Knowledge Progression

Year 5/6 Science Cycle 2

	Animals including humans (Y5&6) TERM: Aut 1 & 2	Electricity Y6 TERM: Spr 1	Light Y6 TERM: Spr 2	Forces Y5 TERM: Sum 1 and 2
Key Vocabulary	Foetus, Embryo, Womb, Gestation, Baby, Toddler, Teenager, Elderly, Growth, Development, Puberty Heart, pulse, rate, pumps, blood, blood vessels, Red Blood Cells, White Blood Cells, Platelets, Plasma, transported, lungs, oxygen, carbon dioxide, nutrients, water, muscles, cycle, circulatory system, diet, exercise, drugs and lifestyle, peristalsis, stomach, oesophagus, colon, rectum, intestines, duodenum, faeces, waste, digestion	Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor, switch, voltage, NB Children do not need to understand what voltage is but will use volts and voltage to describe different batteries. The words cells and batteries are now used interchangeably	Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous straight lines, light rays, periscope,	Force, gravity, Earth, Mars, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears, falling objects, (Galileo Galilei and Isaac Newton) Newtons, streamlined, impact/frictional/strain forces
Previous knowledge/ Learning	In KS1, children will have: 1. Learnt to identify common animals including: fish, amphibians, reptiles, birds and mammals. 2. Learnt to identify: carnivores, herbivores and omnivores. 3. Described the basic parts of the human body and can say which part is associated with each sense. 4. Learnt to care for animals in their local environment. 5. Explored the difference between: living, dead and never alive. . Identified how most things live in habitats to which they are suited. 6. Identified a variety of plants and animals in their habitats (or microhabitats) 7. Investigated the food chain and how plants can provide shelter for animals. 8. Understood that animals have offspring which grow into adults. 9. Learnt about survival (water, food and air) 10. Understood the importance of exercise, healthy diets and hygiene. In LKS2, children will have: 1. Identified how animals need the right types of nutrition and that they cannot make their own food: they get nutrition from what they eat. 2. Learnt that humans and some animals have skeletons and muscles for support, protection and movement. 3. Described the simple functions of the basic parts of the digestive system in humans. 4. Identified the different types of teeth in humans. 5. Constructed and interpret food chains, identifying producers, predators and prey.	1. In LKS2, children will have already learnt how to construct simple series circuits. They will have experience of using switches, bulbs, buzzers and motors. 2. They will have identified common appliances that run on electricity. 3. They can identify common conductors and insulators. 4. They will have represented circuits pictorially but not using circuit symbols. 5. They may have come across the terms ‘current’ and ‘voltage’ and will have investigated and discovered that, when you add more cells, the bulbs get brighter.	In LKS2, children will have: 1. Recognised how light is needed to see things and that darkness is the absence of light. 2. That light is reflected from surfaces. 3. That the light from the sun can be harmful to their eyes. 4. That shadows are formed when the light from a light source is blocked by an opaque object. 5. Explored patterns in the size of shadows. (measuring and explaining what caused the change). 6. Investigated how reduced light affects plant growth	In LKS2, children will have: 1. Compared how things move on different surfaces. 2. Noticed that some forces need contact between 2 objects, but magnetic forces can act at a distance (observed how they attract and repel each other) 3. Observed how magnets attract or repel each other and attract some materials and not others. 3. Compared and group materials based on magnetism. 4. Described polarity and predicted whether 2 magnets will attract or repel.
N.C. Objectives	1. Describe the changes as humans develop to old age 2. Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood 3. Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function 4. Describe the ways in which nutrients and water are transported within animals, including humans	1. Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. 2. 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. 3. Use recognised symbols when representing a simple circuit in a diagram.	1. Recognise that light appears to travel in straight lines 2. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye 3. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them	1. Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object 2. Identify the effects of air resistance, water resistance and friction, that act between moving surfaces 4. Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect
Resources	***LOCATIONS OF PLANNING/RESOURCE*** Growth Survey and Heartrate Pose Investigations – TAPS focused assessments It’s not fair? Or is it – book by Millhouse gate	***LOCATIONS OF PLANNING/RESOURCE*** Bulb Brightness Investigation – TAPS focused assessments Electircal Circuit equipment – batteries, bulbs, wires etc. Resources for DT project – string, pegs, foil, card.	***LOCATIONS OF PLANNING/RESOURCE*** Light Questions Investigation – TAPS focused assessments It’s not fair? Or is it – book by Millhouse gate Torches, Card	***LOCATIONS OF PLANNING/RESOURCE*** Aqua dynamics and Paper Planes Investigations – TAPS focused assessments Squashed Tomato Challenge – Practical Action Schools https://practicalaction.org/schools/squashed-tomato-challenge/ Pulleys, string, levers, range of items to perform experiments with water resistance, friction and air resistance – e.g. bin liners as parachutes, Lego we: do for friction and making boats for water resistance

Enquiry and Working Scientifically	**RESEARCH USING SECONDARY SOURCES/ OBSERVATION OVER TIME** **Working Scientifically Skills:** **Reporting and presenting 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**	**COMPARATIVE/FAIR TESTS** **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**	**COMPARATIVE/FAIR TESTS** **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 explanations of and degree of trust in results, in oral and written forms such as displays and other presentations**	**RESEARCH USING SECONDARY SOURCES** **Working Scientifically Skills:** **Identifying scientific evidence that has been used to support or refute ideas or arguments**

Knowledge Progression

Year 5/6 Science Cycle 2

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?

Animals including humans (Y5&6)
TERM: Aut 1 & 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

S1 - When babies are young, they grow rapidly. They are very dependent on their parents.
S2 - During puberty, a child's body changes and develops primary and secondary sexual characteristics. This enables the adult to reproduce. This needs to be taught alongside PSHE. SEE LEEDS PLANNING.
S3 - The heart pumps blood in the blood vessels (arteries – away) around to the lungs. Oxygen enters the blood and carbon dioxide is removed. The blood goes back (veins return) to the heart and is then pumped around the body. Nutrients, water and oxygen are transported in the blood to the muscles and other parts of the body where they produce energy (mitochondria).
S4 - Red Blood Cells carry oxygenated and deoxygenated blood. White Blood Cells protect us from infection. Platelets fill cuts and Plasma is the liquid that carries the above.
S5 - Carbon dioxide and other waste, by-products are carried by the blood back to the heart and then expelled. This is the human circulatory system.
S6 – Diet (including a digestion recap), exercise, drugs and lifestyle have an impact on the way our bodies function. They can affect how well out heart and lungs work, how likely we are to suffer from conditions such as diabetes, how clearly, we think, and generally how fit and well we feel.

COMMON MISCONCEPTIONS
Some children may think:
- a baby grows in a mother's tummy
- a baby is "made"
- your heart is on the left side of your chest
- the heart makes blood
- the blood travels in one loop from the heart to the lungs and around the body
- when we exercise, our heart beats faster to work the muscles more
- some blood in our bodies is blue and some blood is red
- we just eat food for energy
- all fat is bad for you
- all dairy is good for you
- protein is good for you, so you can eat as much as you want
- foods only contain fat if you can see it
- all drugs are bad for you.

HOW DOES THIS LOOK AT TRANMERE?
1. Children will create a photograph timeline of their lives so far, marking key developmental steps. Further to this, they will use the 'oldify' app to explain how they will age in the future. It is always fun here to play guess who the baby picture belongs to, particularly if the teachers include theirs. If possible, a photographic timeline of an older relative would be great.
2. Children will undertake a growth investigation - ***Today we are going to be biologists***
What could we measure to show how humans develop as they grow older? Groups decide e.g. forearm length, arm span, foot length, etc. Discuss how we could measure this and the number of children/adults we would need to measure. How accurate do our measurements need to be? Decide on how many decimal places or unit. Ensure that children understand that they also need to record the age of the person. Children go to different year groups to measure specified number of children.
Bring data together to create class table. Ask groups to create scatter graphs to present the data, can use ICT to do this.
3. Children will, on the playground, or the hall become a moving example of the CV system. They will become the red blood cells and will develop an understanding of the gaseous, energy exchange process in a practical manner. Having done this, they will produce an information page about the CV system.
4. To promote scientific enquiry, the children complete HR investigation. In order to differentiate this from work done previously, the children will lead their own line of enquiry. They could investigate which activity causes the greatest change, time vs HR, does your heart rate double if you do twice as much exercise? Does height correlate to HR? Does leg length? Whilst doing this, children are encouraged to complete the test fairly by undertaking it 3 times and finding averages – maths link.
5. To promote an understanding of blood, our children will complete an investigation into creating the perfect fake blood (great around Halloween). They are shown the perfect mixture and are told it is made with 4 ingredients. They then act as reverse engineering chemists to attempt to recreate the fake blood (they are given three of the ingredients and measurements and have to test and make observations about the final ingredient).
6. Having worked scientifically to create fake blood – the children learn about the composition of real blood and create a visual representation of it using red and white hammer beads, chocolate sprinkles and custard.
7. Children will recap the main food groups and how the digestive system works, then, in conjunction with computing expectations, will database common foods found in their homes. They will use the information to form graphs and information pages that will inform other children about healthy and unhealthy food choices. Further to this, they can apply their investigations to health conditions such as diabetes or allergies, when writing food plans.
8. They will research the effects of legal and illegal drugs (e.g. tobacco, paracetamol, alcohol, cannabis and cocaine) and the benefits of a healthy diet and regular exercise by asking an expert or using carefully selected secondary sources.

Electricity Y6
TERM: Spr 1

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

S7 - Adding more cells to a complete circuit will make a bulb brighter, a motor spin faster or a buzzer make a louder sound.
S8 - If you use a battery with a higher voltage, the same thing happens.
S9 - Adding more bulbs to a circuit will make each bulb less bright. Using more motors or buzzers, each motor will spin more slowly, and each buzzer will be quieter.
S10 - Turning a switch off (open) breaks a circuit so the circuit is not complete, and electricity cannot flow. Any bulbs, motors or buzzers will then turn off as well.
S11 - A bulb lights because friction generates heat through the filament
S12 - Use recognised circuit symbols to draw simple circuit diagrams.

COMMON MISCONCEPTIONS
Some children may think:
- larger-sized batteries make bulbs brighter
- a complete circuit uses up electricity
- components in a circuit that are closer to the battery get more electricity.

HOW DOES THIS LOOK AT TRANMERE?
1. Children will begin the unit by making a prediction based on prior learning. E.g. more bulbs = less light.
2. Children will then investigate - ***Today we are going to be electrical engineers***. Provide a mix of basic circuit components and challenge pairs or trios to make a quick simple circuit. Compare and discuss the differences in bulb brightness and how to measure/observe this e.g. light seen through layers of paper, datalogger, observation.
Main task: to investigate how they can change the brightness of the bulb choosing from the available equipment (to include different lamps, cells and different thickness/length of high resistance/fuse wires). Each pair/trio to generate a list of variables which could be changed in their circuit and how they will observe/measure the effect of this change. Create a scientific question which identifies the 'change' and 'measure'. Record their plan e.g. question, variables and diagram of test circuit. Carry out and discuss investigations. Children can use LUX and DB meters.
2. Teachers, using a whole class circle of string, will provide a physical/concrete representation of how cells, bulbs and buzzers operate within a circuit.
3. Children will then apply their understanding of circuits, based on the conclusions of their investigations, to hide treasure in the 5/6 phase that is protected by booby traps (pressure pads and trip wires). How can you make these traps louder? Brighter?

Light Y6
TERM: Spr 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

S13 - Light travels in straight lines; it reflects off objects and into our eyes, allowing us to see them. The light may come directly from light sources, but for other objects some light must be reflected from the object into our eyes for the object to be seen.
S14 - Objects that block light (opaque or translucent) will cause shadows. Because light travels in straight lines the shape of the shadow will be the same as the outline shape of the object.
S15 - You can affect the size of a shadow by changing the distance from the light source. Furthermore, light is a colour spectrum (rainbows, soap bubbles)

COMMON MISCONCEPTIONS
Some children may think:
- we see objects because light travels from our eyes to the object.

HOW DOES THIS LOOK AT TRANMERE?
1. Children will revisit their previous understanding of light. ***Today we are going to be physicists***.
Provide a discussion-starting stimulus e.g. pictures of light in different contexts: shining through clouds, shadow puppets, headlights, eye. Explore children's ideas around light.
Challenge small groups to raise questions about light e.g. 20 questions. Then ask them to sort these into groups for how they could be answered e.g. research, direct observation, testing, we may never know...
Share questions from different groups, supporting children to turn some into a form which could be investigated. Select questions which could be: answered now by research; answered in a later lesson by observation or investigation; placed on the class 'Wonder Wall' to consider at the end of term.
2. Children will, working scientifically, prove that light travels in a straight line. The teacher will not tell them how to prove it. They will have to come up with a novel way to categorically prove it (hoses, card with a small hole cut in it, chalk dust) Push that we have to prove it more than once. Children may also investigate another of the questions generated at the start of the topic.
3. Children, will explain how light travels and will link this to how we see objects. Work here, ***linked to WW2,*** will include the creation of a camouflaged periscope. They will investigate which material reflects the most light by changing the reflective material in the periscope (mirror, dull tin foil, shiny tin foil, black paper, metallic border roll, cellophane, bubble wrap). Using their findings, they will be used on the banks to covertly sneak up on a target (game of BLOCKY)
4. Finally, children will once again be asked to prove that, actually light is multi-coloured. (Rainbows, soap bubbles, prisms, colour filters) before the teacher explains the phenomenon (not huge detail as that is KS3).

Forces Y5
TERM: Sum 1 and 2

POWERFUL KNOWLEDGE:
OUR CHILDREN WILL:

S16 - A force causes an object to start moving, stop moving, speed up, slow down or change direction – impact vs frictional vs strain forces.
S17 - Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall. This was discovered by Newton.
S18 - Air resistance, water resistance and friction are contact forces that act between moving surfaces. We can streamline objects to make them faster and use parachutes to slow down objects.
S19 - A mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. The small force moves a long distance and the resulting large force moves a small distance, e.g. a crowbar or bottle top remover. Pulleys, levers and gears are all mechanisms, also known as simple machines.

COMMON MISCONCEPTIONS
Some children may think:
- the heavier the object the faster it falls because it has more gravity acting on it
- forces always act in pairs which are equal and opposite
- smooth surfaces have no friction
- objects always travel better on smooth surfaces
- a moving object has a force which is pushing it forwards and it stops when the pushing force wears out
- a non-moving object has no forces acting on it
- heavy objects sink and light objects float.

HOW DOES THIS LOOK AT TRANMERE?
1. Children will revisit the effect of friction, exploring it in a range of contexts e.g. trainers, bath mats, mats for a helter-skelter, brakes on a bike. This is building on from the car ramp and shoe grip investigations in LKS2. They will measure this in Newtons.
2. Children will investigate the effects of water resistance in a range of contexts, culminating in an investigation using blu-tack. ***Today we are marine engineers*** - Challenge pairs to make a ball of plasticine or blue-tack fall as slowly as possible through water (size will depend on how big your container is e.g. a large transparent plastic box or tall measuring cylinder – if using cylinder, put plasticine on string for retrieval).
Ask children to explain why they think it will fall more slowly e.g. draw and label design or hold up and explain. Ask children to identify the control variables e.g. depth of water, mass of plasticine, position of drop. Test designs e.g. repeating in groups or as a whole class with a number of the children timing.
Discuss test results and their trustworthiness. Use the test results to predict which shapes will fall fastest (Streamlining). If time, challenge pairs to change the shape so that it falls quickly through the water.
3. Children will investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats. Observing how forces make things get faster or slow down. This will lead onto an investigation with paper planes and the forces that act upon them. ***Today we will be aeronautical engineers*** - Explore making and flying paper planes. Discuss different features of the planes and how they could tell which flew 'best'? Clarify the need to investigate 1 thing at a time, to see if it has an effect – each group will change 1 feature (not the whole design).
Identify different variables which could be changed (e.g. type/size of paper, number of folds, angle of flaps etc.) or measured (e.g. distance flown or flight time).
Use post-it planning boards to plan a fair test.
Ask pupils to show you/explain to you how they will be keeping their test as fair as possible (this can be done at the beginning and during the investigation, enabling more children to explain/show you).
Discuss how to carry out the investigation safely (e.g. throw in one direction, name planes).
Carry out tests and discuss outcomes for different plane features.
4. To extend this investigation, children will also investigate material, size and shape of parachutes to ensure an egg gets safely to the ground.
5. Children will explore how levers, pulleys and gears work, and will then undertake Practical Action's Squashed Tomato Challenge to design, build and test a way of moving tomatoes down a mountainside that won't squash them! This gives the challenge a real-world context.
6. Children will research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.