



Willingham Primary School Science Planning



To be able to access the deeper levels of science delivered at secondary school and beyond, students must have a strong grasp on these fundamental scientific principles.

Substantive and Declarative Knowledge			Disciplinary and Procedural Knowledge	
Biology	Chemistry	Physics	Working Scientifically	Numeracy and Mathematical Links:
<p>Pupils will understand:</p> <ul style="list-style-type: none"> • What it means to be 'living' and how to sustain life. • The physical structure and workings of organisms (plants and animals). • The life cycle of organisms including specific stages and changes during their lifetime. • How sexual reproduction results in variation • The interaction and interdependence of the organisms within Ecosystems. • How organisms are classified. • How adaptations to habitats and variations have led to evolution • How to live a healthy lifestyle. 	<p>Pupils will understand that:</p> <ul style="list-style-type: none"> • All substances are made of materials which can be grouped in different ways. • How to differentiate between chemical and physical changes using the particle model. <p>Pupils will understand that:</p> <ul style="list-style-type: none"> • Materials look continuous on a big scale but are made of small parts. <p>Pupils will be able to describe</p> <ul style="list-style-type: none"> • Simple separation techniques at a high level based on particle model • The effect temperature has on the state of materials. • The water cycle and rock cycle. 	<p>Pupils will be able to:</p> <ul style="list-style-type: none"> • Identify forces as (invisible) push and pulls. <p>Pupils will understand:</p> <ul style="list-style-type: none"> • How changes in forces can cause changes in motion and shape. • That sound requires particles. • That light is a method of transferring energy that does not require particles. • That electricity is a method of transferring energy. • That opposites (north-south, positive-negative) attract and likes repel. • Earth's place in the solar system and how it is used as a measure of time. 	<p>Pupils will:</p> <ul style="list-style-type: none"> • Understand how scientific theories have developed over time (e.g. geocentric model). • recognize the importance of following the scientific method and conducting fair tests. • Develop experimental skills and strategies: including suggesting a hypothesis using observations, plan basic valid investigations to answer their questions, identify different variables, make and record observations in appropriate formats. • Be use analysis and evaluation to translate data from one form to another, present reasoned explanations including relating data to hypothesis • Use correct terminology including: accuracy, precision, repeatability, reproducibility, random and systematic error. • Recognise and use SI units. 	<p>Pupils will be able to:</p> <ul style="list-style-type: none"> • Present data in tables and diagrams. • Construct and interpret charts (bar, line and pie charts) and histograms. • Translate data from tables into graphs (scatter graphs). • Use measuring tools and scales to accurately record data (distance, mass and volume, temperature). • Recognize and use SI units of Force in Newtons.

Year Grp	Term	Cycle A	Cycle B
EYFS	Autumn 1 Biology/ Chemistry	Bears Looking at hibernation and habitats and different species of bear.	
	Autumn 2 Biology/ Biology	Emergency Services	
	Spring 1 Biology/ Chemistry	Owls Owls life cycle - (owls don't deliver live young) Nocturnal animals Habitats Survival and characteristics (talons to catch prey etc)	
	Spring 2 Physics/ Biology		
	Summer 1 Chemistry/ Biology	Lifecycles / Wicken Fen Butterfly Lifecycle (linked back to owls and bears and all about us) habitats of minibeasts	
	Summer 2 Physics/ Physics	Keeping healthy / The human body Looking at how heart works and learning correct vocabulary of body parts and organs. Importance of maintaining healthy hygiene and diet to support a healthy lifecycle.	
Y1/2	Autumn 1 Biology/Chemistry	<p>LIVING THINGS AND THEIR ENVIRONMENTS - "Food Webs" booklet <i>NC Living Things Y2</i></p> <p>Teachers: Introduce the idea of interdependence between living things and their environment.</p> <p>A. HABITATS</p> <p>Built upon in Y3/4 Ecology</p> <ul style="list-style-type: none"> • Living things live in environments to which they are particularly suited. • Specific habitats and what lives there, for example: <ul style="list-style-type: none"> ○ Forest (for example: oak trees, squirrels, foxes, badgers, snails, mice) ○ Meadow and plains (for example: wildflowers, grasses, prairie dogs) 	<p>MATERIALS "Principles of Chemistry" booklet <i>NC Materials Y1 & Y2</i></p> <p>Teachers: Children should use correct vocabulary to describe different materials and their properties. Sort materials into groups based on their properties. For example: soft, hard, bendy, ability to float, magnetic or non-magnetic.</p> <ul style="list-style-type: none"> • Recognise and name a variety of widely used materials. For example: wood, plastic, rock, paper, metal. • Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. • Explain why materials are chosen for specific tasks based on their properties. For example wool for clothing, glass for windows, wood for tables, metal for bridges.

		<ul style="list-style-type: none"> ○ Underground (for example: fungi, moles, worms) ○ Desert (for example: cacti, lizards, scorpions) ○ Water (for example: fish, oysters, starfish) Diversity of ocean life: from organisms too small for the eye to see (plankton), to giant whales ● The food chain: a way of picturing the relationships between living things <ul style="list-style-type: none"> ○ Animals: big animals can be eaten by little ones, big animals die and are eaten by little ones. ○ Plants: nutrients, water, soil, air, sunlight/ <p>C. SPECIAL CLASSIFICATIONS OF ANIMALS <i>Built upon in Y3 and Y6 Classification</i></p> <ul style="list-style-type: none"> ● Herbivores: plant-eaters (for example, elephants, cows, deer) ● Carnivores: flesh-eaters (for example, lions, tigers) ● Omnivores: plant and animal eaters (for example, bears) ● Extinct animals (for example: dinosaurs) 	<ul style="list-style-type: none"> ● Become aware that some materials are natural and some are man-made. <p>PROPERTIES OF MATTER: MEASUREMENT</p> <p>Teachers: Have children describe and classify objects according to what they are made of, and according to their physical properties (colour, shape, size, weight, texture, etc.)</p> <ul style="list-style-type: none"> ● Units of measurement: <ul style="list-style-type: none"> ○ Length: centimetre, metre ○ Volume: millilitre, litre ○ Temperature: degrees Celsius
<p>Autumn 2 Biology/Biology</p>		<p><i>Living Things (Y2) (continued from above)</i></p>	<p><i>NC Materials Y1 & Y2 (continued from above)</i></p>
<p>Spring 1 Biology/Chemistry</p>		<p>PLANTS AND PLANT GROWTH <i>NC Plants (Y1 & Y2)</i></p> <p>Teachers: Reading aloud, observation and activities such as growing plants from seeds in varying conditions are useful ways to explore the following topics with children.</p> <ul style="list-style-type: none"> ● Understand what plants need to grow: sufficient warmth, light and water. ● observe and describe how seeds and bulbs grow into mature plants 	<p>THE HUMAN BODY – “Being Healthy” booklet “Principles of Biology” booklet <i>Animals inclu. Humans -Human Element Y1</i></p> <p>A. THE FIVE SENSES</p> <ul style="list-style-type: none"> ● Identify the five senses and associated body parts: <ul style="list-style-type: none"> ○ Sight: eyes (link with year 3/4 Cycle A) ○ Hearing: ears (link with year 3/4 Cycle A) ○ Smell: nose ○ Taste: tongue ○ Touch: skin

		<ul style="list-style-type: none"> • Recognise basic parts of plants: seeds, roots, stems, branches and leaves. • Understand that plants make their own food. • Recognise the importance of flowers and seeds. For example, seeds such as rice, nuts, wheat and corn are food for plants and animals. • Know that there are two kinds of plants: deciduous and evergreen. <p>SEASONS AND WEATHER <i>NC Seasonal Changes(Y1 &2)</i></p> <p>Teachers: The emphasis in Year 1 should be on observation and description; technical explanations of meteorological phenomena should be taken up in later years.</p> <ul style="list-style-type: none"> • Identify the four seasons. • Be able to describe characteristic local weather patterns during the different seasons. • Recognise the importance of the sun as a source of light and warmth. • Understand daily weather changes. <ul style="list-style-type: none"> o Temperature: thermometers are used to measure temperature o Clouds: rainfall comes from clouds o Rainfall: how the condition of the ground varies with rainfall; rainbows o Thunderstorms: lightning, thunder, hail, safety during thunderstorms o Snow: snowflakes, blizzards 	<ul style="list-style-type: none"> • Review the importance of taking care of your body: exercise, cleanliness, healthy foods and rest. <p>B. SYSTEMS AND PREVENTING ILLNESS</p> <p>i. BODY SYSTEMS (link with year 3/4 and 5/6 Cycle A)</p> <p>Teachers: Introduce the idea of body systems, and have children identify basic parts of the following body systems:</p> <ul style="list-style-type: none"> • Skeletal system: skeleton, bones, skull • Muscular system: muscles • Digestive system: mouth, stomach • Circulatory system: heart and blood • Nervous system (brain and nerves) <p>ii. GERMS, DISEASES, AND PREVENTING ILLNESS</p> <ul style="list-style-type: none"> • Taking care of your body: exercise, cleanliness, healthy foods, rest • Vaccinations
<p>Spring 2 Physics/Biology</p>		<p>States of Matter (new) “Principles of Chemistry” booklet MATTER (link with year 3/4 and 5/6 Cycle A Chemistry)</p> <p>Teachers: Introduce children to the idea that everything is made of matter, and that all matter is made up of parts too small to see.</p> <ul style="list-style-type: none"> • Basic concept of atoms • Names and common examples of three states of matter: 	<p>THE HUMAN BODY (continued from above)</p>

		<ul style="list-style-type: none"> ○ Solid (for example, wood, rocks) ○ Liquid (for example, water) ○ Gas (for example, steam) ● Water as an example of changing states of matter of a single substance 	
<p>Summer 1 Physics/Biology</p>	<p>SUBSTANCES and MIXTURES (NEW) (link with year 3/ 4 cycle A and 5/6 cycle B) “Principles of Chemistry” booklet</p> <ul style="list-style-type: none"> ● Objects, Materials and Substances ● Mixtures ● Solids, Liquids and Gases ● Changing between Solids, Liquids and Gases ● Gases ● Dissolving ● Separating Mixtures: Filtering ● Separating Mixtures: Sieving ● Separating Mixtures: Evaporating 	<p>ANIMALS AND THEIR NEEDS NC Animals inclu. Humans (Y2)</p> <p>Teachers: Through reading aloud, observation and activities, explore with children the common characteristics and needs of animals.</p> <ul style="list-style-type: none"> ● Make the connection that animals, like plants, need food, water and space to live and grow. ● Recognise that plants make their own food, but animals obtain food from eating plants or other living things. ● Understand that offspring are very much (but not exactly) like their parents. ● Understand that most animal babies need to be fed and cared for by their parents; human babies are especially in need of care when young. ● Recognise that pets have special needs and must be cared for by their owners. 	
<p>Summer 2 Physics/Physics</p>	<p>INTRODUCTION TO MAGNETISM (NEW) - “Principles of Physics” booklet</p> <p>(link with year 3/4 cycle B) Teachers: Through reading aloud, observation and experiments with magnets, introduce children to the idea that there are forces we cannot see that act upon objects.</p>	<p>INTRODUCTION TO ASTRONOMY (NEW) - “Orbits” booklet “Principles of Physics” booklet</p> <ul style="list-style-type: none"> ● Sun: source of energy, light, heat ● Moon: phases of the moon (full, half, crescent, new) ● The eight planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune) <ul style="list-style-type: none"> ○ Note that, in 2006, Pluto was classified as a dwarf planet. ☐ Stars ○ Constellations: the Plough 	

		<ul style="list-style-type: none"> Identify familiar, everyday uses of magnets. For example: in toys, in cabinet locks, in refrigerator magnets, etc. ☑ Classify materials according to whether they are or are not attracted by a magnet. 	<ul style="list-style-type: none"> The sun is a star. Earth and its place in the solar system The Earth moves around the Sun; the sun does not move The Earth revolves (spins); one revolution takes one day (24 hours) Sunrise and sunset o When it is day where you are, it is night for people on the opposite side of the Earth
	<p>Year 1/2 Disciplinary knowledge (specified in the working scientifically section of the curriculum)</p>	<p><i>Disciplinary knowledge is knowledge of how scientific enquiry generates and grows substantive knowledge. Pupils should not simply be expected to acquire disciplinary knowledge by carrying out practicals. Pupils must carry out scientific enquiries themselves using a range of methods. This should be taught and should always take place in a substantive context (i.e. through teaching the content in the programme of study).</i></p> <ul style="list-style-type: none"> asking simple questions and recognising that they can be answered in different ways performing simple tests observing closely, using simple equipment gathering and recording data to help in answering questions identifying and classifying using their observations and ideas to suggest answers to questions 	
	Potentially relevant scientists and their work for Year 1/2 curriculum.	<ul style="list-style-type: none"> Joseph Banks (botanist) Jane Goodall (studied chimpanzees) Wilburn and Orville Wright (made first aeroplane) 	<ul style="list-style-type: none"> Rosalind Franklin (often-overlooked woman scientist, discovered double-helix structure of DNA) Thomas Edison (invented an electric light bulb) Edward Jenner (found a way to stop smallpox) Louis Pasteur (made milk safe to drink)
Y3/4	Autumn 1 Biology/Chemistry	<p>THE HUMAN BODY: CELLS AND SYSTEMS "Principles of Biology" booklet <i>NC Animals Inclu. Humans Y3</i> (link with 5/6 Cycle A) (link with 1/ 2 Cycle Animals including Humans – Internal Organs, Skeletal Systems and Healthy Lifestyles)</p> <p>A. CELLS</p> <p>All living things are made up of cells, too small to be seen without a microscope.</p> <ul style="list-style-type: none"> Cells make up tissues. 	<p>THE EARTH - "Rocks and Fossils" booklet <i>NC Rocks Y3</i></p> <p>A. ROCKS AND MINERALS Link with 3/4 Geography Volcanoes/Earthquakes</p> <ul style="list-style-type: none"> Formation and characteristics of different kinds of rocks: metamorphic, igneous, sedimentary Compare and grouping on the basis of appearance and simple physical properties Important minerals in the Earth (such as quartz, gold, sulphur, coal, diamond, iron ore)

- Tissues make up organs.
- Organs work in systems.

B. THE SKELETAL SYSTEM

- Skeleton, bones, marrow
- Musculo-skeletal connection
 - Ligaments
 - Tendons, Achilles tendon
- Cartilage
- Skull, cranium
- Spinal column, vertebrae
- Joints
- Ribs, rib cage, sternum
- Scapula (shoulder blades), pelvis, tibia, fibula
- Broken bones, X-rays

C. THE MUSCULAR SYSTEM

- Muscles
 - Involuntary and voluntary muscles

D. THE NERVOUS SYSTEM

- Brain: medulla, cerebellum, cerebrum, cerebral cortex
- Spinal cord
- Nerves
- Reflexes

E. VISION: HOW THE EYE WORKS

[Links with Y1/2 Sight](#)

- Parts of the eye: cornea, iris and pupil, lens, retina (made of light sensitive cells)
- Optic nerve
- Farsighted and nearsighted

- describe in simple terms how fossils are formed when things that have lived are trapped within rock

B. SOILS

[Link with 3/4 Geography Coastal Landforms](#)

- The formation of soil: topsoil, subsoil, bedrock

<p>Autumn 2 Biology/ Physics</p>	<p>THE HUMAN BODY: CELLS AND SYSTEMS (continued from above)</p> <p>Nutrition (Links with Year 1 & 2 Cycle A – Animals including Humans – Healthy Lifestyles, Living Things – How animals obtain their food/ food chains)</p>	<p>MAGNETISM - “Forces and Motion” booklet “Principles of Physics” booklet NC Forces and Magnets Y3 Link with Y5 Forces</p> <p>Teachers: Magnetism was introduced in Year 1/2. Review and introduce new topics in Year 3/4, with greater emphasis on experimentation.</p> <ul style="list-style-type: none"> • Magnetism demonstrates that there are forces we cannot see that act upon objects. • Most magnets contain iron • Lodestones: naturally occurring magnets • Magnetic poles: north-seeking and south-seeking poles • Magnetic field (strongest at the poles) • Law of magnetic attraction: unlike poles attract, like poles repel. • The Earth behaves as if it were a huge magnet: north and south magnetic poles (near, but not the same as, geographic North Pole and South Pole). • Orienteering: use of a magnetised needle in a compass, which will always point to the north
<p>Spring 1 Physics/Biology</p>	<p>INTRODUCTION TO ELECTRICITY “Principles of Physics” booklet NC Electricity Y4</p> <p>Teachers: Through reading aloud, observation and experiment, explore with children the basic principles of electricity and safety rules.</p> <ul style="list-style-type: none"> • Identify common appliances that run on electricity • Static electricity • Basic parts of simple electric circuits (for example, batteries, wire, bulb or buzzer, switch) <ul style="list-style-type: none"> ○ identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery ○ recognise that a switch opens and closes a circuit and associate this with whether 	<p>INTRODUCTION TO CLASSIFICATION OF ANIMALS NC All Living Things Y4</p> <p>Built upon in Y6 CLASSIFYING LIVING THINGS</p> <ul style="list-style-type: none"> • Scientists classify animals according to the characteristics they share, for example: <ul style="list-style-type: none"> ○ Cold-blooded or warm-blooded ○ Vertebrates (have backbones and internal skeletons) or invertebrates (do not have backbone or internal skeletons) ○ Different classes of vertebrates • Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment <p>Teachers: Children should become familiar with examples of animals in each class and some basic characteristics of each</p>

or not a lamp lights in a simple series circuit

- Conductive and nonconductive materials (insulators)
- Safety rules for electricity (for example, never put your finger or anything metallic in an electrical outlet, never touch a switch or electrical appliance when your hands are wet or when you're in the bathtub, never put your finger in a lamp socket, etc.)

class, such as:

- Fish: aquatic animals, breath through gills, cold-blooded, most have scales, most develop from eggs that the female lays outside her body
- Amphibians: live part of their life cycle in water and part on land, have gills when young, later develop lungs, cold-blooded, usually have moist skin
- Reptiles: hatch from eggs, cold-blooded, have dry, thick, scaly skin
- Birds: warm-blooded, most can fly, have feathers and wings, most build nests, hatch from eggs, most baby birds must be fed by parents and cared for until they can survive on their own (though some, like baby chickens and quail, can search for food a few hours after hatching)
- Mammals: warm-blooded, have hair on their bodies, parents care for the young, females produce milk for their babies, breathe through lungs, most are terrestrial (live on land) though some are aquatic

ECOLOGY

Teachers: Some topics here, such as habitats, were introduced in Year One. In this year, these topics will be covered in more detail and new areas will be studied.

- Habitats, interdependence of organisms and their environment
- The concept of a 'balance of nature' (constantly changing, not a static condition)
- The food chain: producers, consumers, decomposers
- Ecosystems: how they can be affected by changes in environment (for example, rainfall, food supply, etc.) and by man-made changes
- Fossils and how they can tell us about the environment long ago ([link to Rocks 3/4](#))
- Man-made threats to the environment
- Air pollution: emissions, smog

			<ul style="list-style-type: none"> • Water pollution: industrial waste, run-off from farming • Measures we can take to protect the environment (for example, conservation, recycling)
	<p>Spring 2 Biology/Biology</p>	<p>CYCLES IN NATURE “Principles of Biology” booklet “Principles of Physics” booklet <i>NC All Living Things Y4</i></p> <p>A. SEASONAL CYCLES Link to Y1 Seasons</p> <ul style="list-style-type: none"> • The four seasons and Earth’s orbit around the Sun [Review from Year 1] • Seasons and life processes <ul style="list-style-type: none"> • Spring: sprouting, sap flow in plants, mating and hatching • Summer: growth • Autumn: ripening, migration • Winter: plant dormancy, animal hibernation <p>LIFE CYCLES</p> <p>Year 1 & 2 – Offspring Built upon in 5/6</p> <ul style="list-style-type: none"> • The life cycle: birth, growth, reproduction, death • Reproduction in plants and animals <ul style="list-style-type: none"> ○ From seed to seed with a plant ○ From egg to egg with a chicken ○ From frog to frog ○ From butterfly to butterfly: metamorphosis (see below: insects) <p>INSECTS EYFS ? Minibeasts?? Wicken Fen Year 1 & 2 – Cycle ___ – Animals Including humans – body structure (insect specific) within Animal body parts. Also comes under the Habitats part of Living Things.</p>	<p>THE HUMAN BODY: SYSTEMS, HEALTH AND FOOD CHAINS “Principles of Biology” booklet <i>NC Animals Inclu. Humans Y4</i></p> <p>A. THE DIGESTIVE SYSTEM</p> <p>Teachers: Explore with children what happens to the food we eat by studying body parts and functions involved in taking in food and getting rid of waste.</p> <p>Children should become familiar with the following:</p> <ul style="list-style-type: none"> • Salivary glands, taste buds • Teeth: incisors, canines, premolars and molars • Oesophagus, stomach, liver, small intestine, large intestine <p>B. TAKING CARE OF YOUR BODY: A HEALTHY DIET</p> <ul style="list-style-type: none"> • The ‘food pyramid’ • Vitamins and minerals <p>C: FOOD CHAINS</p> <ul style="list-style-type: none"> • Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat • construct and interpret a variety of food chains, identifying producers, predators and prey.

		<p>Built upon in 5/6</p> <ul style="list-style-type: none"> • Insects can be helpful and harmful to people. <ul style="list-style-type: none"> ○ Helpful: pollination; products like honey, beeswax, and silk; eat harmful insects ○ Harmful: destroy crops, trees, wooden buildings, clothes; carry disease; bite or sting ☑ Distinguishing characteristics • Exoskeleton, chitin • Six legs and three body parts: head, thorax and abdomen • Most but not all insects have wings • Life cycles: metamorphosis <ul style="list-style-type: none"> • Some insects look like miniature adults when born from eggs, and they moult to grow (for example: grasshopper, cricket) • Some insects go through distinct stages of egg, larva, pupa, adult (for example: butterflies, ants) • Social Insects <ul style="list-style-type: none"> ○ Most insects live solitary lives, but some are social (for example: ants, honeybees, termites, wasps) ○ Ants: colonies ○ Honeybees: workers, drones, queen 	
	<p>Summer 1 Chemistry/Biology</p>	<p>States of Matter - “Changing Substances” booklet “Principles of Chemistry” booklet NC State of Matter Y4 Link to year 1/2 and built upon 5/6 chemistry</p> <ul style="list-style-type: none"> • introduction to particle diagrams of solids liquids and gases • compare and group materials together, according to whether they are solids, liquids or gases • observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) 	<p>PLANT STRUCTURES AND PROCESSES “Principles of Biology” booklet NC Plants Y3 Link to Y1 PLANTS AND PLANT GROWTH</p> <p>A. STRUCTURE: NON-VASCULAR AND VASCULAR PLANTS</p> <ul style="list-style-type: none"> ○ Non-vascular plants (for example: algae) ○ Vascular plants <ul style="list-style-type: none"> ○ Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant ○ Parts and functions of vascular plants: roots, stems and buds, leaves <p>B. PHOTOSYNTHESIS</p>

		<ul style="list-style-type: none"> • identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. Link with the water cycle covered in Geography Autumn 1 	<ul style="list-style-type: none"> ○ Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis = putting together). Unlike animals, plants make their own food, through the process of photosynthesis. ○ Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)
	<p>Summer 2 Physics/Physics</p>	<p>SOUND "Principles of Physics" booklet <i>NC Sound Y4</i></p> <p>Teachers: Through experimentation and observation, introduce children to some of the basic physical phenomena of sound, with associated vocabulary.</p> <ul style="list-style-type: none"> • Sound is caused by an object vibrating rapidly. • Sounds travel through solids, liquids and gases. • Sound waves are much slower than light waves. • Speed of sound: Concorde • Qualities of sound <ul style="list-style-type: none"> ○ Pitch: high or low, faster vibrations = higher pitch, slower vibrations = lower pitch ○ Intensity: loudness and quietness ☑ Human voice ○ Larynx (voice box) ○ Vibrating vocal chords: longer, thicker vocal chords create lower, deeper voices • Sound and how the human ear works • Protecting your hearing <p>THE HUMAN BODY <i>NC Animals inc Humans</i></p> <p>HEARING: HOW THE EAR WORKS Links with Y1/2 Cycle B: Animals including humans (The Five Senses)</p>	<p>LIGHT AND OPTICS – "Light" booklet "Principles of Physics" booklet <i>NC Light Y3 & Y6</i> Built upon in 5/6</p> <p>Teachers: Through experimentation and observation, introduce children to some of the basic physical phenomena of light, with associated vocabulary.</p> <ul style="list-style-type: none"> • recognise that they need light in order to see things and that dark is the absence of light • The speed of light: light travels at an amazingly high speed. • Light travels in straight lines (as can be demonstrated by forming shadows). • Transparent and opaque objects • Reflection <ul style="list-style-type: none"> ○ Mirrors: plane, concave, convex ○ Use of mirrors in telescopes and some microscopes • The spectrum: use a prism to demonstrate that white light is made up of a spectrum of colours. • Lenses can be used for magnifying and bending light (as in magnifying glass, microscope, camera, telescope, binoculars). • Recognising that light can be dangerous.

		<ul style="list-style-type: none"> • Sound as vibration • Outer ear, ear canal • Eardrum • Three tiny bones (hammer, anvil and stirrup) pass vibrations to the cochlea • Auditory nerve 	
	Year 3/4 Disciplinary knowledge (specified in the working scientifically section of the curriculum)	<p><i>Disciplinary knowledge is knowledge of how scientific enquiry generates and grows substantive knowledge. Pupils should not simply be expected to acquire disciplinary knowledge by carrying out practicals. Pupils must carry out scientific enquiries themselves using a range of methods. This should be taught and should always take place in a substantive context (i.e. through teaching the content in the programme of study).</i></p> <ul style="list-style-type: none"> • asking relevant questions and using different types of scientific enquiries to answer them • Setting up simple practical enquiries, comparative and fair tests • making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers <ul style="list-style-type: none"> • gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • identifying differences, similarities or changes related to simple scientific ideas and processes • using straightforward scientific evidence to answer questions or to support their findings. • using results to draw simple conclusions, make predictions for new values and suggest improvements and raise further questions • reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions 	
	Potentially relevant scientists and their work for Year 3/4 curriculum	<ul style="list-style-type: none"> • Archimedes (ancient Greek mathematician, physicist, engineer, inventor, and astronomer) [Cross-curricular link with History and Geography] • Aristotle (Greek philosopher: wrote on physics, biology, logic, poetry, theatre, rhetoric, politics and ethics) • Anton van Leeuwenhoek (invented the microscope) • The Curie Family including Marie Curie (discovered radiation and two new elements) 	<ul style="list-style-type: none"> • Alexander Graham Bell (invented the telephone) • Copernicus (had new sun-centred idea about the solar system) • Galileo Galilei ('Father of modern science', provided scientific support for Copernicus's theory) • Caroline Herschel (German-British astronomer, discovered several comets, worked with brother <ul style="list-style-type: none"> ○ William) ○ Isaac Newton (English physicist, mathematician, astronomer, natural philosopher and alchemist)
Yr 5/6	Autumn 1 Physics/ Physics	Light (Y6)	ASTRONOMY - "Orbits" booklet "Principles of Physics" booklet NC Earth and space Y5 Introduced in 1/2 Built on in KS3 – Space Physics <ul style="list-style-type: none"> ○ The 'Big Bang' as one theory

			<ul style="list-style-type: none"> ○ The universe: an extent almost beyond imagining ○ Galaxies: Milky Way and Andromeda ○ Our solar system <ul style="list-style-type: none"> ○ Sun: source of energy (heat and light) ○ The nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto ○ [Note that, in 2006, Pluto was classified as a dwarf planet] ○ Planetary motion: orbit and rotation <ul style="list-style-type: none"> ○ How day and night on Earth are caused by the Earth's rotation ○ Sunrise in the east and sunset in the west ○ How the seasons are caused by the Earth's orbit around the sun, tilt of the Earth's axis ○ Gravity, gravitational pull <ul style="list-style-type: none"> ○ Gravitational pull of the moon (and to a lesser degree, the sun) causes ocean tides on Earth ○ Gravitational pull of 'black holes' prevents light from escaping ○ Asteroids, meteors ('shooting stars'), comets, Halley's Comet ○ How an eclipse happens ○ Stars and constellations ○ Orienteering (finding your way) by using North Star, Big Dipper ○ Exploration of space <ul style="list-style-type: none"> ○ Observation through telescopes ○ Rockets and satellites: from unmanned flights ○ Apollo 11, first landing on the moon: 'One small step for a man, one giant leap for mankind' ○ Space shuttle
	<p>Autumn 2 Physics/ Physics</p>	<p>ELECTRICITY – “Energy transfers and Electrical circuits” booklet “Principles of Physics” booklet</p>	<p>SIMPLE MACHINES - “Force and Motion” booklet <i>NC Forces Y5</i> “Principles of Physics” booklet</p>

	<p>NC Electricity Y6 Built on in KS3 – Static & current</p> <p>Teachers: Through reading and observation, and experiment, examine the following:</p> <ul style="list-style-type: none"> ○ Electricity as the charge of electrons ○ Static electricity ○ Electric current ○ Electric circuits, and experiments with simple circuits (battery, wire, light bulb, filament, switch, fuse) <ul style="list-style-type: none"> ○ Closed circuit, open circuit, short circuit ○ Conductors and insulators ○ Electromagnets: how they work and common uses ○ Using electricity safely 	<p>Built on in KS3 – Forces</p> <p>Teachers: Examine with children how specific tools are made to perform specific jobs- for example, hammers, screwdrivers, pliers, etc. Through observation and experimentation, examine with children how simple machines help make work easier, and how they are applied and combined in familiar tools and machines.</p> <p>A. SIMPLE MACHINES</p> <ul style="list-style-type: none"> ○ Lever ○ Pulley ○ Wheel and axle <ul style="list-style-type: none"> ○ Gears: wheels with teeth and notches ○ How gears work and familiar uses (for example, in bicycles) ○ Inclined plane ○ Wedge ○ Screw <p>B. FRICTION, AND WAYS TO REDUCE FRICTION (LUBRICANTS, ROLLERS, ETC.)</p> <ul style="list-style-type: none"> • comparing how materials move on different surfaces. • explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • identify the effects of air resistance, water resistance and friction, that act between moving surfaces • investigate the effect of lubricants, rollers
<p>Spring 1 Biology/Chemistry</p>	<p>CLASSIFYING LIVING THINGS - “Classification” booklet “Principles of Biology” booklet NC Living things Y6</p> <p>Teachers: As the children study animal classifications, discuss: why do we classify? How does classification help us understand the natural world?</p>	<p>CHEMISTRY: BASIC TERMS AND CONCEPTS - “Changing Substances” booklet “Principles of Chemistry” booklet NC Changes of materials Y5 Link to Matter 1/2 /States of Mater 3/4 Built on in KS3 – Atoms, Elements & Compounds</p> <p>A. ATOMS</p> <ul style="list-style-type: none"> ○ All matter is made up of particles too small for the eye to see, called atoms

- Scientists have divided living things into five large groups called kingdoms, as follows:
 - Plant
 - Animal
 - Fungus (Mushrooms, yeast, mould, mildew)
 - Protist (algae, protozoans, amoeba, euglena)
 - Prokaryote (blue-green algae, bacteria)
- Each Kingdom is divided into smaller groupings as follows:
 - Kingdom
 - Phylum
 - Class
 - Order
 - Family
 - Genus
 - Species
 - Variety
- When classifying living things, scientists use special names made up of Latin words (or words made to sound like Latin words), which help scientists around the world understand each other and ensure that they are using the same names for the same living things
 - Homo Sapiens: the scientific name for the species to which human beings belong to (genus: Homo, species: Sapiens)
 - Taxonomists: biologists who specialise in classification
- Different classes of vertebrates and major characteristics: fish, amphibians, reptiles, birds, mammals (review from Year 4)

CELLS: STRUCTURES AND PROCESSES (Builds on year 3/4 The Human Body Cycle A)

Built on in KS3 – Cells & organisation

- All living things are made up of cells
- Structure of cells (both plant and animal)

- Scientists have developed models of atoms; while these models have changed over time as scientists make new discoveries, the models help us imagine what we cannot see.
- Atoms are made up of even tinier particles: protons, neutrons, electrons.
- The concept of electrical charge
 - Positive charge (+): proton
 - Negative charge (-): electron
 - Neutral (neither positive or negative): neutron
 - ‘Unlike charges attract, like charges repel’ (relate to magnetic attraction and repulsion).

B. PROPERTIES OF MATTER

- Mass: the amount of matter in an object, similar to weight
- Volume: the amount of space a thing fills
- Density: how much matter is packed into the space an object fills
- Vacuum: the absence of matter

C. ELEMENTS

- Elements are the basic kinds of matter, of which there are a little more than one hundred.
 - There are many different kinds of atoms, but an element has only one kind of atom. o Familiar elements, such as gold, copper, aluminium, oxygen, iron
 - Most things are made up of a combination of elements.

D. SOLUTIONS

- A solution is formed when a substance (the solute) is dissolved in another substance (the solvent), such as when sugar or salt is dissolved in water; the

- Cell membrane: selectively allows substances in and out
- Nucleus: surrounded by nuclear membrane, contains genetic material, divides for reproduction
- Cytoplasm contains organelles, small structure that carry out the chemical activities of the cell, including mitochondria (which produce the cell's energy) and vacuoles (which store
 - food, water, or wastes)
- Plant cells, unlike animal cells, have cell walls and chloroplasts.
- Cells without nuclei: monerans (bacteria)
- Some organisms consist of only a single cell: for example, amoeba, protozoans, some algae.
- Cells are shaped differently in order to perform different functions.
- Organisation of cells into tissues, organs, and systems:
 - In complex organisms, groups of cells form tissues (for example: in animals, skin tissue or muscle tissue; in plants, the skin of an onion or the bark of a tree).
 - Tissues with similar functions form organs (for example: in some animals, the heart, stomach, or brain; in some plants, the root or flower).

In complex organisms, organs work together in a system (recall, for example, from earlier studies of the human body, the digestive, circulatory, and respiratory systems).

TAXONOMIES

Teachers: Introduce an example of how an animal is classified, in order for students to become familiar with

- dissolved substance is present in the solution even though you cannot see it.
- Concentration and saturation (as demonstrated through simple experiments with crystallisation)

		<p>the system of classification, not to memorise specific names. For example, a collie dog is classified as follows:</p> <ul style="list-style-type: none"> ○ Kingdom: Animalia ○ Phylum: Chordata (Subphylum: Vertebrata) ○ Class: Mammalia (mammal) ○ Order: Carnivora (eats meat) ○ Family: Canidae (a group with doglike characteristics) ○ Genus: Canis (a coyote, wolf, or dog) ○ Species: Familiaris (a domestic dog) ○ Variety: Collie (a breed of dog) 	
	<p>Spring 2 Biology/Chemistry</p>	<p>EVOLUTION - “Rocks and Fossils” booklet “Principles of Biology” booklet NC Evolution and inheritance Y6 Built on in KS3 – Genetics & evolution</p> <ul style="list-style-type: none"> ○ Animals have offspring that are of the same kind but often offspring have different appearances ○ Animals and plants have adapted to suit the environment within which they live ○ Adaptation may lead to evolution: Darwin’s finches 	<p><i>Continued from above</i></p> <p>CHEMISTRY: MATTER AND CHANGE “Principles of Chemistry” booklet A. ATOMS, MOLECULES, AND COMPOUNDS</p> <ul style="list-style-type: none"> ○ Basics of atomic structure: nucleus, protons (positive charge), neutrons (neutral), electrons (negative charge) ○ Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels). ○ Atoms may join together to form molecules or compounds. ○ Common compounds and their formulas: <ul style="list-style-type: none"> ○ Water H₂O ○ Salt NaCl ○ Carbon Dioxide CO₂ ○ <p>B. ELEMENTS</p> <ul style="list-style-type: none"> ○ Elements have atoms of only one kind, having the same number of protons. There are a little more than 100 different elements. ○ The periodic table: organises elements with common properties <ul style="list-style-type: none"> ○ Atomic symbol and atomic number

			<ul style="list-style-type: none"> ○ Some well-known elements and their symbols <ul style="list-style-type: none"> ○ Hydrogen H ○ Helium He ○ Carbon C ○ Nitrogen N ○ Oxygen O ○ Sodium Na ○ Aluminium Al ○ Silicon Si ○ Chlorine Cl ○ Iron Fe ○ Copper Cu ○ Silver Ag ○ Gold Au ○ Two important categories of elements: metals and non-metals <ul style="list-style-type: none"> ○ Metals comprise about 2/3 of the known elements ○ Properties of metals: most are shiny, ductile, malleable, conductive <p>C. CHEMICAL AND PHYSICAL CHANGE</p> <ul style="list-style-type: none"> ○ Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour ○ Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water
<p>Summer 1 Biology/Biology</p>		<p>THE HUMAN BODY: CIRCULATORY AND RESPIRATORY SYSTEMS (Builds on year 3/4 The Human Body Cycle A) "Principles of Biology" booklet NC Animals including humans Y6</p> <p>A. THE CIRCULATORY SYSTEM</p>	<p>LIFE CYCLES AND REPRODUCTION - "Life Cycles" booklet "Principles of Biology" booklet NC Living things Y5 Built on in KS3 – Reproduction</p> <p>A. THE LIFE CYCLE AND REPRODUCTION</p>

- Pioneering work of William Harvey
- Heart: four chambers (atrium/atria or atriums [plural] and ventricle/ventricles), aorta
- Blood
 - Red blood cells, white blood cells, platelets, haemoglobin, plasma, antibodies
 - Blood vessels: arteries, veins, capillaries
 - Blood pressure, pulse
- Filtering function of liver and spleen
- Fatty deposits can clog blood vessels and cause a heart attack.
- Blood types (four basic types: A, B, AB, O) and transfusions

B. THE RESPIRATORY SYSTEM

Built on in KS3 – Gas exchange systems

- Process of taking in oxygen and getting rid of carbon dioxide
- Nose, throat, voice box, trachea (windpipe)
- Lungs, bronchi, bronchial tubes, diaphragm, ribs, alveoli (air sacs)
- Smoking: damage to lung tissue, lung cancer

- Life cycle: development of an organism from birth to growth, reproduction, death
 - Example: Growth stages of a human: embryo, foetus, newborn, infancy, childhood, adolescence, adulthood, old age
- All living things reproduce themselves. Reproduction may be asexual or sexual.
 - Examples of asexual reproduction: fission (splitting) of bacteria, spores from mildews, moulds, and mushrooms, budding of yeast cells, regeneration and cloning
 - Sexual reproduction requires the joining of special male and female cells, called gametes, to form a fertilised egg.

B. SEXUAL REPRODUCTION IN ANIMALS

- Reproductive organs: testes (sperm) and ovaries (eggs) SRE
- External fertilisation: spawning
- Internal fertilisation: birds, mammals
- Development of the embryo: egg, zygote, embryo, growth in uterus, foetus, newborn

C. REPRODUCTION IN PLANTS

- Asexual reproduction
 - Example of algae
 - Vegetative reproduction: runners (for example: strawberries) and bulbs (for example: onions), growing plants from eyes, buds, leaves, roots, and stems
- Sexual reproduction by spore bearing plants (for example: mosses and ferns)
- Sexual reproduction of non-flowering seed plants: conifers (for example: pines), male and female
 - cones, wind pollination
- Sexual reproduction of flowering plants (for example: peas)

			<ul style="list-style-type: none"> ○ Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule) ○ Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilisation, growth of ovary, mature fruit ○ Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example: corn) and dicots (for example: beans)
	<p>Summer 2 Biology/Biology</p>	<p>THE HUMAN BODY: HORMONES AND REPRODUCTION "Principles of Biology" booklet <i>NC Animals including humans Y6</i> Link to Year 3/4 The Human Body</p> <p><i>A&B Covered following SRE curriculum.</i></p> <p>A. HUMAN GROWTH STAGES Built on in KS3 – Reproduction</p> <ul style="list-style-type: none"> ○ Puberty ● Glands and hormones (see below, Endocrine System), growth spurt, hair growth, breasts, voice change <p>B. THE REPRODUCTIVE SYSTEM</p> <ul style="list-style-type: none"> ○ Females: ovaries, fallopian tubes, uterus, vagina, menstruation ○ Males: testes, scrotum, penis, urethra, semen ○ Sexual reproduction: intercourse, fertilisation, zygote, implantation of zygote in the uterus, pregnancy, embryo, foetus, newborn <p>C. THE ENDOCRINE SYSTEM</p> <ul style="list-style-type: none"> ○ The human body has two types of glands: duct glands (such as the salivary glands), and ductless glands, also known as the endocrine glands. 	<p>Continued from above</p>

		<ul style="list-style-type: none"> ○ Endocrine glands secrete (give off) chemicals called hormones. Different hormones control different body processes. ○ Pituitary gland: located at the bottom of the brain; secretes hormones that control other glands, and hormones that regulate growth ○ Thyroid gland: located below the voice box; secretes a hormone that controls the rate at which the body burns and uses food ○ Pancreas: both a duct and a ductless gland; secretes a hormone called insulin that regulates how the body uses and stores sugar; when the pancreas does not produce enough insulin, a person has a sickness called diabetes (which can be controlled). ● Adrenal glands: secrete a hormone called adrenaline, especially when a person is frightened or angry, causing rapid heartbeat and breathing. 	
	<p>Year 5/6 Disciplinary knowledge (specified in the working scientifically section of the curriculum)</p>	<p><i>Disciplinary knowledge is knowledge of how scientific enquiry generates and grows substantive knowledge. Pupils should not simply be expected to acquire disciplinary knowledge by carrying out practicals. Pupils must carry out scientific enquiries themselves using a range of methods. This should be taught and should always take place in a substantive context (i.e. through teaching the content in the programme of study).</i></p> <ul style="list-style-type: none"> ● Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary ● taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. ● recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs ● identifying scientific evidence that has been used to support or refute ideas or arguments ● using test results to make predictions to set up further comparative and fair tests ● Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations ● Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations 	
	<p>Potentially relevant scientists and their work for Year 5/6 curriculum.</p>	<ul style="list-style-type: none"> ● Michael Faraday (chemist and physicist, developed the electric motor and electric generator) 	<ul style="list-style-type: none"> ● Tim Burners-Lee (inventor of the World Wide Web) ● Humphry Davy (chemist and inventor; discovered alkaline earth metals, chlorine and iodine) ● Dorothy Hodgkin (British chemist, confirmed the structures of penicillin and vitamin B12)

		<ul style="list-style-type: none">• Elizabeth Garrett Anderson (English physician and feminist, first Englishwoman physician and surgeon)• Florence Nightingale (pioneering woman nurse during the Crimean War who later established the Nightingale Training School for nurses at St Thomas' Hospital in London)• Charles Drew (American doctor and medical researcher)• Charles Darwin (English naturalist known for his theory of evolution called Natural Selection)• Mary Anning (She is credited with finding the first specimen of Ichthyosaur.)	<ul style="list-style-type: none">• Carl Linnaeus (botanist and 'Father of taxonomy' who standardised the classification system)
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