

# Science Knowledge Progression

	Biology	Chemistry	Physics
<b>Year 5</b>	<p><u>Living things and their habitats</u></p> <p>Children can:</p> <p>Describe differences in life cycles for mammal, an amphibian, an insect and a bird;</p> <p>Describe the life process of reproduction in some plants and animals.</p> <p><u>Animals, including humans</u></p> <p>Children can:</p> <p>Describe the changes as humans develop to old age</p>	<p><u>Properties and changes of materials</u></p> <p>Children can:</p> <p>Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.</p> <p>Describe the differences between solids, liquids and gases.</p>	<p><u>Earth and space</u></p> <p>Children can:</p> <p>Describe the movement of the Earth, and other planets, relative to the Sun in the solar system.</p> <p>Describe the movement of the Moon relative to the Earth</p> <p>Describe the Sun, Earth and Moon as approximately spherical bodies</p> <p>Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.</p> <p><u>Forces</u></p> <p>Children can:</p> <p>Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.</p> <p>Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.</p> <p>Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.</p>

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<p><b>Year 6</b></p>	<p><b><u>Living things and their habitats</u></b></p> <p>Children can:</p> <p>Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals.</p> <p>Give reasons for classifying plants and animals based on specific characteristics.</p> <p><b><u>Animals, including humans</u></b></p> <p>Children can:</p> <p>Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.</p> <p>Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function</p> <p>Describe the ways in which nutrients and water are transported within animals, including humans.</p>	<p><b><u>Properties and changes of materials</u></b></p> <p>Children can:</p> <p>Use knowledge of solids, liquids and gases to decide how mixtures might be separated</p> <p>Demonstrate that dissolving, mixing and changes of state are reversible changes</p> <p>Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution</p> <p>Explain that some changes result in the formation of new materials</p>	<p><b><u>Light</u></b></p> <p>Children can:</p> <p>Recognise that light appears to travel in straight lines</p> <p>Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye</p> <p>Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes</p> <p>Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.</p> <p><b><u>Electricity</u></b></p> <p>Children can:</p> <p>Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit</p> <p>Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches</p> <p>Use recognised symbols when representing a simple circuit in a diagram.</p>
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<p><b>Year 7</b></p>	<p><b><u>Structure and function of living organisms</u></b></p> <p>Children know about:</p> <p>Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope.</p> <p>The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.</p> <p>The similarities and differences between plant and animal cells.</p> <p>The role of diffusion in the movement of materials in and between cells.</p> <p>The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms.</p> <p>The structure and functions of the human skeleton, to include support, protection, movement and making blood cells.</p> <p>Biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles</p> <p>The function of muscles and examples of antagonistic muscles.</p> <p>The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food.</p> <p>The importance of bacteria in the human digestive system.</p>	<p><b><u>The particulate nature of matter</u></b></p> <p>Children know about:</p> <p>The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure</p> <p>Changes of state in terms of the particle model.</p> <p><b><u>Atoms, elements and compounds</u></b></p> <p>Children know about:</p> <p>A simple (Dalton) atomic model</p> <p>Differences between atoms, elements and compounds</p> <p>Chemical symbols and formulae for elements and compounds</p> <p>Conservation of mass changes of state.</p> <p><b><u>Pure and impure substances</u></b></p> <p>Children know about:</p> <p>The concept of a pure substance</p> <p>Mixtures, including dissolving</p> <p>Diffusion in terms of the particle model</p> <p>Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography</p>	<p><b><u>Energy</u></b></p> <p>Children know about:</p> <p>Fuels and energy resources.</p> <p><b><u>Energy changes and transfers</u></b></p> <p>Children know about:</p> <p>Other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.</p> <p><b><u>Motion and Forces</u></b></p> <p>Children know about:</p> <p>Forces as pushes or pulls, arising from the interaction between two objects</p> <p>Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces</p> <p>Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water</p> <p>Forces measured in newtons, measurements of stretch or compression as force is changed</p> <p>Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)</p>
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# Science Knowledge Progression

<p>The structure and functions of the gas exchange system in humans, including adaptations to function</p> <p>The mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume</p> <p>The impact of exercise, asthma and smoking on the human gas exchange system.</p> <p><b><u>Genetics and evolution</u></b></p> <p>Children know about:</p> <p>Heredity as the process by which genetic information is transmitted from one generation to the next</p> <p>A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model</p> <p>Differences between species</p> <p>The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation.</p>	<p>The identification of pure substances.</p> <p><b><u>Chemical reactions</u></b></p> <p>Children know about:</p> <p>Thermal decomposition and oxidation reactions</p> <p><b><u>The Periodic Table</u></b></p> <p>Children know about:</p> <p>The properties of metals and non-metals</p>	<p>Change depending on direction of force and its size.</p> <p><b><u>Waves</u></b></p> <p>Children know about:</p> <p>Frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound</p> <p>Sound needs a medium to travel, the speed of sound in air, in water, in solids</p> <p>Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal</p> <p>Auditory range of humans and animals.</p> <p>The similarities and differences between light waves and waves in matter</p> <p>Light waves travelling through a vacuum; speed of light</p> <p>The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface</p> <p>Use of ray model to explain imaging in mirrors</p> <p>Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.</p>
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# Science Knowledge Progression

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<p><b>Year 8</b></p>	<p><b><u>Structure and function of living organisms</u></b></p> <p>Children know about:</p> <p>The structural adaptations of some unicellular organisms</p> <p>Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed</p>	<p><b><u>Atoms, elements and compounds</u></b></p> <p>Children know about:</p> <p>Conservation of mass changes of state and chemical reactions.</p> <p><b><u>Chemical reactions</u></b></p>	<p><b><u>Energy changes and transfers</u></b></p> <p>Children know about:</p> <p>Simple machines give bigger force but at the expense of smaller movement (and vice versa); product of force and displacement unchanged</p>

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<p>Calculations of energy requirements in a healthy daily diet.</p> <p>The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases</p> <p>Explain how the digestive system digests food and how enzymes are used as biological catalysts.</p> <p>Plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots.</p> <p>The role of leaf stomata in gas exchange in plants.</p> <p>Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta.</p> <p>Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.</p> <p>The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.</p> <p><b><u>Material cycles and energy</u></b></p> <p>Children know about:</p> <p>The reactants in, and products of, photosynthesis, and a word summary for photosynthesis</p>	<p>Children know about:</p> <p>Chemical reactions as the rearrangement of atoms</p> <p>Representing chemical reactions using formulae and using equations</p> <p>Combustion and displacement reactions</p> <p>Defining acids and alkalis in terms of neutralisation reactions</p> <p>The pH scale for measuring acidity/alkalinity; and indicators</p> <p>Reactions of acids with metals to produce a salt plus hydrogen</p> <p>Reactions of acids with alkalis to produce a salt plus water</p> <p><b><u>Energetics</u></b></p> <p>Children know about:</p> <p>Energy changes on changes of state (qualitative) Exothermic and endothermic chemical reactions (qualitative).</p> <p><b><u>The Periodic Table</u></b></p> <p>Children know about:</p> <p>The varying physical and chemical properties of different elements</p> <p>The principles underpinning the Mendeleev Periodic Table</p>	<p>Heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators</p> <p><b><u>Motion and forces</u></b></p> <p>Children know about:</p> <p>Speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)</p> <p>The representation of a journey on a distance-time graph</p> <p>Relative motion: trains and cars passing one another.</p> <p>Moment as the turning effect of a force</p> <p>Force-extension linear relation; Hooke's Law as a special case</p> <p>Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity.</p> <p>Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.</p> <p><b><u>Waves</u></b></p> <p>Children know about:</p>
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	<p>The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere.</p> <p>The adaptations of leaves for photosynthesis.</p> <p>Aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life</p> <p>A word summary for aerobic respiration The process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration</p> <p>The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.</p> <p><b><u>Interactions and interdependencies</u></b></p> <p>Children know about:</p> <p>The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops.</p> <p>The importance of plant reproduction through insect pollination in human food security</p> <p>How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.</p>	<p>The Periodic Table: periods and groups; metals and non-metals</p> <p>How patterns in reactions can be predicted with reference to the Periodic Table</p> <p>The chemical properties of metal and non-metal oxides with respect to acidity.</p> <p><b><u>Materials</u></b></p> <p>Children know about:</p> <p>The order of metals in the reactivity series.</p>	<p>Use of ray model to explain the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye</p> <p><b><u>Electricity and electromagnetism</u></b></p> <p>Children know about:</p> <p>Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge</p> <p>Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current</p> <p>Differences in resistance between conducting and insulating components (quantitative). Static electricity</p> <p>Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects</p> <p>The idea of electric field, forces acting across the space between objects not in contact.</p> <p>Magnetic poles, attraction and repulsion</p> <p>Magnetic fields by plotting with compass, representation by field lines</p> <p>Earth's magnetism, compass and navigation</p> <p>The magnetic effect of a current and electromagnets</p> <p><b><u>Matter</u></b></p>
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# Science Knowledge Progression

## Genetics and evolution

Children know about:

The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection.

Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction

The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.

Children know about:

The differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice-water transition

## Space physics

Children know about:

Gravity force, weight = mass x gravitational field strength (g), on Earth  $g=10 \text{ N/kg}$ , different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)