Science Curriculum Framework

Intent:

The purpose of the Futura Learning Partnership cross-phase Science curriculum is to help students understand and question the world around them. It gives them the scientific knowledge and skills that they need in order to be successful in their future lives and make a contribution to the wider community. Students are empowered with a strong knowledge base that they can then use to evaluate important issues, analyse evidence and problem solve. They develop the confidence to form their own opinions and articulate themselves effectively. Our engaging and challenging curriculum means that students who have studied Science at a Futura school will continue to enjoy learning about Science and how the world works throughout their lives.

Inclusion: Our curriculum is ambitious for all and strives to address inclusion and disadvantage in its intent and implementation

Aims: Underpinning the intent are key **substantive and disciplinary concepts**

P4 – Substantive knowledge
P7 – Disciplinary knowledge/scientific skills
P10 – KS1 contexts for disciplinary knowledge
P11 – KS1 contexts for substantive knowledge
P24 – KS2 contexts for disciplinary knowledge
P25 – KS2 contexts for substantive knowledge
See accompanying Excel document for KS3 and KS4

Curriculum structure

Our cross phase science curriculum is not explicitly split into key stages, but fully covers the National Curriculum. *It focuses on 10 big ideas that are spiralled in increasing complexity over the course of the 9 years (Forces; Electricity and electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems; Genes).* Scientific skills are developed throughout a student's time with us, focusing on 4 key areas that develop pupils scientific competences; planning investigations, investigate, analyse and thinking like a scientist.

Early Years Foundation Stage

In planning and guiding what children learn, practitioners must reflect on the different rates at which children are developing and adjust their practice appropriately. The three Characteristics of Effective Teaching and Learning are **playing and exploring** - children investigate and experience things, and 'have a go'; **active learning** - children concentrate and keep on trying if they encounter difficulties, and enjoy achievements; **creating and thinking critically** - children have and develop their own ideas, make links between ideas, and develop strategies for doing things. In addition, the prime areas of learning **(PSE, CL, PD)** underpin and are an integral part of children's learning in all areas.

Birth to Five Range 6 statements – Understanding the World - The World

Looks closely at similarities, differences, patterns and change in nature

Knows about similarities and differences in relation to places, objects, materials and living things

Talks about the features of their own immediate environment and how environments might vary from one another

Makes observations of animals and plants and explains why some things occur, and talks about changes

ELG – Understanding the World – The World: Children at the expected level of development will:

Explore the natural world around them, making observations and drawing pictures of animals and plants

Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class

Understand some important processes and changes in the natural world around them

Birth to Five Range 6 statements – PSED – Managing Self

Eats a healthy range of foodstuffs and understands need for variety in food

Describes a range of different food textures and tastes when cooking and notices changes when they are combined or exposed to hot and cold temperatures

Describes physical changes to the body that can occur when feeling unwell, anxious, tired, angry or sad

EYFS Science Skills

Asking simple questions and recognising that they can be answered in different ways	Observing closely, using simple equipment	Performing simple tests	Identifying and classifying	Using their observations and ideas to suggest answers to questions	Gathering and recording data to help in answering questions.
Adults supporting children to ask questions and find the answers in free play.	Within provision children will have access to simple equipment such as magnifying glasses.	Some tests such as floating and sinking and forces available through provision.	Using books as part provision to identify bugs and other wildlife.	Questioning by teachers and other adults to support.	With support from adults children gather and record data.

First-hand experiences and pupil offer:

Science at Foundation Stage is introduced indirectly through activities that encourage children to explore, observe, think, make decisions, and discuss. This is scaffolded through skilful adult interaction. Children will have opportunities to explore a range of scientific skills such as discussion, observation, scientific vocabulary, analysis, perspectives and interpretations and empathy. They experience first-hand artefacts and materials which they use to inspire learning.

The first-hand experiences children should be offered are:

- First-hand discussions with children about changes they notice and the world around them.

- Opportunities within provision for children to explore nature, make observations and experiment.
- Exploring the school environment and local area.
- Books and learning time focussed around scientific concepts like habitats, other countries and seasons.
- Opportunities for growing plants.
- Opportunities for making food.

Key Vocabulary

Animals Including Humans	Plants	Materials	Seasonal Changes	Forces, Earth and Space	Sound, Light and Electricity
Herbivore, carnivore, omnivore, human, fish, birds, animal, face, hair, leg, knee, arm, elbow, back, head, toes, ear, hands, eye, fingers, mouth, nose	Tree, trunk, fruit, branch, petals, roots, leaves, bulb, flowers, seed, stem	Material, metal, wood, rock, plastic, glass, hard, soft, paper, fabric, shiny, smooth, rough	Summer, Spring, Autumn, Winter, day, night, light, dark, Season, Moon, Sun	Earth, Moon, Planet, space, Sun, star	Loud, quiet, volume, sound

Substantive knowledge

Year Group	Substantive Knowledge - Biology	Substantive Knowledge - Chemistry	Substantive Knowledge - Physics

The 10 big ideas			
	Forces		Matter
	Electricity and electromagnets:		Reactions
	Energy		Earth
	Waves		Organisms

	Ecosystems		Genes
1	Identifying Plants and structures Naming and grouping animals and humans	Naming properties of materials	Seasonal changes
2	Plant Growth & requirements of life Lifecycles & habitat & requirements for life Food Chains Exercise, food & hygiene	Suitability of materials and changing solids	
3	Functions of parts of plants, inc. water transport Skeleton & muscles Diet including nutrition	Rocks	Magnets & forces Light Waves
4	Habitat changes Comparing plant requirements Food webs Teeth and digestion	States of Matter Water Cycles	Sound Electricity
5	Comparing life cycles Impact of drugs, lack of exercise and poor Nutrition - non-communicable diseases Circulatory and respiratory system	Complex properties and testing materials	Earth & Space Forces, including gravity & resistance mechanisms
6	Classification of plants and animals Reproduction & changes to old age	Dissolving & separating materials Reversible and irreversible reactions Basic particle theory	Evolution Electricity Light

7	Cells and organisation Skeletal and Muscular Systems Animal reproduction Plant reproduction (including fruit formation and seed dispersal) Health Relationships in an ecosystem Inheritance, chromosomes, DNA and genes	The particulate nature of matter Atoms, elements and compounds Pure and impure substances Chemical Reactions The Periodic Table Physical change Particle Model	Energy Changes and transfers Changes in Systems Describing motion Forces Pressure in fluids Balanced Forces and Motion Energy in matter Space Physics
8	Nutrition and digestion Gas exchange Systems Plants and Photosynthesis Respiration Natural Selection and evolution	Chemical Reactions continued The Periodic Table continued Earth structure - Earth and rocks Earth atmosphere- Climate Chemical energy	Calculations of fuel uses and costs in the domestic context Observed Waves Sound Waves Energy and Waves Light Waves Current electricity Static electricity Magnetism
9	Cells and Organisation Continued The Particulate nature of matter (chem in NC) Health	Atoms, Elements and Compounds continued The Periodic Table Continued The Particulate Nature of Matter continued Earth Atmosphere continued Chemical Energy continued	Energy Changes and Transfers continued Changes in Systems continued Energy in Matter continued Forces continued The Particulate Nature of Matter Continued Physical Change Continued Particle Model Continued Energetics (chem in NC)
10	Ecology Organisation (systems) Bioenergetics Homeostasis and response Ecology and evolution	Bonding and Structure Energy changes Chemical reactions Chemical calculations and organic I	Work and energy Electricity Forces and motion Waves

11	Inheritance	Rates of reaction Organic II (separate only)	Magnetism and forces Separate physics (Separate only)

Disciplinary knowledge / scientific skills

Year Group	**Planning investigations** devise questions, estimate risk, plan variables	**Investigate** Using appropriate techniques test hypothesis and collect data	**Analyse** Present data, analyse patterns, draw conclusion and discuss limitations	**Thinking like a scientist** Construct explanations, review theories, critique claims, justify opinions	**Possible Context**
1	Ask simple questions.	Observe closely.			
2	Ask simple questions and recognise that they can be answered in different ways.	Observe closely using simple equipment to perform simple tests.	Use observations and ideas to suggest answers to questions.		
3	Ask relevant questions and use different types of scientific enquiries to answer them.	Gather data to help in answering questions.	Record data in a table and draw simple bar graphs.	Explain what is meant by a theory.	
4	Use results in a variety of ways to help in answering questions.	Set up simple practical enquiries which are fair tests.	Report on findings from enquiries including oral and written explanations, based on graphical data.	Use straightforward scientific evidence to state whether it supports a theory.	

5	Plan different types of scientific enquiries to answer questions.	Make systematic and careful observations, taking accurate measurements usinga range of equipment. Make simple predictions.	Report and present findings from enquiries in line graphs and use these to describe patterns.	Use scientific words to report findings and suggest scientific ideas.	
6	Plan different types of scientific enquiries to answer questions.	Make predictions for results. Record data and results with increasing complexity.	Present findings from enquiries and comment on the degree of trust in the results.	Identify scientific evidence that has been used to support or refute ideas or arguments.	
7	Write an investigative question. Use variable terms: independent; dependant and control with confidence. Identify hazards and how to reduce the risk. List all the variables and focus on ones that effect the dependent variable. e.g. Chemistry – Reaction of Mg and Acid. Physics – Heat loss of different objects	Gather sufficient data for the investigation and repeat if appropriate, calculating means. Prepare a table for spaces to record all measurements. e.g. Biology - sampling Chemistry – pH of different substance	Decide a suitable chart or graph type based on the type of data collected and correctly label the independent and dependent variables. Describe the pattern found in a conclusion. e.g. Biology - Continuous and discontinuous variation Chemistry – Cooling curve	List all the facts, scientific ideas, data or conclusions that support an idea. Comment on the strength of the data in support of a claim. e.g. Chemistry – particle model Physics – energy in food	
8	Identify how to control each variable and ones that cannot be controlled. e.g. Biology – effects of exercise Biology – photosynthesis	See if repeated measurements are close. Design tables with space for further calculations. e.g. Chemistry – speed of chemical reaction Physics – resistance in a wire	Draw appropriate curve or straight line of best fit. Comment on the strength of the findings. Suggest ways to improve the method. e.g. Chemistry – speed of a chemical reaction Biology - Photosynthesis	Evaluate scientific methods and identify the reasoning behind a conclusion. e.g. Biology – Food tests Chemistry – reactivity series through experiment	
9	1 - Explain how to investigate a given question.	Carry out the method carefully and consistently,	Explain the choice of type of graph and line of best fit,	Comment on whether the evidence is scientifically	

	2 - Weigh up benefits and risks of a particular investigation. 3 - Explain why some variables are difficult to control. e.g. 1-Physics – ionising radiation 2-Biology – data for non-communicable diseases 3-Chemistry – pollution/acid rain experiment	taking precise measurements to minimise error and be able to identify and remove anomalies. e.g. Physics – energy in a spring/elastic band Physics – weight/mass calculations	identifying any outliers. Justify whether anomalous results can be explained or ignored. Suggest ways to reduce measurement errors. e.g. Physics – energy in a spring/elastic band	accurate and relevant to the claim. Identify secondary sources which would improve or justify the conclusion. Be able to explain how you a conclusion can be defended under criticism. e.g. Biology – non-communicable diseases	
10	Understand how scientific methods and theories develop over time. Appreciate the power and limitations of science and consider any ethical issues which may arise. Use data to make predictions.	Use scientific theories and explanations to develop hypotheses. Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. Make and record observations and measurements using a range of apparatus and methods.	Construct and interpret frequency tables and diagrams, bar charts and histograms. Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. Draw conclusions from given observations. Comment on the extent to which data is consistent with a given hypothesis.	Assess whether sufficient, precise measurements have been taken in an experiment.	
11	Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.	Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.	Plot two variables from experimental or other data. Carrying out and represent mathematical and statistical analysis. Draw conclusions from given observations.	Evaluate methods and suggest possible improvements and further investigations.	

	Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.	Read measurements off a scale in a practical context and record appropriately.	Identify which of two or more hypotheses provides a better explanation of data in a given context.		

Key Stage 1 Contexts for Disciplinary Knowledge

In science, disciplinary knowledge is the knowledge needed to collect, understand and evaluate scientific evidence. In Key Stage 1 the focus is on three key areas that develop pupils' scientific competences; planning investigations, investigating and analysing.

Planning investigations	**Questions** Pupils should explore the world around them and be given opportunities to devise their own questions through a variety of different types of scientific enquiry and recognise that questions can be answered in different ways. They should begin to use secondary sources to find answers.
Investigate	**Observe closely using simple equipment to perform simple tests and use appropriate techniques to test hypothesis and collect data.** Pupils should have opportunities to observe closely, use simple features to compare objects, materials and living things. They should begin to identify, sort and group objects, materials and living things giving reasons for their choices. Pupils should use simple measurements and scientific equipment to gather data, carry out simple tests and record simple data.

Analyse	**<u>Present data, analyse patterns, draw conclusion.</u>** Pupils should be supported to identify patterns and relationships in their results and given opportunities to discuss their results and how they found them out. They should record and communicate their findings in a range of ways and begin to use simple scientific language to express their conclusions.

<u>Key Stage 1 Contexts for Substantive Knowledge</u>

Scientific knowledge and conceptual understanding is developed through the disciplines of biology, chemistry and physics. It is essential that pupils develop secure understanding of knowledge and concepts in order to progress to the next stage. Pupils are given opportunities to experience different types of scientific enquiries to help them answer scientific questions about the world around them.

Year 1

Children should be given the opportunity to **ask questions** throughout each subject area		
Substantive Knowledge	**Disciplinary Knowledge**	**Possible contexts**
Biology - **Organisms**.		
Identifying Plants and structures	**Observe** plants in the surrounding environment.	**<u>Where do plants grow?</u>** Observe a variety of plants growing in the school environment. Pupils use a camera/Ipad to take photographs and group photographs identifying and labelling common features. <u>Questions to support discussion</u> • Where is the plant/tree growing? • Can you describe the habitat where it grows?

	Identify and **classify** types of trees and flowering plant.	• Are all the plants the same in the habitat? • What are the similarities/differences of the plants in this habitat? • What do you notice about these plants? • Why might the plants look different? • What happens to it during different seasons? **<u>How can we compare plants and trees?</u>** Go on a welly walk around the school grounds and collect different leaves. <u>Questions to support discussion</u> • What does a leaf look like? • How are these leaves different/similar? • What shape/colour is your leaf? • Where did you find your leaf? How do you think it got there? • Does you leaf have hairs/veins? Why do you think they are there? • Does your leaf look the same on both sides? Look closely at a variety of different wild and garden plants, including deciduous and evergreen trees. Draw a detailed picture of a plant/make a model/playdough plant and label basic structure. <u>Questions to support discussion</u> • Where is the stem/leaf/petal/root? • Why does a plant have roots? • Why do plants have flowers? • Can you tell me the name of this part? • What does each part of the plant do? **<u>What do plants need to grow?</u>** Give children the opportunity to grow flowers and vegetables, recording through photographs, labels and captions how they have changed over time. <u>Questions to support discussion</u> • Where is the best place to grow flowers/vegetables? • What do they need to grow? • How do you know?

		• How have they changed? Why do you think they have changed?
Naming and grouping animals and humans	**Recognise** and **label** basic parts of animals including humans. **Identify, name, sort and group** different types of animals. **Observe** differences between animals.	**<u>What are the basic parts of the human body and senses?</u>** Name and label a diagram of the human body including parts of the body associated with each sense. Give pupils opportunities to use their senses: • Identify common smells in scent pots e.g. herbs • Taste a variety of fruits and describe the taste (be aware of allergies) • Use feely bags and describe what is inside the bag • Identify various common recorded sounds • Work in pairs, one child describes a picture the other draws it, then look at the picture and draw. Was it easy to draw a picture without seeing it? <u>Questions to support discussion</u> • What different parts of the body have you drawn? • What does that part of the body do? • What does this part help us to do? • Which part of the body helps us to smell etc? • What do you think happens inside? **<u>Are all animals the same?</u>** Using photographs or toy animals label and sort into groups: amphibians, fish, reptiles, birds and mammals identifying similarities and differences. <u>Questions to support discussion</u> • What are the main features of amphibians? • What are the main features of fish? • What are the main features of reptiles?

		• What are the main features of birds? • What are the main features of mammals? • What are the differences between the different types of animals? • What are the similarities between the animals? • How will you group your animals? Learn about looking after different types of pets from the 5 animal groups and what they need to survive: food, water, warmth, shelter. Make a class pet/animal book to display work. Questions to support discussion • What do animals need to survive? • What happens if animals cannot get these things? Identify and group carnivores, herbivores and omnivores. Identify some features of each e.g. carnivores have sharper teeth for tearing meat. Questions to support discussion • What is a carnivore/herbivore/omnivore? • How could you sort them? What labels will you write for your groups?
Chemistry - **Matter**		
Naming properties of materials	Interact with and **compare** a variety of materials, recognising their properties. **Use** materials in different real-life contexts	**What are the properties of different materials?** Explore and name everyday materials and their properties – use feely bags for different materials and pupils use their sense of touch to describe. Questions to support discussion • What does it feel like? Provide a list of adjectives to describe materials for children to use if needed. • Have you felt anything similar before? • Is it easy to guess the material using only your sense of touch? Why/why not? Write material property labels and display with materials for children to sort and group.

	Begin to **test** different materials.	Give pupils the opportunity to explore materials independently suggesting what they could be used for. **<u>Which materials will be suitable to make a pet bed?</u>** Make a pet bed using suitable materials describing why they have chosen each material. <u>Questions to support discussion</u> • Which pet are you making a bed for? • What do you think makes a good pet bed? • What properties of materials will be most suitable for your bed? • How will we join the materials together? • How will you know if your bed is successful? **<u>Which materials are most suitable to make a bridge?</u>** Children investigate a variety of known materials and decide which materials will be most suitable to make a bridge. <u>Questions to support discussion</u> • Which bridge shapes are we testing? • How will we know which bridge shape is the strongest? • How can we make it a fair comparison? • How many pennies do you predict this bridge will hold? • How will you know when to stop counting the pennies? Where will you write that down? • Which bridge shape did you find to be the strongest? The weakest? What do you think makes a good bridge?
Physics - Earth		
Seasonal changes	**Observe** changes in the environment and weather throughout the year.	**<u>What do we know about different seasons?</u>** Look at a variety of photographs, including photographs of the school

	Monitor and **record** simple weather data.	playground showing the four seasons. <u>Questions to support discussion</u> • What is the weather like in winter/spring/summer/autumn? • What is the temperature in each of the four seasons? • What happens to the trees/plants in each of the four seasons? • What happens to the day length in the four seasons? • Why have things changed? • What have you observed? Observe and list changes that occur in the four seasons including weather, day length, deciduous plants. Make a season wheel. Draw and label the four seasons including observations recorded on the list. • Can you use your seasons wheel to describe what happens in each of the four seasons? **<u>What do we know about the weather?</u>** Record the weather in a chart in terms 1, 3, 4, 6 (four seasons) and compare similarities and differences. <u>Questions to support discussion</u> • What is the difference in the weather in the four seasons? Are there any similarities in the weather in the four seasons?

Key Vocabulary Year 1

<u>Plants</u>
tree, leaves, flowers, blossoms, buds, petals, fruit, roots, bulb, seed, trunk, branches, stem, deciduous, evergreen, habitat, vegetables.
Animals inc humans
Fish, amphibians, reptiles, birds, mammals, carnivores, herbivores, omnivores, pets, wild, habitats
Head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth, senses, touch, smell, taste, hearing, sight

<u>Naming materials</u>

Wood, plastic, glass, metal, water, rock, hard, soft, stretchy, stiff, shiny, dull, rough, smooth, bendy, waterproof, absorbent, opaque, transparent, floating, sinking, brick, fabric, paper, elastic, foil

Seasonal changes
Season, autumn, spring, summer, winter, weather, Sun, Earth, day, night, wind, rain, sunny, snow, cloudy, hot, cold

Working Scientifically
Question, equipment, test, name, sort, same, similar, different

Year 2

Substantive Knowledge	Disciplinary Knowledge	Possible Context
Children should be given the opportunity to ask questions throughout each subject area and recognise different ways of answering them.		
Biology - **Organisms**		
Plant Growth and requirements of life	**Observe** plants growing from seeds, **recording** changes over time. **Test** the impact of different conditions on plants.	**What do we know about plant growth?** Pupils grow a variety of seeds and bulbs including sunflowers and beans which germinate and grow quickly so that children can record each stage as it happens. **What do plants need to stay healthy? How can we test this?** Identify that plants need light and water to stay healthy. Pupils investigate what happens to plants, seeds or bulbs when one of the variables (light or water) is changed. Children raise questions they would like to investigate, e.g. How long can plants last without water/light? Does it matter if the plant is inside or outside? How will less light affect the plant? Discuss the importance of a fair test. Pupils measure growth and record in a chart/graph. Discuss their findings. Questions to support discussion • What do you notice about the plants? Can you see any differences? • Why might the plants look different?

		• What similarities are there between the plants? • How are we going to observe the differences over time? • What will we record? • Have our results answered our question? Why? What does a plant need to grow? Pupils use the local environment throughout the year to identify plants that grow and identify the changes that occur.
Exercise, food and hygiene	**Identify** different sources of food. **Collect data** on nutritional value of different foods.	**<u>How do we keep our bodies healthy?</u>** Identify the basic needs of humans for survival: food, water, air/oxygen and discuss what would happen if one of these requirements were missing. <u>Questions to support discussion</u> • What are the basic needs of humans for survival? • What would happen if humans did not have one of these basic needs? Investigate further by looking at the Eatwell Guide (NHS) food wheel and identify different types of foods that make up a balanced diet: Carbohydrates, fruit and vegetables, proteins, dairy, fats, oils and spreads. Create a healthy meal/lunchbox and give reasons for choices. <u>Questions to support discussion?</u> • What do you think makes a healthy/unhealthy meal? • What would happen if you only ate items from one of the sections of the Eatwell Guide? • What are the different types of food that make up the Eatwell guide? • Why do we need to eat different types of food? • What do we mean by healthy and unhealthy sugars? • How much sugar is in different types of food drink? How do we find out? **<u>How much sugar is in different drinks/food?</u>** Discuss and identify food/drink with healthy/unhealthy sugars. Compare amounts of sugar in different food/drink by weighing sugar and sorting from

	Test the effects of physical activity on the human body. **Identify** ways to stay clean and healthy.	least sugar/most healthy to most sugar/unhealthiest food/drink. Make a healthy cereal bar using the Eatwell guide and choosing healthy options/healthy sugars. **<u>What happens to your body when you exercise?</u>** Children take part in physical activity and list changes to their body. Identify why it is important for us to exercise focusing on the role of the heart, lungs and muscles. <u>Questions to support discussion</u> • Why is it important to exercise? • What happens to our bodies when we exercise? • How does exercise help our body to be healthy? **<u>Why do we need to stay clean?</u>** Discuss the importance of hygiene to keep your body healthy. Look at the way germs/viruses are spread through not washing your hands. <u>Questions to support discussion</u> • How can we keep our bodies clean? • Why is it important to keep clean? • What could happen to us if we did not keep clean? **<u>How are viruses transferred?</u>** <u>Glitter experiment.</u> Pupils put glitter on their hands and touch objects to show how germs can be transferred easily. Pupils use a cloth, water then soap to clean glitter off their hands and decide the best method to clean their hands describing reasons for ideas. <u>Questions to support discussion</u> • How do germs transfer from one person to another? • How easy is it for germs to transfer to different surfaces? • What is the best way to clean germs from our hands or surfaces?

		Can you write instructions on a poster to tell people how to clean their hands effectively?
Biology - Ecosystems		
Lifecycles and Requirements for life	**Observe** changes over time in living things.	**What is a lifecycle?** Pupils look at a variety of life cycles, human, animal, insect and plant. Understand that each stage shows growth and match offspring to parents. Identify the main stages of each and draw, label and discuss what happens at each stage. **How do we know if something is alive?** Identify the basic needs of humans for survival: food, water, air/oxygen and discuss what would happen if one of these requirements were missing. Pupils sort photographs/objects into groups labelled living, dead or never alive and give reasons for their groupings. Questions to support discussion • Are any of these alive? • Did any of these used to be alive? • Have any of these never been alive? • How do you know? What else could go in that hoop? Pupils investigate a variety of habitats including microhabitats on the school grounds.

Habitats	**Observe** habitats in the surrounding environment. **Identify** and **compare** different habitats.	**What is a habitat?** Pupils investigate a variety of habitats including desert, rainforest, ocean, woodland, polar, woodland, meadow. Describe each habitat specifically looking at climate, plants and animals. Give pupils the opportunity to look at secondary sources to research information. Questions to support discussion • How are you going to answer the question? • Where are you going to gather your data? • How can we investigate different types of habitats? • How could you record which animal lives in which habitat? • What does this part on your chart/map mean? • Do any animals/ plants share their habitats? Why might this be? What are the characteristics of these habitats? Identify adaptations of plants and animals which allow them to survive in their habitat and how their requirements for life are met in their habitat. **How can we investigate microhabitats?** Pupils identify different microhabitats in the school grounds and take photographs/video clips, recording in a tally chart the minibeasts which live there and describe the conditions of the habitat. Pupils draw pictures/take photographs of two microhabitats and compare similarities and differences and discuss whether the conditions of the microhabitat affect the number and type of plants and animals that live there. Question to support discussion • Drawing on what you know about habitats, what is a microhabitat? • What would live in a microhabitat? • What different types of microhabitats are there? • Can you describe a microhabitat? How will we investigate different microhabitats? How will you record what you find in each microhabitat?

Food Chains	**Identify** and **compare** the different parts of food chains and their dependency on one another.	**<u>What is a food chain?</u>** Look at a variety of food chains of animals in different habitats. Identify that the animals and plants in a habitat are linked together through their food chain and depend on one another for survival. Play games giving pupils the opportunity to sort photographs or objects into food chains and describe them ensuring they use the scientific vocabulary 'producer' to describe plants and 'consumers' to describe animals which eat the plants and other animals in the food chain. Ensure pupils understand the role of the sun in the food chain and that plants need sunlight in order to make food and grow. Challenge pupils to make the longest food chain they can and label. Pupils create a food chain with humans as a consumer and discuss. <u>Questions to support discussion</u> • What is a producer? • What is a consumer? • What does a food chain always begin with? • What does it mean if a consumer is dependent on a producer? Can you explain what happens in a food chain?
Chemistry- Matter		
Suitability of materials and changing solids	**Identify** more complex features of materials **Test** the suitability of materials in different contexts. **Gather** and **record** data about the effectiveness of materials in different contexts. Used **gathered data** and **observations** to **predict** the suitability of a material.	**<u>How can we investigate the suitability of different materials?</u>** Pupils identify the suitability of materials for various jobs through creating investigations to test a variety of materials and their properties, e.g. the most suitable material to make a visor to test whether a material is transparent, translucent or opaque. <u>Questions to support discussion</u> • How could you test it? • Which is the most / least transparent? How do you know? • What other words could you use to describe the materials? • Does everyone in your group agree? Can you explain to the others why you have put that material there? • Can you tell me another way to test this object?

		Pupils predict and reason why one material is more suitable than another based on simple tests carried out e.g.to investigate which materials are suitable to make a boat they will test materials which are waterproof and will float. Record results in table/chart. <u>Questions to support discussion</u> • How will you know if it is waterproof? • How much water will you use? How long will you put it in the water for? • Can you order the materials: most to least waterproof? • Do you think everyone else will find the same result? How else could you test the material?

Key Vocabulary Year 2

Plant Growth and requirements of life
Seed, bulb, young, mature, healthy, growth, water, light, temperature, storing food, stage

Lifecycles and habitats
Living, dead, healthy, adult, young, baby, toddler, child, teenage, egg, chick, chicken, pupa, caterpillar, butterfly, spawn, tadpole, frog, lamb, sheep, lifecycle, habitat, micro-habitat, environment, shelter, seashore, ocean, woodland, rainforest

Food chains
Consumer, producer, predator, prey, herbivores, carnivores, omnivores

Exercise and nutrition
Hygiene, food, food groups, carbohydrate, protein, fat, sugar, dairy, fruit, vegetable, healthy, unhealthy, muscles, energy, teeth

Suitability of materials
Wood, plastic, glass, metal, water, cardboard, rock, hard, soft, stretchy, stiff, shiny, dull, rough, smooth, bendy, waterproof, absorbent, opaque, transparent, translucent, floating, sinking, brick, fabric, paper, elastic, foil, squashing, bending, twisting, stretching, suitable

Working Scientifically
Question, equipment, test, name, sort, same, similar, different, record, results, table, predict

Key Stage 2 Contexts for Disciplinary Knowledge

In science, disciplinary knowledge is the knowledge needed to collect, understand and evaluate scientific evidence. In Key Stage 2 the focus is on four key areas that develop pupils' scientific competences; planning investigations, investigating, analysing and thinking like a scientist.

Key stage 2

Planning investigations	**Questions** Pupils should develop their ability to ask scientific questions and use scientific enquiries to answer them. They should begin to plan their own different types of enquiries, taking variables into consideration.
Investigate	**Observe closely using simple equipment to perform simple tests and use appropriate techniques to test hypothesis and collect data.** Pupils should have opportunities to gather data from practical enquiries, becoming more systematic and ensuring measurements are accurate, while recording data effectively. They should be aware of fair testing principles and begin to apply these when they are carrying out enquiries. They should make predictions based on their scientific understanding.
Analyse	**Present data, analyse patterns, draw conclusions.** Pupils should be supported to present their results using increasingly complex methods. Bar graphs should be used before they progress onto line graphs. They should explain their results both orally and in writing. Pupils should also begin to comment on how trustworthy their results are and explain why this is.
Thinking Like a Scientist	**Construct explanations, review theories, critique claims, justify opinions**

	Pupils should be taught what a theory is and to recognise when straightforward scientific evidence supports a theory. They should be able to use scientific vocabulary to report the findings of investigations and use their findings to suggest, support and refute their own ideas and arguments.

Key Stage 2 Contexts for Substantive Knowledge

Scientific knowledge and conceptual understanding is developed through the disciplines of biology, chemistry and physics. It is essential that pupils develop secure understanding of knowledge and concepts in order to progress to the next stage. Pupils are given opportunities to experience different types of scientific enquiries to help them answer scientific questions about the world around them. All possible contexts for KS2 taken from PSST Focused Assessments found at: https://pstt.org.uk/resources/curriculum-materials/assessment

Year 3

Children should be given the opportunity to **ask questions** and **perform enquiries** throughout each subject area. They should begin **recognise scientific theories** and the evidence used by scientists to support these.		
Substantive Knowledge	**Disciplinary Knowledge**	**Possible context**
Biology - **Organisms**		
Functions of parts of plants, inc. water transport **Skeleton & muscles**	**Identify** parts of the process for pollination, water transport and seed dispersal.	**Celery / Carnation Experiment** Put a piece of celery or a carnation in food-coloured water. Predict what will happen and record results. What will happen if the stalk is split and put in two separate containers with differently coloured water sources? Discuss the part of the plant that allows the water to be transported.

Diet including nutrition	**Identify** the different muscles and parts of the skeleton. **Compare** the functions of different muscles. **Compare** the muscles and skeletons of different animals.	**<u>Human skeleton investigation</u>** 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) Ask children to explain how they will answer their question. Support them to carry out their pattern seeking enquiries to answer their own questions.
	Identify the impact of different food groups on the body. **Compare** nutritional information of different foods. **Identify** nutritional needs for different animals.	**<u>What is on Your Plate?</u>** Using resources such as the Eatwell guide, discuss what each food group does for a body, introducing a full range of vocabulary by examining the nutritional information on food products. Make links between each food group and how they affect / are used by the human body.
Physics – Earth, Magnets and forces, Light		
Rocks	**Observe** different types of rocks and soils. **Identify and classify** different types of rocks. **Identify** composition of soil layers . **Test** the properties of rocks. **Identify** how fossils are formed.	**<u>Rock Reports</u>** Provide a purpose for the investigation e.g. to find the best material for a new paved area in school. Suggest that you would like to find out which rock would last the longest/be the least wearing/the strongest. Decide whether to do a rub test and/or a scratch test etc. Rub: Children to rub rocks on sandpaper and collect scrapings onto white paper. Scratch: Try scratching the rocks with e.g. a fingernail, a matchstick, a metal nail etc. Ask children to order the rocks and justify their selection of strongest rock. How will you report your findings (to persuade), e.g. draw, write, present?

Magnets and forces	**Test** the magnetic properties of various materials. **Record results** of tests in simple tables.	**Magnet Tests** Provide the children with a collection of magnets and other materials (e.g. card, fabric, tissue, thin wood, aluminium foil, paperclips) to explore. Ask them to find out ways to test whether the magnets are all equally strong e.g. through paper/card or layers of each, how close magnet needs to be before it attracts a paper clip etc. Ask the children to report their findings verbally, e.g. explaining how they carried out their investigation to their peers. As a class, discuss the different ways of testing magnet strength and talk about the advantages and disadvantages of each approach. Discuss why it is a good idea to try different ways of answering a question (to get a more reliable answer).
Light	**Observe** shadows and reflections and the effect of the absence of light. **Identify** the dangers of direct sunlight. **Record data** on shadows and reflection.	**Shadow Making** 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?

Key Vocabulary Year 3

Functions of parts of plants, inc. water transport
Roots, stem, trunk, leaves, fruit, flowers, structure, flowering, transport, support, nutrition, reproduction, life cycle, pollination, seed formation, seed dispersal, pollinators, fertiliser

Skeleton & muscles
Bones, limbs, movement, support, function, nutrition, growth

Diet including nutrition

nutrition, growth, healthy, unhealthy, hygiene, food, food groups, carbohydrate, protein, fat, sugar, dairy, fruit, vegetable, healthy, unhealthy, muscles, energy, teeth

Rocks
Fossils, soil, organic, grains, crystals, sedimentary, layers

Magnets & forces
Surfaces, attract, repel, poles, magnetic, strength

Light
Dark, reflective, shadow, opaque, translucent, transparent, mirror, light source, Sun

WS
Compare, microscope, investigate, pattern, measure, enquiry, gather, data, tables, bar charts, similarities, differences, changes, record, scientific idea

Year 4

Substantive Knowledge	Disciplinary Knowledge	Possible Context
Children should be given the opportunity to **ask questions** and **perform enquiries** throughout each subject area. They should begin **recognise scientific theories** and the evidence used by scientists to support these.		
Biology –Ecosystems, Organisms		
Comparing Plant Requirements	**Identify** requirements for life and growth of plants. **Test and observe** the effect of not having one or more of the requirements for growth. **Draw bar graphs** based the data.	**<u>Plant Growing</u>** Choose a relatively fast-growing plant suitable for indoor growth. Discuss the different requirements for growth and talk about how we can control these by planting and placing our plants in different places. Get the children to label and place the plants in as many different places as possible, perhaps also placing one that will not be watered. Have the children make predictions about how the plants will grow and get them to collect measurements regularly before presenting these results in a bar graph.

Habitat Changes	**Observe and identify** changes in the environment, particularly those that pose a danger to living things. **Identify** ways in which the environment can be protected.	**<u>Local Survey</u>** Recap previous work on classifying and habitats. Consider school grounds/local area as a habitat and go on a search for living things (incl. plants) in the grounds. Take a camera/draw/make lists of larger things and collect smaller things. Classify the living things into groups e.g. vertebrates / invertebrates / plants. Create subsets within groups e.g. flowering / non-flowering plants, birds / mammals/ invertebrates etc. Ensure the habitat for each creature or plant is recorded and discuss whether there a relationship between a habitat and the types of living thing found there.
Food Webs	**Identify and record** different parts of a food web and their dependency on one another. **Identify** the impact of removing part of the food web.	**<u>Local Survey Continued</u>** If a local survey has already been carried out for habitats, use the same information, otherwise go out into the school grounds or local area and search for living things. Use this to compile a food web, describing the relationships or producers and consumers and how these are linked to one another.

Teeth and Digestion	**Identify** different parts of the digestive system and their functions. **Observe and model** the process of digestion using simple equipment. **Identify** different teeth and their functions.	**Teeth (Eggs) in Liquid** 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 to investigate the effects that different liquids have on teeth e.g. cola, water, vinegar, milk, sports drink and orange juice. Discuss how they can make the comparison fair, i.e. as to 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.
Chemistry- Matter, Earth		
States of Matter	**Identify and compare** materials based on their state. **Observe** changes in materials as they change state. **Test and measure** the effect of temperature on materials. **Record results** of testing in tables and bar graphs.	**Dunking Biscuits** Discuss context/problem e.g. dunk breaktime biscuit in tea and leave in too long. Discuss possible questions to investigate, e.g. Which is the best biscuit type/brand/shape? Which is the best cup/temperature for dunking? Share ideas for how to test the biscuits e.g. time how long to fall, count dunks before falls etc. Different groups could investigate different things to pool evidence for recommendations. Discuss practicalities: kit/time available etc. Work in groups to carry out dunking investigations. Pause to share ideas and discuss problems. Discuss findings across the class and consider fairness and accuracy of methods.

		Ask children to talk about / draw a diagram / write about their findings, with a focus on suggesting improvements to their method.
Water Cycles	**Identify** different parts of the water cycle and relate them to states of matter.	**<u>Drying Day</u>** Plan an investigation to reach a conclusion within a real-life context, e.g. Where is the best place to dry your washing? Which conditions are the best to dry materials by evaporation? Make a list of different places/conditions (e.g. temperature or draughtiness). Discuss how to know if it is dry e.g. dry to touch, handprint no longer visible, no imprint on tissue. In small groups, children to decide on the type of material (cloth/paper towels), quantity of water, locations to test evaporation (e.g. could arrange washing lines in different locations around the school) and how often to observe/check. Provide measuring equipment including thermometers, jugs, rulers. Pupils could record their method before/after set up. N.B. Paper towels can dry in an afternoon, heavy fabric will take longer.
Physics – Waves, Electricity		
Sound	**Identify** the way sound is made, including the strength of vibrations, and how this enables humans to hear. **Observe and compare** different objects and the sounds they produce. **Test** materials, measuring their insulation against sound.	**<u>Investigating Pitch</u>** Show children some homemade 'musical instruments': elastic bands over shoe box, 'straw flute/pan pipes', 'sound sandwich' (lolly stick and straw harmonica), stretched balloon 'drum skin' over tube, glass bottle containing water to blow or tap. Explore how to play them to make a sound and ask the children to suggest which parts are vibrating. Ask children to record a range of questions that they could investigate, focusing on changing pitch (e.g. How does the width of the elastic band affect pitch?) Children then work in small groups investigating their questions, considering different ways to alter pitch.

Electricity	**Identify** the function of various components by constructing simple circuits. **Test** complete and incomplete circuits. **Identify** appliances which run on electricity. **Test** different materials for conductivity. **Record results** of tests in a table.	**<u>Does it Conduct Electricity?</u>** Introduce the terms conductors and insulators. Example context: soldiers wear 'smart' clothing which conducts electricity: http://www.bbc.co.uk/news/technology-17580666 E.g. a soldier in the desert 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). Recap on the terms insulators and conductors.

Key Vocabulary Year 4

Living things and habitat changes

Environment, classification key, local, wider, negative effect, positive effect, population, pollution, deforestation, pollinators, impact, nature reserves, recycling, vertebrates, invertebrates, fish, amphibians, reptiles, birds, mammals, snails, slugs, worms, spiders, insects

Comparing plant requirements

Growth, light, water, air, nutrients, soil, space

Food webs

Food chains, consumer, producer, predator, prey, herbivores, carnivores, omnivores

Teeth and digestion
Digestive system, mouth, tongue, teeth, incisors, molars, canine, chewing, biting, tearing, oesophagus, stomach, small intestine, large intestine, damage, plaque, decay

States of Matter
Solid, liquid, gas, state, heated, cooled, melting, freezing, temperature, degrees Celsius, thermometer, evaporation, condensation, pool, shape, container, substance, material, properties

Water Cycles
evaporation, condensation, precipitation, temperature, vapour, clouds, rain, snow

Sound
Vibration, volume, pitch, travel, medium, insulation, soundproof, particles

Electricity
Conductors, insulators, circuit, components, cell, wire, bulb, switch, buzzer, lamp, battery, motor, loop, series

WS
Enquiry, investigation, conclusion, prediction, record, report, compare, data, chart, table, key, fair tests, scientific ideas, measure, equipment, evidence, findings

Year 5

Substantive Knowledge	Disciplinary Knowledge	Possible Context
Children should be given the opportunity to **ask questions** and **perform enquiries** throughout each subject area. They should begin **recognise scientific theories** and the evidence used by scientists to support these.		
Biology –Ecosystems, Organisms		

Comparing life cycles	**Identify** similarities and differences between lifecycles of mammals, amphibians, insects and birds.	**Lifecycle Research** Ask children to research the life cycles of two different species using a range of secondary sources. This could be in small groups or individually. Discuss possibilities for presenting their research (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.
Impact of drugs, lack of exercise and poor nutrition and non-communicable diseases	**Identify** how these factors might affect specific parts of the body or general health.	**Drugs Education** Using an appropriate scheme of work, discuss how various legal and illegal drugs can affect the human body.

Circulatory and respiratory system	**Identify** different parts of the circulatory and respiratory system and their functions.	**<u>Heart Rate Poses</u>** Previous lesson: measuring pulse rate at rest and after exercise (measuring and recording focus). This lesson: Discuss previous findings about pulse rate: can be hard to measure, but generally found that pulse rate increases after exercise. Recap why: blood carries oxygen around the body, the muscles need more oxygen during exercise, so your heart works harder to supply more oxygen. But what if your body is still e.g. headstand, raised arms, balance, yoga pose, plank? Focus individual recording on predictions and explanations. Discuss with the children how to plan and carry out a test into a stationary exercise. Consider how long the pose should last, comparison with resting pulse rate, whether one child or several children should be tested, how to carry out the tests safely. Ask the children to carry out the test and record results as in a group. Discuss findings.

Chemistry- Matter, Earth		
Complex properties and testing materials	**Use fair testing** to demonstrate the suitability of various materials for a range of everyday purposes.	**Insulation Layers** You want to see which cup will keep your tea warm for longer. Show different cups of hot water, e.g. paper cup, stacked paper cups, thermos mug. Measure the temperature of the water, repeat after about one hour (e.g. at the beginning and end of lunchtime). Activity Use the results of the pre-activity to make predictions about insulation (e.g. a good insulator has more layers / traps air / made of….). Provide a collection of different materials and invite the children to discuss their ideas about which might be good for keeping the drink warm. The children could order the materials according to which will be best insulators or select one to test for layering and record their predictions, giving reasoning based on the previous test results. Children plan and carry out an investigation to test their predictions.
Earth & Space	**Record** the observable effects of the movement of the Moon around the Earth and the Earth around the Sun. **Identify** the objects in the Solar System and their movement around the Sun.	**Solar System Research** Use an animation, photo or video clip to begin a discussion about our solar system. Raise questions about different planets in our solar system e.g. movement, relative movement, size etc. Provide books or access to the internet. Help to phrase search questions. How will you share your research? Agree options e.g. labelled diagram or model, information leaflet, drama, animation, presentation etc. Small groups could research different planets or different features. Present/share outcomes with rest of the class. Groups could peer assess against agreed success criteria e.g. clarity.

Physics – Forces		
Forces, including gravity & resistance mechanisms	**Observe and test** the effects of water resistance, air resistance, friction and gravity. **Test** the impact that levers and pulleys have on the amount of force required to move objects.	**<u>Aqua dynamics</u>** 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. If time, challenge pairs to change the shape so that it falls quickly through the water.

Key Vocabulary Year 5

Comparing life cycles

Food chains, consumer, producer, predator, prey, herbivores, carnivores, omnivores

Impact of drugs, lack of exercise and poor nutrition, non-communicable diseases

Diet, exercise, drugs, lifestyle, function, internal organs, substances

Circulatory and respiratory system

Blood, heart, vessels, arteries, veins, chambers, red blood cells, white blood cells, platelets, lungs, pressure, oxygen, carbon dioxide, transport

Complex properties and testing materials

Properties, hardness, solubility, transparency, conductivity, electrical, thermal, magnetic, insulation, heat loss

Earth & Space

Sun, Moon, Earth, hemisphere, solar system, axis, orbit, planets, stars, spherical, rotation, waning, waxing, gibbous, crescent

Forces, including gravity & resistance mechanisms

Gravity, air resistance, water resistance, friction, mechanisms, levers, pulleys, gears, effect, movement, acting in pairs

WS

Planning, enquiries, investigation, variables, accuracy, precision, repeat readings, recording, conclusions, fair test, compare, evidence, control

Year 6

Substantive Knowledge	Disciplinary Knowledge	Possible Context
Children should be given the opportunity to **ask questions** and **perform enquiries** throughout each subject area. They should begin **recognise scientific theories** and the evidence used by scientists to support these.		
Biology –Organisms, Genes		
Classification of plants and animals	**Identify** the broad scientific categories that living things can be sorted into by observing similarities and differences in their characteristics.	**Invertebrate Research** (To be completed after some input on animal classification). Show children some invertebrate film clips (e.g. David Attenborough). Explain that their task is to research different invertebrates (show egs). Discuss: how will you share what you have found out? Agree options e.g. poster, labelled diagram or model (playdough), written report, information leaflet, drama, animation etc. Give small groups a different invertebrate group to focus on (annelids, molluscs, insects, arachnids, crustaceans and myriapods). Each group must give an example and describe the features which make it a member of its classification group. Present/share with rest of the class. Groups peer assess against agreed success criteria.
Reproduction and changes to old age	**Observe** the changes in humans to old age. **Identify and compare** the reproductive process in some animals, including humans, and plants.	**Growth Survey** 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.

Evolution	**Identify** the way that offspring vary from their parents. **Observe** how variation leads to adaptation in different environments. **Identify** the changes in living things over long period of time, observing fossils to understand how scientists use these as evidence.	**Fossil Habitats** 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.
Chemistry- Reactions		
Dissolving & separating materials **Reversible and irreversible reactions** **Basic particle theory**	**Investigate** reversible changes including dissolving and mixing. **Observe** irreversible changes and identify the formation of new materials.	**Dissolving Investigation** 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. Post it planners or planning boards could be used to focus on types of variable. Carry out tests and discuss outcomes.

Physics – Electricity, Waves		
Electricity	**Identify** circuit symbols. **Record** simple circuits in diagrams. **Test** the effect of various components, particularly cells, on the operation of other components, such as lamps or buzzers. **Record results** of tests in tables.	**Bulb Brightness** 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.
Light	**Identify** the way light travels and reflects off of objects. **Identify** the way humans see by reflected light entering the eye. **Test** the effect of light brightness and position on the size and position of shadows**.** **Record** measurements in tables and graphs.	**Light Questions** 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. 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. (Before the children can plan different types of enquiries, they need to recognise how they might find out the answer to questions. Once able to recognise the different types they will then be able to independently choose an appropriate enquiry type and plan accordingly).

Key Vocabulary Year 6

Classification of plants and animals

Kingdom, phylum, class, order, family, genus, species, characteristics, organisms, micro-organisms, subdivide, classifying

Reproduction & changes to old age

Sexual, asexual, cells, puberty, adolescent, gestation

Dissolving & separating materials inc. reversible and irreversible reactions

dissolving, filtering, sieving, evaporating, reversible, irreversible, particles, reaction

Evolution

Inheritance, adaptation, characteristics, variation, reproduction, survival, extinction, endangered, gene

Electricity

Conductors, insulators, circuit, components, cell, wire, bulb, switch, buzzer, lamp, battery, motor, loop, series, symbols, parallel, voltage

Light

Dark, reflection, shadow, opaque, translucent, transparent, mirror, light source, Sun, spectrum, optical

WS

Planning, enquiries, investigation, variables, accuracy, precision, repeat readings, recording, conclusions, fair test, compare, evidence, control, predict, scatter graph, line graph, bar chart, table, relationship