Substantive and disciplinary knowledge
Science curriculum Hilltop Primary Academy

Biology – Plants						
EYFS	Year 1	Year 2	Year 3			
Core substantive knowledge						
To know vocabulary linked to plants such as leaf, flower, stem.	To know and name ferns, roses, daffodils, dandelions, nettles, conifers, oak trees and horse chestnut trees.	To know what a plant lifecycle is and show seed/ bulb/ cone, root and shoot, leaf, flower. Blossom.	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 the root, stem, flower, petal of a flowering plant and the trunk and branch of a tree.	To know that plants need light, heat, water and nutrients to grow.	To know that water is transported from root to leaf through the stem/ trunk using capillary action.			
	To know that conifers produce pinecones and horse chestnuts produce chestnuts and oaks produce acorns		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 plants grow from a seed to plant.			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. Closey observe using relevant, simple equipment.	To experience different types of scientific enquiry To experience comparative and fair testing. Use straightforward scientific evidence to answer questions			

Substantive and disciplinary knowledge
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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	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Core substantive knowledge						
To know that my heart beats faster after I exercise.	To know and name animals into fish, amphibians, reptiles, birds and mammals and know why they are different.	To know animals including humans, reproduce and have offspring.	To know what a skeleton does and the different types of skeletons.	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.	To know the changes as humans, develop from birth to old age.	To know how exercise, diet and drugs can affect the body in different ways.
To know that germs can spread if my hands are not clean.	To know what a carnivore, herbivore and omnivore eats.	To know that animals, including humans need water, nutrition, shelter and oxygen for survival.	Know that muscles help us move our skeletons.	To know what molars, canines and incisors are and explain their uses.	To know the life cycle of humans and other animals from gestation to embryo to young, adult through to old age.	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.
To know that I can see, hear and smell.	To know that parts of the body link to their senses,	Know that a balanced diet includes carbohydrates, protein, vitamins and fat.	Know the main food groups and the amount needed of each for a healthy diet.	To know how to construct and interpret a variety of food chains identifying the producers, predators and prey.	To know the life cycle of plants including fertilisation from pollen in the stigma to create a seed in the ovary.	To know that nutrients and water are transported through the blood stream in humans and animals.
		Know why it is important to exercise and eat healthily.				Know that plants move water and nutrients using capillary action.

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Disciplinary knowledge						
Be curious and make comments and ask questions **Use their senses to recognise the world around them.**	**To begin to discuss my ideas**	**Using their observations and ideas to suggest answers**	**To experience comparative and fair testing.** **To experience different types of scientific enquiry**	**Record findings using simple scientific language, drawings, labelled diagrams,**	**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**
Vocabulary						
Head, body, eyes Ears, mouth teeth leg	Amphibian, mammal Omnivore, carnivore Herbivore, senses Wings, claw	offspring nutrition reproduce carbohydrate protein vitamin	Skeleton, muscle Spine, joint, vertebrate invertebrate exoskeleton endoskeleton	digestion oesophagus pancreas, organ intestine, molars canine, incisors. producer, predator, prey	puberty gestation, fertilisation, reproduction, embryo teenager, hormones Stigma, ovary	Capillary, artery Vein, ventricle Chamber, circulation Vessel, cell

Substantive and disciplinary knowledge
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Biology - Living things						
EYFS		Year 2		Year 4	Year 5	Year 6
Core substantive knowledge						
To know the main similarities and differences between themselves and others.		To know that some things are living, dead and things that have never been alive		To know how to classify invertebrates into arthropod's (jointed limbs) and non -arthropods.	To know that mammals give birth to live young.	To know how to create classify living things into broad groups including micro - organisms, plants and animals.
To know where animas live in their environment, in woodland, ponds or soil.		To know how a polar bear, Fox, frog, ant, beetle have adapted to their environment.		To know how to create classification keys of living things in their local environment.	To know that amphibians lay eggs in water, an insect goes from egg, larva pupa adult.	To know how to give reasons for classifying plants and animals based on specific characteristics
		To know how a cactus, water lily, and mangrove tree have adapted to suit their environment.		To know the impact of plastic pollution on ocean life, deforestation on forest dwellers and industrial waste in rivers.	Know that the pupa stage in certain insects is when they go through metamorphosis.	To know that microorganisms can also be divided into a number of specific groups.
		To know how to construct a simple food chain			To know that plants can be pollinated by wind, water, insects such as beetles or bees.	
		To know that indigenous means to occur naturally in an area.			To know the reproductive cycle of a flowering plant, and a fern.	
Disciplinary knowledge						
Be curious and make comments and ask questions To know some similarities and differences		To record and communicate their findings in a range of ways. Ask simple questions and recognise that they can be answered in different ways.		To set up simple practical enquiries. Ask relevant questions and use different types of scientific enquiries to answer them.	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.

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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

Substantive and disciplinary knowledge
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Biology – Seasonal Change. Rocks and Soils. Evolution and Inheritance

Core knowledge

EYFS	Year 1		Year 3			Year 6
Seasonal change		Previous knowledge	**Rocks and soils**		Previous knowledge	**Evolution and inheritance**
To show concern and care for the environment.	**To know the changes across the four seasons in the temperature, animal activity and plant lifecycle.**	Know that rocks are materials that are hard.	**To investigate different kinds of rocks on the basis of their appearance and simple physical properties.**		Know about human and animal lifecycles	**To explain that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.**
To notice changes and differences in the environment.	**To describe weather associated with the seasons.**	Know that soil is used to grow plants.	**To sort different types of rocks compared to how they are formed including sedimentary, igneous and metamorphic.**		Know how animals adapt to their habitats	**To identify how animals and plants are adapted to suit their environment and that adaptation may lead to evolution.**
To develop an understanding of decay and changing over time.	**To observe how day length changes.**		**To explain how fossils are formed.**			**To know that living things have changed over time and fossils provide a record.**
			To explain that soils are made from rocks and organic matter.			

Disciplinary knowledge

Be curious and make comments and ask questions **Talk about changes and why things occur.**	**To say what surprised me and what I observed.** To gather and record data		Gather, record, classify and present data in a variety of ways			Identify scientific evidence used to support or refute ideas or arguments.

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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

Substantive and disciplinary knowledge
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Physics – materials and their properties – states of matter

Core substantive knowledge

EYFS	Year 1	Year 2		Year 4	Year 5	
				States of matter	Changes in materials	
To know and use a range of technological toys	To know that spoons can be made from a variety of materials.	To know the best materials for specific parts of our classroom including the windows, doors, walls, rulers, scissors.		To know that materials are solids, liquids or gases	To know how to experiments to test an objects solubility, transparency, conductivity and response to magnets.	
To know why things happen and how things work.	To know that wood, plastic, glass, metal, water, and rock are materials.	To know the four ways of changing the shape of a solid object.		Know that some materials change state when they are heated or cooled and know the temperature at which this happens.	To know that solutions from water and salt or sugar and use heat to retrieve the salt and sugar.	
To know and notice changes in properties as they are transformed through becoming wet, dry, flaky or fixed.	To know that plastic is flexible, glass is transparent, metal is smooth and rock is hard.			Know what evaporation and condensation is and its part in the water cycle.	To know that you can separate mixtures of sand/ mud and water through filtering, sand and rice through sieving and solutions through evaporating.	
	To know that everyday materials can be compared based on whether they are stiff, flexible, transparent or hard.			Know how the rate of evaporation and temperature link.	To know that mixtures and solutions are reversible changes as well as freezing and melting.	
					To know that irreversible changes form a new material such as wood to charcoal and bread to toast.	

Disciplinary knowledge

Be curious and make comments and ask questions	To compare objects, materials and living things	Using their observations and ideas to suggest answers		Identify differences, similarities or changes related to simple scientific ideas and processes.	Set up a series of comparative or fair tests.	

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To find ways to solve problems. To explain and or record their answers Talk about changes and why things occur.	Be curious and ask simple questions related to their science area of study.	To begin to use prior understanding to predict the outcomes. Closey observe using relevant, simple equipment.		Make systematic and careful observations and take accurate measurements using standard units To set up simple practical enquiries, comparative and 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	
Vocabulary						
Wet, dry, shiny, dull, bendy, stiff, squashy, hard/soft, lumpy, wrinkly. Smooth, rough, push, pull, twist, stretch, turn, open, lift, squeeze, pinch, flick, tap	Plastic, stretch Stiff, metal, liquid Solid, transparent	Stretching, squashing Bending, twisting John Dunlop Charles Macintosh		Condensation, evaporation, boiling point, water vapour, precipitation	Dissolve, solubility, filtering, melting, separating, thermal	

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Physics – Light and sound – Earth and Space							
Core substantive knowledge							
		Year 3		Year 4		Year 5	Year 6
	Previous knowledge	Light	Previous knowledge	Sound	Previous knowledge	Earth and space	Light
	Know that light comes from a range of sources (light bulb, lamp, sun, moon)	**To show how we see using light and that darkness is the absence of light.**	Will know that sound travels.	**To know that sounds are caused by vibration.**	Will know that the earth is a planet in our solar system	**To know that the Earth and other planets orbit, the Sun.**	**To show that light travelling is straight lines using mirrors.**
	Will know what a reflection is in a mirror/ surface of water	**To prove that light can be reflected from surfaces.**	Will know that volume means louder or quieter.	**To know that vibrations can move through the air, water and other materials.**	Will have experienced the moon and other celestial bodies such as mars	**To know that the Moon orbits the Earth**	**To know that we see by light reflecting into the eye.**
	Have worn sunglasses	**To form shadows of different lengths by moving the angle of the torch.**	Will have heard thunder and noticed that it gets quieter as it moves away,	**To know that the pitch of a sound refers to the size of the vibrations.**	Will have seen pictures of the earth from space	**Know that the Sun, Earth and Moon are spherical bodies**	**To know that shadows have the same shape as the object that casts them because the light travels in straight lines.**
	Will have experienced shadows of themselves	**To explain the difference between convex (curves out) and concave (curves in)**		**To know that the volume of sounds is linked to the strength of the vibrations that produced it.**	Will know that the day length changes in accordance to the season	**Know that day and night are caused by the Earth's rotation, explain the apparent movement of the sun across the sky.**	
				To know that sound gets fainter the further away it is.			

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Disciplinary knowledge							
		Report on findings including oral and written explanations. **Use straightforward scientific evidence to answer questions**		**Identify differences, similarities or changes related to simple scientific ideas and processes.** **Make systematic and careful observations and take accurate measurements using standard units**		**Know a number of relevant scientific evidence's related to their scientific enquiry.** **Report and present findings from enquiries, including conclusions and causal relationships.**	**Plan different types of scientific enquiries to answer questions, including recognising and controlling variables.** **Take measurements, with increasing accuracy and precision, taking repeat readings when appropriate.**
Vocabulary							
		Reflection, shadows, opaque, refraction Convex, concave		Pitch, volume Vibrating, frequency Hammer, sound wave		Satellite, orbit, axis, heliocentric,	Retina, cornea Iris, pupil, lens light wave

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Physics – Forces and electricity					
	Year 3		Year 4	Year 5	Year 6
Core Knowledge					
Previous knowledge	Forces and magnets	Previous knowledge	Electricity	Forces	Electricity
Have experienced how different materials have specific properties for making different objects	**To know that different surface can affect how things move.**	Know that a plug socket powers everyday objects	**To know common conductors and insulators.**	**To know that gravity is a downward force that moves an object towards the Earth's centre due to its mass.**	**To know that brightness and volume link directly to the number and voltage of cells used.**
Experienced toys that contain magnets	**To know that pushes and pulls need contact between two objects. (gravity, friction, water resistance)**	Have used switches in everyday life	**To know that a circuit must be part of a complete loop with a battery to light a bulb.**	**To know that air resistance, water resistance and friction slows a moving object down by acting in the opposite direction.**	**To know and recognise symbols in a simple circuit diagram**
	To know that magnetic forces can act at a distance.				
	To know that magnets attract/repel each other, and some other materials made from iron or steel.	Will have investigated materials and their properties.	**To know that a switch opens and closes a circuit.**	**To know that a levers, gears and pulleys work by minimising weight and increasing the force exerted**	
	To know some magnetic materials.				
	To know the poles of a magnet				
Disciplinary knowledge					
	Take accurate measurements using a range of equipment.		**Identify differences, similarities or changes related to simple scientific ideas and processes.**	**Experience using a range of scientific equipment** **Record data and results of increasing complexity.**	**Define the degree of trust in results, in oral and written forms such as**

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	To experience different types of scientific enquiry		**To set up simple practical enquiries.** **Draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.**	**Report and present findings from enquiries, including conclusions and causal relationships.**	**displays and other presentations.** **Record data and results of increasing complexity using scientific diagrams.**
Vocabulary					
	Force, repel Attract, surface Pole magnetism		Circuit, conductor Insulator, battery Cells, appliance	Friction, gravity air resistance water resistance pulley, lever	series circuits voltage, socket generator turbine, fuses

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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.	Closey 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)