

Substantive and disciplinary knowledge

Science curriculum Springfield Academy

Biology – Plants

EYFS

KS1 Cycle A

LKS2 Cycle B

Core substantive knowledge

To know vocabulary linked to plants such as leaf, flower, stem.
To know that plants grow from a seed to plant.

To know and name ferns, roses, daffodils, dandelions, nettles, conifers, oak trees and horse chestnut trees.
To know the root, stem, flower, petal of a flowering plant and the trunk and branch of a tree.
To know that conifers produce pinecones and horse chestnuts produce chestnuts and oaks produce acorns
To know what a plant lifecycle is and show seed/ bulb/ cone, root and shoot, leaf, flower. Blossom.
To know that plants need light, heat, water and nutrients to grow.

To know that roots anchor, stem/ trunks support and transport water, leaves photosynthesise and produce food, flowers produce seeds to make new plants.
To know that water is transported from root to leaf through the stem/ trunk using capillary action.
To know that pollination is when the seed is produced in a flower. It can be done by the wind or an insect.
To know that seeds must disperse to have a good chance of survival.
To know that the stamen produces the pollen, and the carpel produces the seed

Disciplinary knowledge

Be curious and make comments and ask questions.
Use their senses to recognise the world around them.

Be curious and ask simple questions begin to understand that these can be answered in different ways.
Begin to use simple equipment to observe scientific processes.
To begin to discuss my ideas
Using their observations and ideas to suggest answers
To observe and identify, classify, compare.
Ask simple questions and recognise that they can be answered in different ways.
Closely observe using relevant, simple equipment.
I can observe and record the growth of a variety of plants as they change over time from a seed or bulb.
I can observe closely, using magnifying glasses, to compare and contrast familiar plants.
I can identify and group plants.
I can set up a comparative test to show that plants need light and water to stay healthy.
I can draw diagrams to show the parts of different plants including trees.

To experience different types of scientific enquiry
To experience comparative and fair testing.
Use straightforward scientific evidence to answer questions
I can observe how water is transported in plants.
I can set up a simple fair test to investigate the effect the amount of light has on plant growth.



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Vocabulary

Plants, flowers, grow
Leaf, stem, Seed, Plant

Trunk, petal, branch oak, Deciduous, evergreen Rose, daisy, fern, daffodil,
conifer, dandelion, chestnut, acorn
Blossom, seed, pinecone, bulb, soil, nutrients, root,
Growth

Photosynthesis, pollen, pollination, dispersal
Reproduce, germination, carpel, stamen, capillary
action.

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Biology - Animals including humans					
EYFS	KS1 Cycle A	KS1 Cycle B	LKS2 Cycle A	LKS2 Cycle B	UKS2 Cycle B
Core substantive knowledge					
<p>To know that my heart beats faster after I exercise.</p> <p>To know that germs can spread if my hands are not clean.</p> <p>To know that I can see, hear and smell.</p>	<p>To know that parts of the body link to their senses.</p> <p>Know why it is important to exercise and eat healthily.</p> <p>To know that animals, including humans need water, nutrition, shelter and oxygen for survival.</p>	<p>To know animals including humans, reproduce and have offspring.</p> <p>Know that a balanced diet includes carbohydrates, protein, vitamins and fat.</p> <p>To know and name animals into fish, amphibians, reptiles, birds and mammals and know why they are different.</p> <p>To know what a carnivore, herbivore and omnivore eats.</p>	<p>To know how to construct and interpret a variety of food chains identifying the producers, predators and prey.</p>	<p>Know that food is chewed, passed through the oesophagus, digested by the liver and pancreas in the stomach and travels through the small and large intestine to the bowel.</p> <p>To know what molars, canines and incisors are and explain their uses.</p> <p>Know the main food groups and the amount needed of each for a healthy diet.</p> <p>To know what a skeleton does and the different types of skeletons.</p> <p>Know that muscles help us move our skeletons.</p>	<p>To know how exercise, diet and drugs can affect the body in different ways.</p> <p>To know how to label the heart, veins and arteries. Describe the function of the heart and lungs to pump oxygenated blood around the body through blood vessels.</p> <p>To know that nutrients and water are transported through the blood stream in humans and animals.</p> <p>Know that plants move water and nutrients using capillary action. To know the changes as humans, develop from birth to old age.</p> <p>To know the life cycle of humans and other animals from gestation to embryo to young, adult through to old age.</p>
Disciplinary knowledge					

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<p>Be curious and make comments and ask questions Use their senses to recognise the world around them.</p>	<p>To begin to discuss my ideas I can ask questions about what things animals need for survival. I can ask questions about what humans need to stay healthy. I can suggest ways to find the answers to my questions.</p>	<p>Using their observations and ideas to suggest answers I can group animals according to what they eat. I can use my senses to compare different textures, sounds and smells. I can ask questions about what things animals need to survive and suggest ways to find answers to my questions.</p>	<p>To experience comparative and fair testing. To experience different types of scientific enquiry</p>	<p>Record findings using simple scientific language, drawings, labelled diagrams, I can identify and group animals with and without skeletons.</p>	<p>Know a number of relevant scientific evidence's related to their scientific enquiry. Report and present findings from enquiries, including conclusions and causal relationships. Use test results to make predictions to set up further comparative and fair tests I can plan a scientific enquiry which investigates 'What happens to our heart rate when we perform different exercises?' I can record data appropriately and present results as a line graph.</p>
Vocabulary					
<p>Head, body, eyes Ears, mouth teeth leg</p>	<p>Amphibian, mammal Omnivore, carnivore Herbivore, senses Wings, claw</p>	<p>offspring nutrition reproduce carbohydrate protein vitamin</p>	<p>Skeleton, muscle Spine, joint, vertebrate invertebrate exoskeleton endoskeleton</p>	<p>digestion oesophagus pancreas, organ intestine, molars canine, incisors. producer, predator, prey</p>	<p>puberty gestation, fertilisation, reproduction, embryo teenager, hormones Stigma, ovary</p> <p>Capillary, artery Vein, ventricle Chamber, circulation Vessel, cell</p>

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Biology - Living things			
EYFS	KS1 Cycle B	LKS2 Cycle A	UKS2 Cycle B
Core substantive knowledge			
<p>To know the main similarities and differences between themselves and others.</p> <p>To know where animals live in their environment, in woodland, ponds or soil.</p>	<p>To know that some things are living, dead and things that have never been alive To know how a polar bear, African elephant, frog, shark, ant, beetle have adapted to their environment.</p> <p>To know how a cactus, water lily, and mangrove tree have adapted to suit their environment.</p> <p>To know how to construct a simple food chain To know that indigenous means to occur naturally in an area. To identify and name a variety of plants and animals in their habitats, including microhabitats.</p>	<p>To know how to classify invertebrates into arthropod's (jointed limbs) and non - arthropods.</p> <p>To know how to create classification keys of living things in their local environment.</p> <p>To know the impact of plastic pollution on ocean life, deforestation on forest dwellers and industrial waste in rivers.</p>	<p>To know that mammals give birth to live young. To know that amphibians lay eggs in water, an insect goes from egg, larva pupa adult. Know that the pupa stage in certain insects is when they go through metamorphosis.</p> <p>To know that plants can be pollinated by wind, water, insects such as beetles or bees.</p> <p>To know the reproductive cycle of a flowering plant, and a fern.</p> <p>To know how to create classify living things into broad groups including micro - organisms, plants and animals.</p> <p>To know how to give reasons for classifying plants and animals based on specific characteristics To know that microorganisms can also be divided into a number of specific groups.</p>
Disciplinary knowledge			
<p>Be curious and make comments and ask questions To know some similarities and differences</p>	<p>To record and communicate their findings in a range of ways. Ask simple questions and recognise that they can be answered in different ways. I can classify things according to whether they are living, dead or were never alive and record my findings using charts.</p>	<p>To set up simple practical enquiries. Ask relevant questions and use different types of scientific enquiries to answer them.</p>	<p>Report and present findings from enquiries, including conclusions and causal relationships. Know a number of relevant scientific evidence related to their scientific enquiry. Record data and results of increasing complexity using scientific diagrams. I can grow new plants from different parts of the parent plant (e.g. seeds, stem and root cuttings, tubers, bulbs). I can use classification systems and keys to identify animals/plants in the immediate environment.</p>

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Vocabulary

Pond, river, woodland,	Habitat, micro habitat Rainforest, mangrove tree, Venus fly trap, desert, species, pond indigenous	classification arthropod amphibian deforestation industrial waste pollution	reproduction naturalist pollination fertilise metamorphosis	Species, dichotomous key, fungi, bacteria algae organism virus organism micro-organism
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Biology – Seasonal Change. Rocks and Soils. Evolution and Inheritance

Core knowledge

EYFS	KS1 Cycle B		LKS2 Cycle A		UKS2 Cycle B
Seasonal change		Previous knowledge	Rocks and soils	Previous knowledge	Evolution and inheritance
<p>To show concern and care for the environment.</p> <p>To notice changes and differences in the environment.</p> <p>To develop an understanding of decay and changing over time.</p>	<p>To know the changes across the four seasons in the temperature, animal activity and plant lifecycle.</p> <p>To describe weather associated with the seasons.</p> <p>To observe how day length changes.</p>	<p>Know that rocks are materials that are hard.</p> <p>Know that soil is used to grow plants.</p>	<p>To investigate different kinds of rocks on the basis of their appearance and simple physical properties.</p> <p>To sort different types of rocks compared to how they are formed including sedimentary, igneous and metamorphic.</p> <p>To explain how fossils are formed.</p> <p>To explain that soils are made from rocks and organic matter.</p>	<p>Know about human and animal lifecycles</p> <p>Know how animals adapt to their habitats</p>	<p>To explain that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.</p> <p>To identify how animals and plants are adapted to suit their environment and that adaptation may lead to evolution.</p> <p>To know that living things have changed over time and fossils provide a record.</p>

Disciplinary knowledge

<p>Be curious and make comments and ask questions</p> <p>Talk about changes and why things occur.</p>	<p>To say what surprised me and what I observed.</p> <p>To gather and record data</p> <p>I can observe the changes in the weather.</p> <p>I can observe the changes in the seasons.</p>		<p>Gather, record, classify and present data in a variety of ways</p> <p>I can use a hand lens or microscope to help identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them.</p> <p>I can investigate what happens when rocks are rubbed together or what changes occur when they are in water.</p>		<p>Identify scientific evidence used to support or refute ideas or arguments.</p>
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	I can make a table/chart about the weather.				
Vocabulary					
Snow wind sun rain decay leaves	Autumn, winter Spring, summer Direction, heat Measure symbol shadow		Sedimentary, metamorphic igneous, crystals, fossil permeable, impermeable		Adaptation evolution Inheritance palaeontologist genotype

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Physics – materials and their properties – states of matter

Core substantive knowledge

EYFS	KS1 Cycle B		LKS2 Cycle B	UKS2 Cycle A
<p>To know and use a range of technological toys</p> <p>To know why things happen and how things work.</p> <p>To know and notice changes in properties as they are transformed through becoming wet, dry, flaky or fixed.</p>	<p>To know that spoons can be made from a variety of materials.</p> <p>To know that wood, plastic, glass, metal, water, and rock are materials.</p> <p>To know that plastic is flexible, glass is transparent, metal is smooth and rock is hard.</p> <p>To know that everyday materials can be compared based on whether they are stiff, flexible, transparent or hard.</p> <p>To know the best materials for specific parts of our classroom including the windows, doors, walls, rulers, scissors.</p> <p>To know the four ways of changing the shape of a solid object.</p>	<p>Previous knowledge</p> <p>Know and experience solids, liquids and gases in everyday life.</p> <p>Observed a boiling kettle or pan producing steam.</p> <p>Know the main parts of the water cycle</p>	<p>States of matter</p> <p>To know that materials are solids, liquids or gases</p> <p>Know that some materials change state when they are heated or cooled and know the temperature at which this happens.</p> <p>Know what evaporation and condensation is and its part in the water cycle.</p> <p>Know how the rate of evaporation and temperature link.</p>	<p>Properties and changes of materials</p> <p>To know how to use experiments to test an objects solubility, transparency, conductivity and response to magnets.</p> <p>To know that solutions can be made from water (solvent) and salt or sugar (solute) and use heat to retrieve the salt and sugar.</p> <p>To know that you can separate mixtures of sand/ mud and water through filtering, sand and rice through sieving and solutions through evaporating.</p> <p>To know that mixtures and solutions are reversible changes as well as freezing and melting.</p> <p>To know that irreversible changes form a new material such as wood to charcoal and bread to toast.</p>

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Disciplinary knowledge

<p>Be curious and make comments and ask questions To find ways to solve problems. To explain and or record their answers</p> <p>Talk about changes and why things occur.</p>	<p>To compare objects, materials and living things Be curious and ask simple questions related to their science area of study.</p> <p>Using their observations and ideas to suggest answers To begin to use prior understanding to predict the outcomes. Closely observe using relevant, simple equipment. I can observe closely, using simple equipment. I can perform simple tests to answer questions (What is the best material for a raincoat for teddy?) I can identify and classify the uses of different materials.</p>	<p>Identify differences, similarities or changes related to simple scientific ideas and processes. Make systematic and careful observations and take accurate measurements using standard units To set up simple practical enquiries, comparative and fair tests</p>	<p>Set up a series of comparative or fair tests. Begin to plan scientific enquiries that involve a number of variables. Record data and results of increasing complexity. Experience using a range of scientific equipment and taking a number of readings I can carry out tests to answer questions (e.g. 'Which materials would be best for making blackout curtains?')</p>
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Vocabulary

<p>Wet, dry, shiny, dull, bendy, stiff, squashy, hard/soft, lumpy, wrinkly. Smooth, rough, push, pull, twist, stretch, turn, open, lift, squeeze, pinch, flick, tap</p>	<p>Plastic, stretch Stiff, metal, liquid Solid, transparent</p>	<p>Stretching, squashing Bending, twisting John Dunlop Charles Macintosh</p>	<p>Condensation, evaporation, boiling point, water vapour, precipitation</p>	<p>Dissolve, solubility, filtering, melting, separating, thermal, solute, solution.</p>
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Physics – Light and sound – Earth and Space

Core substantive knowledge

	Previous knowledge	LKS2 Cycle B	Previous knowledge	LKS2 Cycle B		UKS2 Cycle B	UKS2 Cycle B
		Light		Sound	Previous knowledge	Earth and space	Light
	<p>Know that light comes from a range of sources (light bulb, lamp, sun, moon)</p> <p>Will know what a reflection is in a mirror/ surface of water</p> <p>Have worn sunglasses</p> <p>Will have experienced shadows of themselves</p>	<p>To show how we see using light and that darkness is the absence of light.</p> <p>To prove that light can be reflected from surfaces.</p> <p>To form shadows of different lengths by moving the angle of the torch.</p> <p>To explain the difference between convex (curves out) and concave (curves in).</p>	<p>Will know that sound travels.</p> <p>Will know that volume means louder or quieter.</p> <p>Will have heard thunder and noticed that it gets quieter as it moves away,</p>	<p>To know that sounds are caused by vibration.</p> <p>To know that vibrations can move through the air, water and other materials.</p> <p>To know that the pitch of a sound refers to the size of the vibrations.</p> <p>To know that the volume of sounds is linked to the strength of the vibrations that produced it.</p> <p>To know that sound gets fainter the further away it is.</p>	<p>Will know that the earth is a planet in our solar system</p> <p>Will have experienced the moon and other celestial bodies such as mars</p> <p>Will have seen pictures of the earth from space</p> <p>Will know that the day length changes in accordance to the season</p>	<p>To know that the Earth and other planets orbit, the Sun.</p> <p>To know that the Moon orbits the Earth</p> <p>Know that the Sun, Earth and Moon are spherical bodies</p> <p>Know that day and night are caused by the Earth's rotation, explain the apparent movement of the sun across the sky.</p>	<p>To show that light travelling is straight lines using mirrors.</p> <p>To know that we see by light reflecting into the eye.</p> <p>To know that shadows have the same shape as the object that casts them because the light travels in straight lines.</p>
Disciplinary knowledge							
		Report on findings including oral and written explanations.		Identify differences, similarities or changes related to		Know a number of relevant scientific evidence's related to	Plan different types of scientific enquiries to answer questions,

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		<p>Use straightforward scientific evidence to answer questions I can look for patterns in what happens to shadows when the distance between the light source and the object changes.</p>		<p>simple scientific ideas and processes. Make systematic and careful observations and take accurate measurements using standard units</p>		<p>their scientific enquiry. Report and present findings from enquiries, including conclusions and causal relationships. I can identify scientific evidence that has been used to support or refute ideas or arguments (when looking at geocentric and heliocentric solar systems).</p>	<p>including recognising and controlling variables. Take measurements, with increasing accuracy and precision, taking repeat readings when appropriate. I can design and make a periscope and use the idea that light travels in straight lines to explain how it works.</p>
Vocabulary							
		<p>Reflection, shadows, opaque, refraction Convex, concave</p>		<p>Pitch, volume Vibrating, frequency Hammer, sound wave</p>		<p>Satellite, orbit, axis, heliocentric,</p>	<p>Retina, cornea Iris, pupil, lens light wave</p>

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Physics – Forces and electricity					
	LKS2 Cycle A		LKS2 Cycle B	UKS2 Cycle A	UKS2 Cycle A
Core Knowledge					
Previous knowledge	Forces and magnets	Previous knowledge	Electricity	Forces	Electricity
<p>Have experienced how different materials have specific properties for making different objects</p> <p>Experienced toys that contain magnets</p>	<p>To know that different surface can affect how things move.</p> <p>To know that pushes and pulls need contact between two objects. (gravity, friction, water resistance)</p> <p>To know that magnetic forces can act at a distance.</p> <p>To know that magnets attract/repel each other, and some other materials made from iron or steel.</p> <p>To know some magnetic materials.</p> <p>To know the poles of a magnet</p> <p>I can predict whether two magnets will attract or repel each other, depending on which poles are facing.</p> <p>I can explore the everyday uses of different magnets.</p>	<p>Know that a plug socket powers everyday objects</p> <p>Have used switches in everyday life</p> <p>Will have investigated materials and their properties.</p>	<p>To know common conductors and insulators.</p> <p>To know that a circuit must be part of a complete loop with a battery to light a bulb.</p> <p>To know that a switch opens and closes a circuit.</p>	<p>To know that gravity is a downward force that moves an object towards the Earth's centre due to its mass.</p> <p>To know that air resistance, water resistance and friction slows a moving object down by acting in the opposite direction.</p> <p>To know that a levers, gears and pulleys work by minimising weight and increasing the force exerted</p> <p>I know how Galileo Galilei and Isaac Newton helped develop the theory of gravitation.</p>	<p>To know that brightness and volume link directly to the number and voltage of cells used.</p> <p>To know and recognise symbols in a simple circuit diagram</p>

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Disciplinary knowledge					
	<p>Take accurate measurements using a range of equipment. To experience different types of scientific enquiry</p>		<p>Identify differences, similarities or changes related to simple scientific ideas and processes. To set up simple practical enquiries. Draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. I can observe patterns about how the number of cells affects the brightness of a bulb.</p>	<p>Experience using a range of scientific equipment Record data and results of increasing complexity. Report and present findings from enquiries, including conclusions and causal relationships. I can design and make a variety of parachutes, carrying out fair tests to determine which designs are most effective.</p>	<p>Define the degree of trust in results, in oral and written forms such as displays and other presentations. Record data and results of increasing complexity using scientific diagrams. I can identify the effect of changing one component at a time in a circuit.</p>
Vocabulary					
	<p>Force, repel Attract, surface Pole magnetism</p>		<p>Circuit, conductor Insulator, battery Cells, appliance</p>	<p>Friction, gravity air resistance water resistance pulley, lever</p>	<p>series circuits voltage, socket generator turbine, fuses</p>

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Working scientifically - disciplinary knowledge (Core)

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Questioning	Be curious and make comments and ask questions about aspects of their familiar world (such as the place where they live) or the natural world.	Be curious and ask simple questions related to their science area of study. Begin to understand that these can be answered in different ways.	Ask simple questions related to their science teaching and recognise that they can be answered in different ways.	To experience different types of scientific enquiry	Ask relevant questions and use different types of scientific enquiries to answer them.	Begin to plan scientific enquiries that involve a number of variables.	Plan different types of scientific enquiries to answer questions, including recognising and controlling variables.
Use of equipment	Use their senses to recognise the world around them. Observe people, vehicles and animals.	Being to use simple equipment to observe scientific processes.	Closely observe in science investigations using relevant, simple equipment.	To experience comparative and fair testing,	To set up simple practical enquiries, comparative and fair tests	Set up a series of comparative or fair tests.	Use test results to make predictions to set up further comparative and fair tests
Making predictions	To find ways to solve problems, find new ways to do things or test their ideas.	To begin to discuss my ideas about how to find things out.	To begin to use prior understanding to predict the outcomes of an investigation when performing simple tests.	Use straightforward scientific evidence to answer questions or to support their findings.	Identify differences, similarities or changes related to simple scientific ideas and processes.	Know a number of relevant scientific evidence's related to their scientific enquiry.	Identify scientific evidence that has been used to support or refute ideas or arguments.
Observation and comparison	To know some similarities and differences in relation to places, objects, materials and living things	To begin to use simple features to compare objects, materials and living things and, with help, decide how to sort and group them.	To observe and identify, classify, compare and describe using simple features.	Take accurate measurements using a range of equipment including data loggers and thermometers.	Make systematic and careful observations and take accurate measurements using standard units and a range of equipment, including thermometers and data loggers	Report and present findings from enquiries, including conclusions and causal relationships.	Define the degree of trust in results, in oral and written forms such as displays and other presentations.

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Drawing conclusions	Be curious and find answers to talk about changes and why things occur.	To begin to describe an experiment and say what surprised me and what I observed.	Using their observations and ideas to suggest answers to questions	Report on findings from enquiries, including oral and written explanations, displays, or presentations of results and conclusions	Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions	Record data and results of increasing complexity	Record data and results of increasing complexity using scientific diagrams,
Data and recording	To explain and or record their answers in a range of ways.	To gather and record data to help in answering questions and display in a simple table and pictogram	To record and communicate their findings in a range of ways.	Gather, record, classify and present data in a variety of ways to help in answering questions bar charts	Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.	Experience using a range of scientific equipment and taking a number of readings to increase accuracy. Line graphs using tables, scatter graphs, bar and line graphs	Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Pie charts labels and classification keys. (dichotomous key)