOURCE</u></p> <p>Cornflour slime Investigation – TAPS focused assessments</p> <p>Water Cycle Rap https://www.youtube.com/watch?v=KM-59IjA4Bs Water Cycle Song https://www.youtube.com/watch?v=TWb4KIM2vts Water Cycle Rap https://www.youtube.com/watch?v=43PrgnE6jDU Water Cycle Rap https://www.youtube.com/watch?v=ILGmddxT178 (Drake!)</p>	<p><u>LOCATIONS OF PLANNING/RESOURCE</u></p> <p>Make shadows Investigation – TAPS focused assessments</p> <p>Book – The Dark by Lemony Snicket</p>	<p><u>LOCATIONS OF PLANNING/RESOURCE</u></p> <p>Electrical Conductors Investigation – TAPS focused assessments</p>

Enquiry and Working Scientifically	<p>GROUPING, IDENTIFYING AND CLASSIFYING</p> <p>Working Scientifically Skills: Identifying and classifying Reporting on findings from enquiries, including oral and written Explanations, displays or presentations of results and conclusions</p>	<p>PATTERN SEEKING/RESEARCH USING SECONDARY SOURCES</p> <p>Working Scientifically Skills: Identifying and classifying Asking relevant questions and using different types of scientific enquiries to answer them Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers Setting up simple practical enquiries, comparative and fair tests</p>	<p>GROUPING, IDENTIFYING AND CLASSIFYING/ RESEARCH USING SECONDARY SOURCES/ COMPARATIVE TESTING</p> <p>Working Scientifically Skills: Identifying and classifying Asking relevant questions and using different types of scientific enquiries to answer them Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers</p>	<p>COMPARATIVE TESTING</p> <p>Working Scientifically Skills: Setting up simple practical enquiries, comparative and fair tests Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions</p>
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Knowledge Progression Year 3/4 Science Cycle 2



Animals including Humans (Y3 & Y4) TERM: Aut 1 & 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

- S1* - Animals, unlike plants which can make their own food, need to eat to get the nutrients they need.
- S2* - Food contains a range of different nutrients – carbohydrates (including sugars), protein, vitamins, minerals, fats, sugars, water – and fibre that are needed by the body to stay healthy. These different nutrients are important for repair, growth, energy and other important jobs in the body. A piece of food will often provide a range of nutrients.
- S3* - Food enters the body through the mouth. Digestion starts when the teeth start to break the food down. Saliva is added, and the tongue rolls the food into a ball. The food is swallowed and passes down the oesophagus to the stomach. Here the food is broken down further (churning and chemicals). The food passes into the small intestine. Here, nutrients are removed from the food and are used elsewhere in the body. The rest then passes into the large intestine. Here, the water is removed and what is left is then stored in the rectum until it leaves the body through the anus (poo).
- S4* - Humans have four types of teeth: incisors for cutting; canines for tearing; and molars and premolars for grinding (chewing). The teeth in carnivores (dog), herbivores (cow) and omnivores look different due to their different roles.
- S5* – When teeth aren't being looked after, either through eating and drinking too much of the wrong things, or not cleaning teeth properly, tooth decay will occur.
- S6* - Humans, and some other animals, have skeletons and muscles which help them move and provide protection and support.
- S7* - Living things can be classified as producers, predators and prey according to their place in the food chain. Energy originates from the sun and can be traced through a food chain, represented by the arrows.

COMMON MISCONCEPTIONS

- certain whole food groups like fats are 'bad' for you
- certain specific foods, like cheese are also 'bad' for you
- diet and fruit drinks are 'good' for you
- snakes are like worms, so they must also be invertebrates
- invertebrates have no form of skeleton.
- arrows in a food chains mean 'eats'
- the death of one of the parts of a food chain or web has no, or limited, consequences on the rest of the chain
- there is always plenty of food for wild animals
- your stomach is where your belly button is
- food is digested only in the stomach
- when you have a meal, your food goes down one tube and your drink down another
- food can go down the wrong way
- the food you eat becomes "poo" and the drink becomes "wee".

HOW DOES THIS LOOK AT TRANMERE?

1. Children will classify food (good for you, bad for you, important for growth, energy), including using food labels to explore the nutritional content of a range of food items, and using secondary sources to find out the types of food that contain the different nutrients. They will create a graph of their findings. **(DO NOT DO EATWELL PLATES!)**
2. Using food labels, they answer enquiry questions (How much fat do different types of pizza contain? How much sugar is in soft drinks?) and then plan a daily diet containing a balance of nutrients. They will also look at specific needs, (a marathon runner or weight lifter) and what their diet should constitute, creating an information page/leaflet/menu.
3. Children will use secondary sources to research the parts and functions of the skeleton. They will learn 'Heads, Shoulders, Knees and Toes' with the correct terms – Cranium, scapula, patella, phalanges.
4. **Today we are going to be osteologists** - Discuss differences between human skeletons, taking care when discussing differences between children in class. Consider which bones can be more easily measured e.g. skull, foot, part of arm/leg etc. Ask children to use these ideas to create a question to be investigated, e.g. Are adult heads bigger than children's heads? Do taller children have longer arms/bigger feet etc? Am I/Are you a square? (look at arm span versus height) They will investigate patterns leading their own line of enquiry.
5. Children will research the function of the parts of the digestive system, creating a working model of the digestive system using tights, Weetabix etc. <https://www.bbc.co.uk/bitesize/topics/zf339j6/articles/zrm48mn>
6. Children will explore eating different types of food (crunchy fruit/veg, meat, bread) to identify which teeth are being used for cutting, tearing and grinding (chewing), they will also classify animals as herbivores, carnivores or omnivores according to the type of teeth they have in their skulls. (dog, cow, rabbit) Comparisons are key.
7. They will investigate the effect different liquids have on teeth using hard boiled eggs. - **This week we're dental scientists.** Discuss how children look after their teeth. Explain that we will be using hard boiled eggs to represent teeth to investigate tooth decay. As a class set up a fair test (e.g. cola, water, vinegar, milk, sports drink and orange juice.) Discuss how they can make the comparison fair, i.e. quantity of liquid, types of containers, time and location (if using milk do they all need to be in the fridge?) Leave for one week, although children can check on the experiment daily to see if they can notice and changes. After one week, unveil the eggs by tipping into a white bowl and photograph. Children to record their observations (look, feel, smell, etc.) and rate the eggs in order of damage to shell observed. Children to consider how they could improve the test and what further questions arise that they could investigate. Brushing could be an angle here?
8. Children will use and create food chains to identify producers, predators and prey within a habitat, and secondary sources to identify animals in a habitat and find out what they eat.

States of Matter Y4 TERM: Spr 1 & 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

- S8* - A solid keeps its shape and has a fixed volume. A liquid has a fixed volume but changes in shape to fit the container. A liquid can be poured and keeps a level, horizontal surface. A gas fills all available space; it has no fixed shape or volume. Granular and powdery solids like sand can be confused with liquids because they can be poured, but when poured they form a heap and they do not keep a level surface when tipped. Each individual grain demonstrates the properties of a solid.
- S9* – Non-Newtonian fluids behave differently. They can be poured and change shape, but if you place force onto them, it will temporarily form a solid.
- S10* - Melting is a state change from solid to liquid. Freezing is a state change from liquid to solid. The freezing point of water is 0oC. Boiling is a change of state from liquid to gas that happens when a liquid is heated to a specific temperature and bubbles of the gas can be seen in the liquid. Water boils when it is heated to 100oC. Evaporation is the same state change as boiling (liquid to gas) but it happens slowly at lower temperatures and only at the surface of the liquid. Evaporation happens more quickly if the temperature is higher, the liquid is spread out or it is windy. Condensation is the change back from a gas to a liquid caused by cooling.
- S11* - Water at the surface of seas, rivers etc. evaporates into water vapour (a gas). This rises, cools and condenses back into a liquid forming clouds. When too much water has condensed, the water droplets in the cloud get too heavy and fall back down as rain, snow, sleet etc. and drain back into rivers etc. This is known as precipitation. This is the water cycle.

COMMON MISCONCEPTIONS

- 'solid' is another word for hard or opaque
- solids are hard and cannot break or change shape easily and are often in one piece
- substances made of very small particles like sugar or sand cannot be solids
- particles in liquids are further apart than in solids and they take up more space
- when air is pumped into balloons, they become lighter
- water in different forms – steam, water, ice – are all different substances
- all liquids boil at the same temperature as water (100 degrees)
- melting, as a change of state, is the same as dissolving
- steam is visible water vapour (only the condensing water droplets can be seen)
- clouds are made of water vapour or steam
- the substance on windows etc. is condensation rather than water
- the changing states of water (illustrated by the water cycle) are irreversible
- evaporating or boiling water makes it vanish
- evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will observe closely and classify a range of solids (wood, metal, plastic, sand, stones, salt), liquids (water, milk, honey, orange juice, vinegar) and gases, identifying the properties. Also, they explore making gases visible e.g. squeezing sponges under water to see bubbles, and showing their effect e.g. using straws to blow objects, trees moving in the wind. Once these have been explored practically, children will classify a selection of materials according to whether they are solids, liquids and gases, and the properties they have.
2. Children will understand that there are changes of state and will observe a range of materials melting e.g. ice, chocolate, butter. This may include: i) Investigating how to melt ice more quickly ii) Observing the changes when making rocky road cakes iii) Investigating the melting point of different materials e.g. ice, margarine, butter and chocolate.
3. Children will also explore freezing different liquids e.g. tomato ketchup, oil, shampoo, and will use a thermometer to measure temperatures e.g. icy water (melting), tap water, hot water, boiling water (demonstration).
4. Children will investigate non-Newtonian fluids - **Today we are chemists.** Discuss the properties of water and cornflour before mixing, noting the children's descriptions, questions and predictions for what will happen when they are mixed. Consider how to make the cornflour slime/oobleck e.g. take turns, aprons, outside/cover floor. Explore their questions and predictions in small groups, for example, beginning with a cup of cornflour and half a cup of water, mixing with hands until the consistency of honey. Observe how when lifted, the mixture runs through your fingers, but when you apply force, it solidifies (this is a Non-Newtonian fluid – a liquid which acts like a solid under pressure). Ask the children to explore further: raising post-it questions to test e.g. trying different amounts of pressure (1 finger etc), can it be held/squeezed/twisted, can it be rolled into a ball, can it bounce, adding more water/flour.... Collate questions and discuss findings.
5. Children will observe water evaporating and condensing e.g. on cups of icy water and hot water (catching it on a glass/bowl from a kettle/pan) and may also look at puddles drying in the playground. They will then set up investigations to explore changing the rate of evaporation e.g. washing, puddles, handprints on paper towels, liquids in containers. To conclude, children use secondary sources to find out about the water cycle and will create a model of the water cycle in a Ziploc sandwich bag. They will also learn the WaterCycle Rap.

Light Y3 TERM: Sum 1

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

- S12* - We see objects because our eyes can sense light. Dark is the absence of light. We cannot see anything in complete darkness. Some objects, for example the sun, light bulbs and candles are sources of light. Objects are easier to see if there is light.
- S13* - Some surfaces reflect light. Objects are easier to see when there is less light if they are reflective.
- S14* - The light from the sun can damage our eyes and therefore we should not look directly at the Sun and can protect our eyes by wearing sunglasses or sunhats in bright light.
- S15* - Shadows are formed on a surface when an opaque or translucent object is between a light source and the surface and blocks some of the light. The size of the shadow depends on the position of the source, object and surface.

COMMON MISCONCEPTIONS

- we can still see even where there is an absence of any light
- our eyes 'get used to' the dark
- the moon and reflective surfaces are light sources
- a transparent object is a light source
- shadows contain details of the object, such as facial features on their own shadow
- shadows result from objects giving off darkness.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will explore how different objects are more or less visible in different levels of lighting, and explore how objects with different surfaces, e.g. shiny vs matt, are more or less visible. They will link this to staying safe on the roads – cyclists – by exploring reflective cyclist gear, high vis jackets, and objects such as glass, plastic, wood, metal.
2. Children will explore how shadows vary as the distance between a light source and an object or surface is changed, exploring how shadows are connected to and disconnected from the object e.g. shadows of clouds and children in the playground. They will use their bodies to make the letters of the alphabet in shadows.
3. Children will investigate and then select suitable materials to make shadow puppets. **Today we are going to be physicists** - Provide the children with a collection of materials to explore (some transparent, some translucent and some opaque). Ask the children to investigate which materials form shadows when a torch is shone on them (e.g. colour, darkness, no shadow?) Ask them to record their observations to answer the question about which materials form a shadow (e.g. draw, write, sort, photo, order, table). Can they categorise or order the materials and/or shadows in some way? Once completed, shadow puppets can be made from the selected materials (**Art/DT link**)
4. Challenge – Recreate Goldilocks with shadow puppets only using one bear, chair and bed. Children have to change the distance from the light source to create larger and smaller shadows for Daddy, Mummy and Baby Bear.

Electricity Y4 TERM: Sum 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

- S16* - Many household devices and appliances run on electricity. Some plug in to the mains and others run on batteries.
- S17* - An electrical circuit consists of a cell or battery connected to a component using wires. If there is a break in the circuit, a loose connection or a short circuit the component will not work.
- S18* - A switch can be added to the circuit to turn the component on and off.
- S19* - Metals are good conductors so they can be used as wires in a circuit. Non-metallic solids are insulators except for graphite (pencil lead). Water, if not completely pure, also conducts electricity.
- N.B.** Children in Year 4 do not need to use standard symbols for electrical components, as this is taught in Year 6.

COMMON MISCONCEPTIONS

- electricity flows to bulbs, not through them
- electricity flows out of both ends of a battery
- electricity works by simply coming out of one end of a battery into the component
- it is called a cell unless there is more than one of them.

HOW DOES THIS LOOK AT TRANMERE?

1. Children will construct a circuit that contains a cell, bulb, wires, buzzer, using a selection of components. They will classify which circuits are complete/broken and explore how this could be tested (trying to light up a bulb).
2. They will investigate which materials can be used instead of wires to make a circuit and will classify the materials that were suitable/not suitable for wires. **Today we are electrical engineers.** - Introduce the terms conductors and insulators. Using the context of a soldier in the desert (or an explorer in the) that has ripped part of 'smart' clothing losing part of the GPS circuit, so unable to provide location for rescue. Explain that the soldier has a pack containing a variety of objects: which could be used to complete a circuit to activate the GPS? Provide each group with a 'soldier's backpack' containing a collection of objects/ materials (including different metals and plastics). Discuss how to find out whether electricity can pass through the materials. Groups test by putting materials into a gap in a circuit with a bulb/buzzer. Focus pupil recording/presenting on explaining what the results show. E.g. they could produce a radio or video message to send to the soldier explaining how to produce a working circuit and why they are confident that this will work, providing scientific evidence and a list of all possible conductors (in case some are damaged).
3. Children will explore how to connect different switches (push button, toggle, selector, slide) and investigate how they function in different ways, choosing switches to add to circuits to solve particular problems, such as a pressure switch for a burglar alarm, then apply their knowledge of conductors and insulators to design and make different types of switch. (using foil, cardboard, split pins etc). Children could then make circuits that can be controlled as part of a DT project. N.B. Children should be given one component at a time to add to circuits.
4. Children research Faraday and the impact his discoveries had.

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?