Futura Science

Curriculum Framework

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 **Light**	**Test** the magnetic properties of various materials. **Record results** of tests in simple tables.	**<u>Magnet Tests</u>** 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).
	Observe shadows and reflections and the effect of the absence of light. **Identify** the dangers of direct sunlight. **Record data** on shadows and reflection.	**<u>Shadow Making</u>** 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.	**Drying Day** 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.	**Investigating Pitch** 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.	**Does it Conduct Electricity?** 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

Futura KS3 Curriculum Plan 2021-22

	Unit	Year 7	Approx. hours	Unit	Year 8	Approx. hours	Unit	Year 9	Approx. hours
Term 1	Y7 Intro	Introduction to Secondary Science	7 Content + 1 Test = 8	Biology 3: Life Processes and Evolution	Nutrition and Digestion	13 Content + 1 Rev + 1 Test + 1 Improvement = 16	Biology 5: Cells & Transport	Cells and Organisation Continued	13 Content + 1 Rev + 1 Test + 1 Improvement = 16
	Biology 1: Cells and Organisms	Cells and Organisation	12 Content + 1 Rev + 1 Test + Improvement = 15		Gas Exchange Systems			The Particulate nature of matter *(chem in NC)*	
		Skeletal and Muscular Systems			Natural Selection and Evolution				
		Health							
Term 2	Chemistry 1: Matter	The Particulate Nature of Matter	12 Content + 1 Rev + 1 Test + 1 Improvement = 15	Chemistry 3: Earth	Earth Structure - Earth and Rocks	11 Content + 1 Rev + 1 Test + 1 Improvement = 14	Chemistry 5: Atomic structure & The periodic table	Atoms, Elements and Compounds continued	15 Content + 1 Rev + 1 Test + 1 Improvement = 18
		Physical Change *(Under Physics in NC)*			Earth Atmosphere - Climate			The Periodic Table Continued	
		Particle Model *(Under Physics in NC)*						The Particulate Nature of Matter continued	
		Atoms, Elements and Compounds							
		Pure and Impure Substances							
Term 3	Physics 1: Forces	Describing Motion	17 Content + 1 Rev + 1 Test + 1 Improvement = 20	Physics 3: Waves	Observed Waves	11 Content + 1 Rev + 1 Test + 1 Improvement = 14	Physics 5: Energy & Forces	Energy Changes and Transfers continued	12 Content + 1 Rev + 1 Test + 1 Improvement = 15
		Forces			Sound Waves			Changes in Systems continued	
		Pressure in Fluids			Energy and Waves			Energy in Matter continued	
		Balanced Forces and Motion			Light Waves			Forces continued	
		Space Physics							
	Futura-Aligned Assessment 1		1 Rev + 1 Test + 1 Improvement	**Futura-Aligned Assessment 3**		1 Rev + 1 Test + 1 Improvement	**Futura-Aligned Assessment 5**		1 Rev + 1 Test + 1 Improvement
	Approx classroom hours required terms 1-3 = 61			**Approx classroom hours required terms 1-3 = 47**			**Approx classroom hours required terms 1-3 = 52**		
Term 4	Biology 2: Genetics and Ecology	Plant Reproduction (including fruit formation and seed dispersal)	17 Content + 1 Rev + 1 Test + Improvement = 20	Biology 4: Bioenergetics	Plants and Photosynthesis	12 Content + 1 Rev + 1 Test + 1 Improvement = 15	Biology 6: Microbes & Disease	Cells and Organisation Continued	14 Content + 1 Rev + 1 Test + 1 Improvement = 17
		Animal Reproduction			Respiration			Health	
		Inheritance, Chromosomes, DNA and Genes							
		Relationships in an Ecosystem							
Term 5	Chemistry 2: The Periodic Table and	The Periodic Table	12 Content + 1 Rev + 1 Test + 1 Improvement = 15	Chemistry 4: Predicting Reactions	The Periodic Table Continued	14 Content + 1 Rev + 1 Test + Improvement = 16	Chemistry 6: The Earth's Atmosphere & Resources	Earth Atmosphere continued	15 Content + 1 Rev + 1 Test + Improvement = 18
		Chemical Reactions			Chemical Reactions Continued			Chemical Energy continued	
					Chemical Energy				
Term 6	Physics 2: Energy	Energy Changes and Transfers	13 Content + 1 Rev + 1 Test + Improvement = 15	Physics 4: Electricity and Magnetism	Calculations of fuel uses and costs in the domestic context	17 Content + 1 Rev + 1 Test + Improvement = 20	Physics 6: Atomic Structure	The Particulate Nature of Matter Continued	14 Content + 1 Rev + 1 Test + Improvement = 17
		Changes in Systems			Current Electricity			Physical Change Continued	
		Energy in Matter			Static Electricity			Particle Model Continued	
					Magnetism			Energetics *(chem in NC)*	
	Futura-Aligned Assessment 2		1 Rev + 1 Test + 1 Improvement	**Futura-Aligned Assessment 4**		1 Rev + 1 Test + 1 Improvement	**Futura-Aligned Assessment 6**		1 Rev + 1 Test + 1 Improvement
	Approx classroom hours required terms 4-6 = 53			**Approx classroom hours required terms 4-6 = 54**			**Approx classroom hours required terms 4-6 = 55**		

Futura Science Year 7 - Detailed Curriculum Overview		
Unit	**Year 7 Lessons**	**National Curriculum**
Y7 Intro	Lab safety and equipment	**Basic introduction to working scientifically (scientific attitudes, experimental skills and investigations, analysis and evaluation, and measurement)**
	The Bunsen Burner	
	Hazard Symbols	
	Writing a method and testing hypotheses	
	Making accurate measurements	
	Drawing graphs	
	Planning an investigation	
Biology 1: Cells and Organisms	Animal cells	*Cells as the fundamental unit of living organisms. The functions of the cell membrane, cytoplasm, nucleus and mitochondria.*
	Plant cells	*The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts; the similarities and differences between plant and animal cells*
	Using microscopes	*How to observe, interpret and record cell structure using a light microscope*
	Specialised cells	*The structural adaptations of some unicellular organisms*
	Levels of organisation	*The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms*
	Role of diffusion	*The role of diffusion in the movement of materials in and between cells*
	Structure and function of skeleton	*The structure and functions of the human skeleton, to include support, protection, movement and making blood cells*
	Muscles (inc. measuring force exerted)	*Biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles*
	Antagonistic muscles	*The function of muscles and examples of antagonistic muscles*
	Smoking	*The effects of recreational drugs (including substance misuse) on behaviour, health and life processes*
	Drugs	
	Alcohol	
Chemistry 1: Matter	Particle model: States of matter	*The properties of the different states of matter (solid, liquid and gas) in terms of the particle model*
	State changes - Particle model	*Changes of state in terms of the particle model; the differences in arrangements, in motion and in closeness of particles explaining changes of state*
	State changes - Density	*Similarities and differences, including density differences, between solids, liquids and gases; shape and density, the anomaly of ice-water transition*
	Particle model: Diffusion	*Gas pressure; Brownian motion in gases; diffusion in terms of the particle model; diffusion in liquids and gases driven by differences in concentration*
	Physical and chemical changes	*The difference between chemical and physical changes*
	Atoms, molecules, elements, compounds, and mixtures	*Atoms and molecules as particles; a simple (Dalton) atomic mode. Differences between atoms, elements and compounds; chemical symbols and formulae for elements and compound.*
	Conservation of mass	*Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving; conservation of mass in changes of state and chemical reaction*
	Pure and impure substances	*The concept of a pure substance; mixtures, including dissolving; the identification of pure substances*
	Filtration	*Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography*
	Evaporation and distilation	
	Fractional distilation	
	Chromatography	*Chromatography*
Physics 1: Forces	Speed	*Speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)*
	Distance-time graphs	*The representation of a journey on a distance-time graph*
	Velocity-time graphs	***N/A***
	Acceleration	***N/A - taught as change in velocity/time taken***
	Forces: Balanced and Unbalanced	*Forces as pushes or pulls, arising from the interaction between two objects; using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces; relative motion: trains and cars passing one another. ;*
	Contact forces and effects of forces	*Forces: associated with deforming objects, stretching and squashing (springs), with rubbing and friction between surfaces, with pushing things out of the way, and resistance to motion of air and wate. Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface; forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only); change depending on direction of force and its size.*
	Stretching - Hooke's law	*Force-extension linear relation; Hooke's Law as a special case*
	Pressure in solids	*Pressure measured by ratio of force over area – acting normal to any surface*
	Pressure in fluids	*Atmospheric pressure decreases with increase of height as weight of air above decreases with height; pressure in liquids increasing with depth*
	Floating and sinking	*Upthrust effects, floating and sinking*
	Work done	*Work done and energy changes on deformatio; forces measured in newtons, measurements of stretch or compression as force is changed*
	Moments	*Moment as the turning effect of a force*
	Non-contact forces	*Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity*
	Mass, Weight & Gravity	*Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only);*
	Solar system and stars	*Our Sun as a star, other stars in our galay*
	Day, Night and seasons	*The seasons and the Earth's tilt, day length at different times of year, in different hemispheres*
	The Universe	*tOher galaxies; the light year as a unit of astronomical distance*
	Characteristics and variation	*differences between species; the variation between individuals within a species being continuous*

Lessons with no National Curriculum content (**N/A**) should be the first to be cut if time is an issue

Biology 2: Genetics and Ecology	Types of variation - continuous and discontinuous	*or discontinuous, to include measurement and graphical representation of variation.*
	DNA, chromosomes, and genes	*A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model*
	Alleles and inheritance	*Heredity as the process by which genetic information is transmitted from one generation to the next;*
	Human reproductive systems and cells (male and female)	*Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta*
	Puberty	
	The menstrual cycle	
	Fertilisation in humans	
	Pregnancy and embryonic development	
	Flower structure	*Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms*
	Pollination and fertilisation	
	Seed dispersal	
	Investigating seed dispersal	
	Food chains and webs (and ecosystems)	*The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops; the importance of plant reproduction through insect pollination in human food security; how organisms affect, and are affected by, their environment, including the accumulation of toxic materials*
	Pyramids of number, biomass and energy	
	Predator-Prey Relationships (Interdependence)	
	Humans in ecosystems (food security and bioaccumulation)	
Chemistry 2: The Periodic Table and Chemical Reactions	Periodic table - introduction	*The principles underpinning the Mendeleev Periodic Table; the Periodic Table: periods and groups, metals and non-metals*
	Development of the periodic table - Mendeleev	
	Physical and chemical properties	*The varying physical and chemical properties of different elements*
	Chemical reactions (using formulae)	*Chemical reactions as the rearrangement of atoms; representing chemical reactions using formulae and using equations*
	Combustion	*Combustion*
	Thermal decomposition	*Thermal decomposition*
	Acids, alkalis and the pH scale	*Defining acids and alkalis in terms of neutralisation reactions; the pH scale for measuring acidity/alkalinity and indicators*
	Neutralisation	*Reactions of acids with alkalis to produce a salt plus water*
	Reactions of acids and metals	*Reactions of acids with metals to produce a salt plus hydrogen*
	Reactions of metals and water	***N/A***
	Reactions of metals with oxugen	*Oxidation reactions* ***(also in Y8 in terms of electrons)***
	Catalysts	*What catalysts do*
Physics 2: Energy	Froms of Energy	*Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change; comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions; using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes; other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels*
	Energy transfers	
	Energy in food	
	Burning fuels	
	Sankey diagrams and Energy efficiency	***N/A***
	Thermal energy introduction (heat transfer)	*Heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators*
	Conductors and insulators	
	Conduction	
	Convection	
	Radiation	
	Insulation	
	Contraction and expansion	*Changes with temperature in motion and spacing of particles; internal energy stored in materials*
	Simple machines	*Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged*

Futura Science Year 8 - Detailed Curriculum Overview		
Unit	**Year 8 Lessons**	**National Curriculum**
Biology 3: Life Processes and Evolution	Balance diet and food groups	*Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed; calculations of energy requirements in a healthy daily diet; The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases*
	Food tests	***N/A***
	Digestive system	*The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts); the importance of bacteria in the human digestive system*
	Bacteria and Enzymes in digestion	
	The effect of temperature on enzymes	***N/A***
	The human respiratory system	*The mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume*
	Gas exchange	*The structure and functions of the gas exchange system in humans, including adaptations to function; t the role of leaf stomata in gas exchange in plants*
	Effect of exercise on breathing rate	*The impact of exercise, asthma and smoking on the human gas exchange system*
	The human circulatory system	***N/A***
	Natural selection	*The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection*
	Evolution	
	Mutation and extinction	*Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction*
	Maintaining biodiversity	*The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material*
Chemistry 3: Earth	Structure of the Earth and its atmosphere	*The composition of the Earth; the structure of the Earth and its atmosphere*
	Weathering and erosion	*The rock cycle and the formation of igneous, sedimentary and metamorphic rocks*
	Sedimentary rocks	
	Metamorphic rocks	
	Igneous rocks	
	The rock cycle	
	Earth's resources	*Earth as a source of limited resources and the efficacy of recycling*
	Reduce, re-use, recycle	
	The greenhouse effect	*The production of carbon dioxide by human activity and the impact on climate*
	Global warming and climate change	
	Carbon cycle	*The carbon cycle*
Physics 3: Waves	Waves - introduction	*Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition*
	Sound and speed of sound	*Sound waves are longitudinal; frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of soun. Sound needs a medium to travel, the speed of sound in air, in water, in solids.*
	The microphone and the Loudspeaker	*Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; auditory range of humans and animals*
	The ear and Hearing	
	Uses of sound	*Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone*
	Light	*The similarities and differences between light waves and waves in matter; light waves travelling through a vacuum; speed of light*
	Reflection	*The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface; use of ray model to explain imaging in mirrors, the refraction of light and action of convex lens in focusing (qualitative)*
	Refraction	
	Absorption and transmission	***N/A***
	The camera and the eye	*Use of ray model to explain imaging in the pinhole camera; the human eye; light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras*
	Colours of light	*Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection*
Biology 4: Bioenergetics	Respiration	*Aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life; a word summary for aerobic respiration; the process of anaerobic respiration in humans, and a word summary for anaerobic respiration; the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism*
	Aerobic respiration	
	Anaerobic respiration	
	Fermentation	*The process of anaerobic respiration in micro-organisms, including fermentation*
	Fermentation investigation	***N/A***
	Plant organs and minerals	*Plants gaining mineral nutrients and water from the soil via their roots*
	Importance of plants	*The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere*
	Photosynthesis	*The reactants in, and products of, photosynthesis, and a word summary for photosynthesis; plants making carbohydrates in their leaves by photosynthesis*
	Leaf adaptations	*The adaptations of leaves for photosynthesis*
	Uses of glucose (testing a leaf for starch)	***N/A***
	Photosynthesis investigation	***N/A***
	Seed germination	***N/A***
	Metals and non-metals	*The properties of metals and non-metals; the chemical properties of metal and non-metal oxides with respect to acidity*

Lessons with no National Curriculum content (**N/A**) should be the first to be cut if time is an issue

Chemistry 4: Predicting Reactions	Periodic table - recap	*The principles underpinning the Mendeleev Periodic Table; the Periodic Table: periods and groups, metals and non-metals*
	Atomic model and electronic structure	***N/A***
	Group 1: The Alkali metals	*How patterns in reactions can be predicted with reference to the Periodic Table*
	Group 7: The Halogens	
	Group 0: The Noble gases	***N/A***
	Reactivity series	*The order of metals and carbon in the reactivity series*
	Displacement reactions	*Oxidation and displacement reactions; the use of carbon in obtaining metals from metal oxides*
	Oxidation and reduction	
	Energy changes - cooling curves	*Energy changes on changes of state (qualitative)*
	Endothermic and exothermic reactions	*Exothermic and endothermic chemical reactions (qualitative)*
	Ceramics	*Properties of ceramics, polymers and composites (qualitative)*
	Polymers	
	Composites	
Physics 4: Electricity and Magnetism	Energy resources	*Comparing energy values of different foods (from labels) (kJ); fuels and energy resources*
	Fossil fuels	
	Renewable energy resources	
	Power	*Comparing power ratings of appliances in watts (W, kW); comparing amounts of energy transferred (J, kJ, kW hour); domestic fuel bills, fuel use and costs*
	Static electricity	*Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects*
	Electricity introduction (components inc. fruit batteries)	***N/A***
	Electrical conductors and insulators	***N/A***
	Measuring current	*Electric current, measured in amperes, in circuits*
	Measuring Voltage	*Potential difference, measured in volts, battery and bulb ratings*
	Series circuits	*Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge*
	Parallel circuits	
	Resistance	*Resistance, measured in ohms, as the ratio of potential difference (p.d.) to current; differences in resistance between conducting and insulating components (quantitative)*
	Magnets	*Magnetic poles, attraction and repulsion*
	Magnetic fields	*Magnetic fields by plotting with compass, representation by field lines*
	Permanent and temporary magnets	*Earth's magnetism, compass and navigation*
	Electromagnetism	*The magnetic effect of a current, electromagnets, D.C. motors (principles only). The idea of electric field, forces acting across the space.*
	Uses of electromagnets (inc. motors)	

Futura Science Year 9 - Detailed Curriculum Overview

Unit	Year 9 Lessons	National Curriculum
Biology 5: Cell Biology & Transport	Plant and animal cells	*cells as the fundamental unit of living organisms, the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplast, the similarities and differences between plant and animal cell, the structural adaptations of some unicellular organisms*
	Prokaryotic cells	
	Specialised cells	
	Microscopy - principles of	*cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope*
	Practical - Microscopy	
	DNA, chromosomes introduction	*heredity as the process by which genetic information is transmitted from one generation to the next*
	Asexual reproduction	*reproduction in plants*
	Mitosis	*cells as the fundamental unit of living organisms,*
	Stem cells	
	Diffusion	*the role of diffusion in the movement of materials in and between cells*
	Practical - Osmosis (Practical and theory)	***N/A***
	Practical - Osmosis	
	Active transport	
Chemistry 5: Atomic structure & The periodic table	Atoms, elements, compounds and mixtures	*differences between atoms, elements and compound, mixtures, including dissolving*
	Models of the atom	*a simple (Dalton) atomic model*
	Atomic structure	
	Isotopes	***N/A***
	History of the Periodic Table	*chemical symbols and formulae for elements and compound, the varying physical and chemical properties of different elements, the principles underpinning the Mendeleev Periodic Table,the Periodic Table: periods and groups; metals and non-metals, how patterns in reactions can be predicted with reference to the Periodic Table, the properties of metals and non-metals*
	Electronic structure	
	The periodic table	
	Group 1	
	Group 7	
	Reactions of the halogens	*chemical symbols and formulae for elements and compounds, chemical reactions as the rearrangement of atom, representing chemical reactions using formulae and using equation, displacement reactions*
	Noble Gases	*chemical symbols and formulae for elements and compounds*
	Solids liquids and Gases	*the properties of the different states of matter (solid, liquid and gas) in terms of the particle model*
	Separating mixtures	*mixtures, including dissolving, simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography*
	Practical - Seperation techniques	
	Practical - Chromatography	
Physics 5: Energy & Forces	Energy stores	*other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuel, energy as a quantity that can be quantified and calculated; the total energy has the, same value before and after a chang, comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions*
	Energy transfers	
	Efficiency	***N/A***
	Conduction, convection & radiation	*heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators*
	Wasted energy and insulation	
	Non-renewable energy	*fuels and energy resources.*
	Renewable energy	
	Contact and non-contact forces	*forces as pushes or pulls, arising from the interaction between two objects, forces measured in newtons, non-contact forces: gravity forces acting at a distance on Earth and in space, forces, between magnets and forces due to static electricit, opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.*
	Weight and gravitational fields	*gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)*
	Free body diagrams and resultant forces	*using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces*
	Practical: Springs	*forces: associated with deforming objects; stretching and squashing – springs; measurements of stretch or compression as force is changed, force-extension linear relation; Hooke's Law as a special case*
	Practical: Springs	
Biology 6: Microbes & Disease	Types of pathogen	*how organisms affect, and are affected by, their environment*
	Bacterial diseases	
	Viral diseases	
	Protist and fungal diseases	
	Plant defence against pathogens	
	Transmission & physical and chemical defences	
	The immune response	***N/A***
	Vaccinations	
	Antibiotics	
	Monoclonal antibodies	
	Culturing microrganisms	
	Practical: Antiseptics	
	Drug testing	
	Pain killers and drug discovery	
Chemistry 6: The Earth's Atmosphere & Resources	Early Atmosphere	*the composition of the atmosphere*
	Changing Atmosphere	
	Greenhouse effect	*the carbon cycle, the production of carbon dioxide by human activity and the impact on climate.*
	Climate Change	
	Carbon Footprint	
	Pollutants	***N/A***
	Impact of pollutants	
	Using the Earth's resources	*the composition of the Earth, Earth as a source of limited resources*
	Water treatment (making potable water)	***N/A***
	Practical: Water treatment (making potable water)	
	Treating waste water	
	Phytomining and bioleaching	*the composition of the Earth, Earth as a source of limited resources and the efficacy of recycling*
	Life Cycle Assessment	
	Recycling and Reuse	
Physics 6: Atomic Structure	Describing atoms	*a simple (Dalton) atomic model (chemistry in NC)*
	How our model of the atom has changed	
	The nature and properties of radiation	***N/A***
	Half life (and half life equations)	
	Irradiation and contamination	
	Background radiation	
	Uses of radiation	
	Nuclear fission	
	Nuclear fusion	
	Practical: Density	*the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure, changes of state in terms of the particle model (chemistry NC), conservation of material and of mass, and reversibility, in melting, freezing*
	The particle model	

		of state in terms of the particle model (chemistry YC), conservation of material and of mass, and reversibility, in melting, freezing,
	The particle model and changes in state	*evaporation, sublimation, condensation, dissolving, similarities and differences, including density differences, between solids, liquids and gases*
	Internal energy	*changes with temperature in motion and spacing of particles internal energy stored in materials.*

Futura Science KS4 Biology - Detailed Curriculum Overview

Unit	KS4 Lessons	Links to prior learning	Unit Summary
Biology A - Ecology	Ecosystems - Communties, biotic and abiotic factors Food chains, webs and pyramids - Sep. Bio. Adaptations (plants and animals) Competition Predator-prey relationships Sampling techniques (and maths skills) RP: Sampling required practical (random sampling) Deforestation and peat bog destruction Water cycle The human population explosion Pollution: Land, air and water Carbon cycle Climate change (and it's impact) Maintaining biodiversity	***Year 7 -*** *Biology 2: Genetics and Ecology* ***Year 8 -*** *Chemistry 3: Earth* ***Year 9 -*** *Chemistry 6: The Earth's Atmosphere & Resources*	The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this unit we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.
Biology B - Organisation (Systems)	Organisation (Cells, tissues organs) - Hierarchy Structure and adaptations of the digestive system RP: Food tests required practical Properties of enzymes Enzymes of the digestive system RP: Enzymes required practical 1 RP: Enzymes required practical 2 Respiratory system in context of exchange surfaces Blood and blood vessels Heart structure and function Diseases of the heart and treatments Non-communicable diseases and data strengths Cancer	***Year 7 -*** *Biology 1: Cells and Organisms* ***Year 8 -*** *Biology 3: Life Processes and Evolution* ***Year 9 -*** *Biology 5: Cell Biology & Transport*	In this unit we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle.
Biology C - Bioenergetics	Plant tissues organs and systems Plant transport (including linking to active transport) Evaporation and transporation inc. factors affecting Photosynthesis overview Factors affecting photosynthesis (and using photosynthesis) RP: Limiting factors of photosynthesis 1 RP: Limiting factors of photosynthesis 2 Uses of glucose Aerobic respiration Anaerobic respiration Respiration investigation - exercise Metabolism and the liver	***Year 7 -*** *Biology 1: Cells and Organisms* ***Year 8 -*** *Biology 4: Bioenergetics* ***Year 9 -*** *Biology 5: Cell Biology & Transport*	In this unit we start with learning how the plant's transport system is dependent on environmental conditions to ensurethat leaf cells are provided with the water and carbon dioxide that they need for photosynthesis. We will then explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.
Biology D - Homeostasis & Response	Principles of homeostasis Nervous system and reflex arc RP: Reaction times required practical The brain - Sep. Bio. The eye - Sep. Bio. Common problems of the eye - Sep. Bio Endocrine system overview inc. reproductive hormones Glucoregulation & treatment of diabetes Hormones and the menstrual cycle Contraception Fertility treatments Plant hormones and responses - Sep. Bio. RP: Tropisms required practical 1 set up - Sep. Bio. Plant diseases and defences recap - Sep. Bio. RP: Tropisms required practical 2 collect results - Sep. Bio. Thermoregulation - Sep. Bio. Kidneys structure and function - Sep. Bio. Kidneys - ADH and dialysis - Sep. Bio. Kidney failure - Sep. Bio.	***Year 7 -*** *Biology 2: Genetics and Ecology* ***Year 8 -*** *Biology 4: Bioenergetics* ***Year 9 -*** *Biology 6: Microbes & Disease (sepearte biology only), Biology 5: Cell Biology & Transport*	Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this unit we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.
Biology E - Ecology & Evolution	Recap - interdependence and carbon cycle Decomposition - Sep. Bio. RP: Decay required practical - 1 - do the prac. - Sep. Bio. RP: Decay required practical - 2 - analysis - Sep. Bio. Factors affecting food security - Sep. Bio. Sustainable food production (biotechnology) - Sep. Bio. Variation/adaption & competition recap Recap Sampling techniques (quadrats and transects) Classification & new systems of classification Theories of evolution - Sep. Bio. Evidence for evolution & natural selection Speciation - Sep. Bio. Fossils and extinction Evolution - bacteria resistance Selective breeding	***Year 7 -*** *Biology 2: Genetics and Ecology* ***Year 8 -*** *Biology 3: Life Processes and Evolution* ***Year 9 -*** *Chemistry 6: The Earth's Atmosphere & Resources*	Content from the Biology A unit is recapped at the start of this unit as part of the spiralling curriculum. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. Charles Darwin, as a result of observations on a round the world expedition, backed by years of experimentation and discussion and linked to developing knowledge of geology and fossils, proposed the theory of evolution by natural selection. Evidence for Darwin's theory is now available as it has been shown that characteristics are passed on to offspring in genes. There is further evidence in the fossil record and the knowledge of how resistance to antibiotics evolves in bacteria. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. .
Biology F - Inheritance	Types of reproduction Recap - DNA, chromosomes and structure of DNA Meiosis DNA and the genome - Sep Bio. DNA structure and Protein synthesis - Sep. Bio. Mendel's work - Sep. Bio. Inheritance - including sex determination Inheritance of genetic diseases Screening for genetic disorders	***Year 7 -*** *Biology 2: Genetics and Ecology,* ***Year 8 -*** *Biology 3: Life Processes and Evolution* ***Year 9 -*** *Biology 5: Cell Biology & Transport*	In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic.

	Variation Recap - Stem Cells Theraputic Cloning Cloning - Sep. Bio. Monoclonal antibodies - Sep. Bio. - Recap Genetic engineering Ethics of genetic technologies (inc. crops)		Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.

Futura Science KS4 Chemistry - Detailed Curriculum Overview

Unit	KS4 Lessons	Links to prior learning	Unit Summary
Chemitry A - Bonding & structure	Forming ions Ionic Bonding Ionic structures and properties Covalent bonding Covalent structures and properties Giant covalent strcutures: diamond and graphite Fullerenes and graphene Metallic structure and properties (metallic bonding) Alloys Polymers Ceramics, composites and polymers - Sep. Chem. Nanoparticles - Sep. Chem. Transition metals - Sep. Chem.	***Year 7:*** *Chemistry 2 - The periodic table and chemical reactions* ***Year 8:*** *Chemistry 4 - Predicting Reactions*	Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.
Chemitry B - Energy Changes	Balancing equations Realtive fomula mass Exothermic and endothermic reactions **RP:** Exo/Endo Temp change **RP:** Exo/Endo Temp change Energy Change in reactions (energy level diagrams) Bond Enthalpy - HT Identifying Gases Reactions with Oxygen Reactivity Series Extraction with Carbon Redox	***Year 8:*** *Chemistry 4 - Predicting Reactions*	Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications.
Chemistry C - Chemical Reactions	Acid and Metal Reactions Neutralisation **RP:** Preparing soluble salts 1 **RP:** Preparing soluble salts 2 pH Strong and weak acids - HT Acid reactions - making salts Titration method (not calculations) - Sep. Chem. Electrolysis of molten compounds Electrolysis of aqueous solutions Metal extraction and electrolysis Reactions at electrodes Ionic equations and Half Equations - HT **RP:** Electrolysis **RP:** Electrolysis	***Year 7:*** *Chemistry 2 - The periodic table and chemical reactions* ***Year 8:*** *Chemistry 4 - Predicting Reactions*	Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organizing their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way
Chemistry D - Chemical calculations & organic I	Moles - HT Gas calculations - Sep. Chem. Masses of reactants and products Moles of balanced equations - HT Limiting Reactants - HT Concentration of solutions Titration calculations - Sep. Chem. Titration calculations - Sep. Chem. Emprical formula Percentage yield - Sep. Chem. Atom economy - Sep. Chem. Cells and Fuel Cells - Sep. Chem. Electrochemical cells (extra lessson) - Sep. Chem. Crude oil and Hydrocarbons Alkanes and alkenes (And testing for them) Fractional distillation Combustion Cracking	***Year 7*** *- Physics 2 - Energy,* ***Year 7*** *Chemistry 1 - Matter,* ***Year 9 Chemistry 6*** *- The Earth's Atmosphere & Resources*	Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas. The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry.
Chemistry E - Rates of Reaction	Measuring Rates Collison Theory Temperatures and rates of reaction Surface area and rates of reaction **RP:** Concentration and rates of reaction **RP:** Concentration and rates of reaction Catalysts Pure substances, formulations and melting Points Chromatography Reversible reactions Le Chatelier's principle - HT Applying Le Chatelier's principle - Ht	***Year 7*** *- Chemistry 2 - The periodic table and chemical reactions* ***Year 8*** *- Chemistry 4 - Predicting Reactions,* ***Year 9*** *- Chemistry 5 - Atomic Structure and the periodic table*	Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.
Chemistry F - Organic II (Separate Only)	Combustion of alkenes - Sep. Chem. Testing for alkenes - Sep. Chem. Reacting of alkenes (extra) - Sep. Chem. Alcohols - Sep. Chem. Reactions of Alcohols (Extra) - Sep. Chem. Carboxyilic acids and esters (Sep. Chem.) Carboxyllic reactions - Sep. Chem. Addition polymerisation - Sep. Chem. Condensation polymerisation - Sep. Chem. Organic polymers - Sep. Chem. Corrosion and Rusting- Sep. Chem. Alloys - Sep. Chem. The Haber Process - Sep. Chem. NPK Fertilisers - Sep. Chem. Flame tests - Sep. Chem. Positive ion tests - Sep. Chem. Testing for negative ions - Sep. Chem. **RP:** Testing ions - Sep. Chem.	***Year 7*** *- Physics 2- Energy* ***Year 8*** *- Chemistry 4 - Predicting Reactions,* ***Year 9*** *- Chemistry 6 - The Earth's Atmosphere & Resources*	The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work.

Futura Science KS4 Physics - Detailed Curriculum Overview

Unit	KS4 Lessons	Links to prior learning	Unit summary
Physics A - Work and Energy	**Phys A - Work & Energy Stores (Yr 10)** Work done & calculating work done Power GPE Stores & calculations KE and elastic energy stores & calculations Energy changes calculations (energy dissipation and efficiency) Specific heat capacity **RP:** Specific heat - required practical **RP:** Specific heat - required practical Heating and insulating buildings Specific latent heat Investigating energy (Sep. Phys.) - insulation Gas pressure and temperaure Expanding and compressing gases (Sep Phy)	***Year 7 -*** *Physics 2 - Energy* ***Year 9 -*** *Physics 5 - Energy and Forces*	This unit builds on the idea that stores of energy are needed to make most things happen. It looks in detail about the equations required to calculate quantitatve amounts of energy in objects and energy transferred. The unit applies the particle model to the concept of latent, specific heat capacity and gas pressure and allows students oppurtunity to develop investigation skills to find the best thermal insulator.
Physics B - Electricity	Electric circuits / symbols Current and charge Potential difference and resistance **RP:** Investigating resistance required practical 1 **RP:** Investigating resistance required practical 2 Series circuits Parallel circuits Ohm's law - ohmic conductors Current voltage charactertistics - filament lamps **RP:** Investigation I-V graphs - required practical Resistors in series and parallel Resistance and sensors (thermistors and LDRs) AC, DC and mains electricity Cables and plugs Electrical power and PD Electrical currents and energy transfer Appliances and efficiency Transformers Sep. Phys Transformer calculations Sep. Phys Static electricity Sep. Phys Effect of static Sep. Phys Electric fields and static safety Sep. Phys	***Year 8*** *- Physics 4 - Electricty and magnetism*	Electric charge is a fundamental property of matter everywhere. This unit develops the understanding of the differences inthe microstructure of conductors, semiconductors and insulators. Students will apprecaite that many circuits are powered with mains electricity, butportable electrical devices must use batteries of some kind. The seperate only content delves further into other applications of electricity including transformers, static electricity and electric fields.
Physics C - Forces and motion	Forces recap Scalar and vector quantities Centre of mass Distance and displacement Speed calculations Distance time graphs	***Year 7*** *- Physics 1-Forces*	This unit focuses on forces that cause motion. Students look at both vertical and horizontal motion causes by different forces. They will practice applying the equations for motion, they will use practical

Physics C - Forces and motion	Velocity time graphs Velocity and acceleration (and moving in a circle) Equations of uniform acceleration Falling under gravity (mass, weight and T-V) Forces and breaking Momentum	***Year 9*** *- Energy and Forces*	the equations for motion, they will use practical equipment to develop investigative skills and to prove hypothesis. Momentum is introduced in its simplest form and built upon in Physics E.
Physics D - Waves	Radioactivity revision - sources and decay equations Nuclear fusion and fission recap - Sep. Phys. Transverse and longitudinal waves Properties of waves Reflection and Refraction of waves **RP:** Required practical waves 1 **RP:** Required practical waves 2 The EM spectrum & general properties Light, IR, Microwaves and radiowaves **RP:** Infra-red radiation required practical 1 **RP:** Infra-red radiation required practical 2 Communications UV waves, X Rays and Gamma X Rays in Medicine	***Year 7*** *- Physics 1 Forces,* ***Year 8 -*** *Physics 3 - Waves,* ***Year 9*** *- Physics 6 - Atomic structure*	The beginning part of this unit recaps on radiaoctivity which is taught in year 9 as a cultural capital oppurtunity. At this point it is sepearte science studenst developing this concept. The unit then intoroduces waves, properties of waves and applications of waves. It has a high component of applied science and links to many career oppurtunities particluaIy in the medical profession.
Physics E - Magnestism and forces	Permanent and induced magnets Magnetic fields Magnetic fields from electric currents & electromagnets Using electromagnets FLHR & the motor effect The loudspeaker - Sep. Phys. The generator - Sep. Phys. Uses of generators - Sep. Phys. Newton's first law **RP:** Acceleration required practical 1 **RP:** Acceleration required practical 2 Inertia, mass and Newton's second law Newton's third law Momentum Using conservation of momentum - Sep. Phys Impact forces - Sep. Phys Moments - Sep. Phys. Pressure at surfaces - Sep. Phys Pressure in fluids - Sep. Phys. Atmospheric pressure - Sep. Phys. Upthrust and flotation - Sep. Phys.	***Year 7 -*** *Physics 1 - Forces* ***Year 8 -*** *Physics 4 - Electricty and magnetism* ***Year 9 -*** *Physics 5 - Energy and forces*	The first section of physics E covers the phenomenum of magnetism and its applications. Physics students take the application of interacting electrical and magnetic fields and apply this to how motors, speakers and generators work. The unit links to the production of electricity and can be linked to chemical/environmental effects of electricty production. The latter section returns to forces and motion looking at pressure, momentum and Newtons laws of motion.
	Sound waves Sep. Phys Uses of ultrasound Sep. Phys Seismic waves Sep. Phys		

Physics F - Separate physics	Reflection of light - Sep. Phys. Refraction of light - Sep. Phys. **RP:** Refraction of light - Sep. Phys Light and colour - Sep. Phys Lenses - Sep. Phys. Using Lenses - Sep.Phys Emission and absorption - Sep. Phys. Black body radiation - Sep. Phys. The solar system - Sep. Phys. The life cycle of a star - Sep. Phys. Orbital motion and satellites - Sep. Phys. Red shift - Sep. Phys. The big bang theory - Sep. Phys.	***Year 7 -*** *Physics 1 - Forces,* ***Year 8*** *- Physics 3 - Waves,* ***Year 9*** *- Physics 5 - Energy & Forces*	This unit looks at sound, light and seismic waves in detail.It covers diffraction, reflection,refraction of waves and how these principles can be applied. Students will investigate the behaviour of light through lenses and make links to careers using the properties of light and lenses. The unit then moves onto space and its contents including the formation of stars, the motion of celestial objects and the theory of the big bang