



Year 5

Working scientifically

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- 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
- using test results to make predictions to set up further comparative and fair tests as well as considering if the test completed was reliable
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments

Pupils should read, spell and pronounce scientific vocabulary correctly.

Topic and objectives	Lesson ideas	Key Words	Misconceptions
<p>Living things and their habitats</p> <p>Pupils should be taught to:</p>	<p>Study and raise questions about their local environment throughout the year. They should observe life-cycle changes in a variety of living things, for example, plants in the vegetable garden or flower border, and animals in the local environment.</p> <p>Find out about different types of reproduction, including sexual and asexual reproduction in plants, and sexual reproduction in animals.</p>	<p>life cycles mammal, amphibian, insect, bird,</p> <p>reproduction plants – sexual, asexual animals - sexual</p>	<p>Misconception: All plants reproduce from seeds. Fact: Many plants reproduce by vegetative propagation – from leaves, stems etc.</p> <p>Misconception: Propagating of fruit trees – as the tree can be propagated by plant parts, e.g. stem cutting, therefore the fruit has no seed. Fact: Fruits produced by vegetative propagation do have seeds. Examples of fruits produced by</p>



<ul style="list-style-type: none"> describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird describe the life process of reproduction in some plants and animals 	<p>Work scientifically by: observing and comparing the life cycles of plants and animals in their local environment with other plants and animals around the world (in the rainforest, in the oceans, in desert areas and in prehistoric times), asking pertinent questions and suggesting reasons for similarities and differences. They might try to grow new plants from different parts of the parent plant, for example, seeds, stem and root cuttings, tubers, bulbs. They might observe changes in an animal over a period of time (for example, by hatching and rearing chicks), comparing how different animals reproduce and grow.</p> <p>Scientist – Eva Crane – reproduction in bees They should find out about the work of naturalist David Attenborough and animal behaviourist Jane Goodall.</p>	<p>life cycles around the world rainforest, oceans, desert, prehistoric, similarities, differences</p>	<p>vegetative propagation may be shown to pupils to show them that they produce seeds.</p> <p>Misconception: Babies are conceived in the stomach. Fact: Stomachs are for food, not babies! Fertilisation takes place naturally in the Fallopian tube (oviduct) of the female reproductive system and the fertilised egg, which develops into a ball of cells over time, develops in the uterus (womb) of the female to become a baby.</p> <p>Misconception: In human reproduction, a miniature baby is folded up inside the sperm or the egg and the other gamete (reproductive cell) triggers its development. Fact: The sperm fertilises the egg when the nuclei of the sperm and egg fuse. The fertilised egg (zygote) develops into a ball of cells, which continue to divide and develop into specialised cells to form different organs and systems.</p> <p>Misconception: Confusion between mating and reproduction. Fact: In general, animals have to mate in order to reproduce but these are different processes.</p> <p>Misconception: Plants do not produce sexually. Fact: Flowering plants produce sexually when the nuclei of pollen grains fuse with the eggs.</p> <p>Misconception: Sexual reproduction must involve mating. Fact: Sexual reproduction does not always involve mating, as in the case of flowering plants.</p>
<p>Animals, including humans</p>	<p>Children should draw a timeline to indicate stages in the growth and development of humans. Compare to those of animals. They should learn about the changes experienced in puberty.</p>	<p>human development, baby – toddler- child- teenager – adult puberty</p>	<p>Misconception: Babies are conceived in the stomach. Fact: Stomachs are for food, not babies! Fertilisation takes place naturally in the Fallopian tube (oviduct) of the female reproductive system and the fertilised egg, which develops into a ball</p>



<p>Pupils should be taught to:</p> <ul style="list-style-type: none"> describe the changes as humans develop to old age 	<p>Work scientifically by researching the gestation periods of other animals and comparing them with humans; by finding out and recording the length and mass of a baby as it grows.</p> <p>Investigate: Do our forearms grow as we grow? How can scientists use a footprint to tell how tall a person is? Measure children’s heights and forearms/foot size in different year groups and look at results.</p> <p>Scientist – Louis Pasteur – Discovered vaccination Alexander Flemming – Discovered penicillin</p>	<p>gestation, length, mass, grows, grow, growing</p>	<p>of cells over time, develops in the uterus (womb) of the female to become a baby.</p> <p>Misconception: In human reproduction, a miniature baby is folded up inside the sperm or the egg and the other gamete (reproductive cell) triggers its development. Fact: The sperm fertilises the egg when the nuclei of the sperm and egg fuse. The fertilised egg (zygote) develops into a ball of cells, which continue to divide and develop into specialised cells to form different organs and systems.</p> <p>Misconception: Confusion between mating and reproduction. Fact: In general, animals have to mate in order to reproduce but these are different processes.</p> <p>Misconception: Bigger organisms have bigger cells. Fact: Bigger organisms have more cells.</p> <p>Misconception: Cells are two dimensional and flat. Fact: Cells are 3 dimensional.</p> <p>Misconception: All cells have nuclei. Fact: Not all cells have nuclei, e.g. red blood cells do not have nuclei.</p> <p>Misconception: Organisms grow bigger when their cells grow bigger. Fact: Organisms grow bigger when their cells go through cell division and multiply</p>
<p>Properties and changes of materials</p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> 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>Build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and about electricity in year 4. Explore reversible changes, including evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes. Explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda.</p>	<p>magnetism (Y3) electricity (Y4) conductivity, insulation, chemists, chemical</p> <p>properties</p>	<p>Misconception: Plastic is not breakable Fact: Plastics can be broken. Different types of plastics have different properties. Some types of plastics can be broken more easily than others, e.g. the plastic used to make cling-wrap breaks more easily than the plastic used to make a plug cover.</p>



<ul style="list-style-type: none"> • know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic • demonstrate that dissolving, mixing and changes of state are reversible changes • explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda 	<p>Note: pupils are not required to make quantitative measurements about conductivity and insulation at this stage. It is sufficient for them to observe that some conductors will produce a brighter bulb in a circuit than others and that some materials will feel hotter than others when a heat source is placed against them. Safety guidelines should be followed when burning materials.</p> <p>Work scientifically by: carrying out tests to answer questions, for example, 'Which materials would be the most effective for making a warm jacket, for wrapping ice cream to stop it melting, or for making blackout curtains?' They might compare materials in order to make a switch in a circuit. They could observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes. They might research and discuss how chemical changes have an impact on our lives, for example, cooking, and discuss the creative use of new materials such as polymers, super-sticky and super-thin materials.</p> <p>Famous Scientist – Spencer Silver – glue for sticky notes Ruth Benerito – wrinkle free cotton Jamie Garcia (look on BP website) – Invention of a new plastic Sir Humphrey Davy – separating gases</p>	<p>hardness, solubility, transparency, conductive</p> <p>dissolve liquid, solution, separate, separating</p> <p>solids, liquids, gases filtering, sieving, evaporating</p> <p>reversible changes dissolving, mixing, evaporation, filtering, sieving, melting</p> <p>irreversible new material, burning, rusting</p>	<p>Misconception: Confusion about hardness and strength Fact: The differences between the common usage and the scientific definitions of the terms 'hardness' and 'strength' should be emphasised to pupils. In science, hardness refers to the ability of a material to withstand scratching and strength refers to the ability of a material to support a heavy load without breaking or tearing. Thus, a piece of chalk which is conventionally considered to be hard is not considered hard in the scientific sense. It can easily be scratched.</p> <p>Misconception: Heat insulators are non-conductors. Fact: Matter which are heat insulators do conduct heat, albeit poorly. Thus, it is more appropriate to call them poor conductors of heat rather than non-conductors. Vacuum, which does not have particles (atoms, molecules or ions) to pass on heat can be considered to be a non-conductor. However, in reality, it is difficult to obtain a true vacuum.</p> <p>Misconception: Sand and rice take the shape of containers, therefore they are not solids. Fact: Each individual grain of sand and rice have definite shape, therefore they are solids.</p> <p>Misconception: Plasticine is not a solid as it has no definite shape. Fact: A solid can change its shape if a force acts on it. Plasticine changes its shape when it is moulded (a force acted on it). It remains in its new shape because it is inelastic.</p> <p>Misconception: Solids are hard, strong and non-malleable. Fact: Different solids have different degree of hardness, strength and malleability.</p>
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<p>Forces</p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> 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 recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect 	<p>Explore falling objects and raise questions about the effects of air resistance. They should explore the effects of air resistance by observing how different objects such as parachutes and sycamore seeds fall. They should experience forces that make things begin to move, get faster or slow down. Explore the effects of friction on movement and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel. Explore the effects of levers, pulleys and simple machines on movement.</p> <p>Work scientifically by: exploring falling paper cones or cupcake cases, and designing and making a variety of parachutes and carrying out fair tests to determine which designs are the most effective. They might explore resistance in water by making and testing boats of different shapes. They might design and make products that use levers, pulleys, gears and/or springs and explore their effects.</p> <p>Famous scientists – Isaac Newton and Galileo – gravity</p>	<p>magnetic attraction, gravitational attraction, gravity, direction, force, motion, weight, friction, upthrust, newton, forcemeter, stationary, reliability, force applied, surface area</p>	<p>Misconception: If there is motion, there is a force acting; when an object is moving, there is a force in the direction of its motion. Fact: No force is acting on the object if the object is in uniform motion (constant speed in a straight line).</p> <p>Misconception: If there is no motion, then there is no force acting. Fact: There are forces acting on a stationary object in equilibrium.</p> <p>Misconception: Kicks and throws are not associated with 'push'. Fact: Kicks and throws are pushes.</p> <p>Misconception: When oil is applied, there is no more friction. Fact: When oil is applied, friction is reduced. Misconception: Moving objects come to a stop even when there is no friction. Fact: Moving objects continue to move when there is no friction.</p> <p>Misconception: Friction only exists between two rough surfaces. Fact: Friction can exist between two very smooth surfaces, e.g. two smooth and clean glass rods, due to electrostatic attraction between the atoms or molecules on the two surfaces in contact.</p> <p>Misconception: Friction only exists between two solid surfaces. Fact: There is friction when solid objects move through fluids (e.g. air resistance when objects move through air).</p> <p>Misconception: Air has no weight or negative weight. Fact: Air has weight and the weight of air per unit area is air pressure.</p>
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<p>Earth and space</p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> describe the movement of the Earth and other planets relative to the sun in the solar system describe the movement of the moon relative to the Earth describe the sun, Earth and moon as approximately spherical bodies 	<p>Introduce a model of the sun and Earth that enables children to explain day and night. They should learn that the sun is a star at the centre of our solar system and that it has 8 planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Pluto was reclassified as a 'dwarf planet' in 2006). They should understand that a moon is a celestial body that orbits a planet (Earth has 1 moon; Jupiter has 4 large moons and numerous smaller ones).</p> <p>Describe the moon's orbit as describing a circular anticlockwise circle in a flat plane with duration of 29.5 days with a single axial spin on its own axis. Note: pupils should be warned that it is not safe to look directly at the sun, even when wearing dark glasses.</p> <p>Find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model.</p>	<p>Solar system astronomy</p> <p>Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune, Pluto, moon, meteorite, comet, sun</p> <p>orbit clockwise anti-clockwise rotate</p>	<p>Misconception: Rotation is the same as revolution. Fact: Rotation is the movement which involves turning about an axis, as in a spinning top. Revolution is the movement in an orbit, as in the Earth revolving round the Sun.</p> <p>Misconception: The moon gives off light. Fact: The moon is a non-luminous body. It can be seen because it reflects the light from the Sun.</p> <p>Misconception: The phenomenon of day and night is caused by the movement of the Earth around the Sun or the movement of the Sun around the Earth.</p>



<ul style="list-style-type: none">• use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	<p>Work scientifically by: comparing the time of day at different places on the Earth through internet links and direct communication; creating simple models of the solar system; constructing simple shadow clocks and sundials, calibrated to show midday and the start and end of the school day; finding out why some people think that structures such as Stonehenge might have been used as astronomical clocks.</p> <p>Scientist – Ptolemy & Copernicus – Heliocentric vs geocentric Margaret Hamilton – computer scientist – moon landings Stephen Hawking – Black holes</p>	shadow sundial	<p>Fact: Day and night is caused by the rotation of the Earth about its axis.</p> <p>Misconception: Phases of the moon are caused by the Earth's shadow covering the Moon. Fact: Phases of the moon are caused by the regular movement of the Moon around the Earth. Only the illuminated parts of the Moon which are facing the Earth can be seen from Earth.</p>
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