Key Learning in Science: Year 5

There should be plenty of opportunities throughout the year for children to use the school/local environment to observe and identify a variety of plant and animal life cycles. This could be done through an ongoing/monthly nature journal to observe, record and review a variety of examples over a period of time. The unit on 'Human life cycles' can be linked to PSHEE work on 'Relationships' and the Year 5 Science unit 'Habitats and life cycles' rather than being taught as a separate unit.

Environment - Observing Life cycles

Pupils should be taught to:

- 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.
- Name, locate and describe the functions of the main parts of reproductive system of plants (stigma, stamen, petal, sepal, pollen, ovary)

Notes and Guidance (non-statutory):

Pupils should 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. They should find out about the work of naturalists and animal behaviourists, for example, David Attenborough and Jane Goodall.

Pupils should find out about different types of reproduction, including sexual and asexual reproduction in plants and sexual reproduction in animals.

Pupils might 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**.
- **Suggesting reasons** for similarities and differences **[grouping and classifying]**.
- They might **try to [explore]** grow new plants from different parts of the parent plant, for e.g., seeds, stem and root cuttings, tubers, bulbs.
- **Observe changes** in an animal **over a period of time** (e.g. by hatching and rearing chicks).
- **Comparing** how different animals reproduce and grow.

Material Properties – Testing Material Properties

Pupils should be taught to:

- 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.
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic (advantages and disadvantages).
  - Compare a variety of materials and measure their effectiveness (e.g. hardness, strength, flexibility, solubility, transparency, thermal conductivity, electrical conductivity).

Temperature and Thermal Insulation

- Heat always moves from hot to cold.
- Some materials (insulators) are better at slowing down the movement of heat than others.
- Objects/liquids will warm up or cool down until they reach the temperature of their surroundings.

Notes and Guidance (non-statutory):

Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials and relating these to what they learnt about magnetism in Year 3 and about electricity in Year 4.

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.

Pupils might work scientifically by:

- **Carry out tests** to answer questions such as '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?'
- **Compare** materials in order to make a switch in a circuit.

Material Changes - Reversible changes

- 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.
- Demonstrate that dissolving, mixing and changes of state are reversible changes.
  - Changes can occur when different materials are mixed.
  - Some material changes can be reversed and some cannot.
  - Recognise that dissolving is a reversible change and recognise everyday situations where dissolving occurs.
  - Distinguish between melting and dissolving.
  - Mixtures of solids (of different particle size) can be separated by sieving.
  - Mixtures of solids and liquids can be separated by filtering if the solid is insoluble (un-dissolved).
  - Evaporation helps us separate soluble materials from water.
  - Changes to materials can happen at different rates (factors affecting dissolving, factors affecting evaporation – amount of liquid, temperature, wind speed, etc).
  - Freezing, melting and boiling changes can be reversed (revision from YR4).

Notes and Guidance (non-statutory):

Pupils should explore reversible changes including evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes.

Material Changes – Irreversible changes

Pupils should be taught to:

- 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 (producing a gas / fizzing).

Notes and Guidance (non-statutory):

Pupils should explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example vinegar with bicarbonate of soda. They should find out about how chemists create new materials, for example Spencer Silver, who invented the glue for sticky notes or Ruth Benerito, who invented wrinkle-free cotton.

Safety guidelines should be followed when burning materials.

Pupils might work scientifically by:

- **Observing** and **comparing** the changes that take place, for example, when burning different materials or baking bread or cakes.
- **Researching** and **discussing** how chemical changes have an impact on our lives, for example cooking.
- **Discuss [research]** the creative use of new materials such as polymers, super-sticky and super-thin materials.
- **Explain** how they know when a change is reversible or irreversible

Key Learning in Science: Year 5

Animals - Human Life Cycles

Pupils should be taught to:

- Describe the changes as humans develop to old age.
  - Animals are alive; they move, feed, grow, use their senses, reproduce, breathe/respire and excrete.

Notes and Guidance (non-statutory):

Pupils should draw a timeline to indicate stages in the growth and development of humans. They should learn about the changes experienced in puberty.

Pupils might work scientifically by:

- **Researching** the gestation periods other animals and **comparing** them with humans.
- By **finding out** and **recording** the length and mass of a baby as it grows.

Light and Astronomy – Earth and Space

Pupils should be taught to:

- Describe the movement of the Earth, and other planets, relative to the Sun and each other in the solar system.
- Describe the movement of the Moon relative to the Earth.
- Describe Sun/Earth/Moon as approximately spherical bodies.
- Use the idea of the Earth's rotation to explain day and night.
  - The Earth spins once around its own axis in 24 hours, giving day and night.
  - The Earth orbits the Sun in one year.
  - We can see the Moon because the Sun's light reflects off it.
  - The Moon orbits the Earth in approximately 28 days and changes to the appearance of the moon are evidence of this.
  - Use the Earth's movement in space to explain the apparent movement of the sun across the sky.
  - The Sun appears to move across the sky from East to West and this causes shadows to change during the day.
  - Changes to shadow length over a day or changes to sunrise and sunset times over a year are evidence supporting the movement of the Earth.

Notes and Guidance (non-statutory):

Pupils should be introduced to a model of the Sun and Earth that enables them to explain day and night. Pupils should learn that the Sun is a star at the centre of our solar system and that it has eight 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 one moon; Jupiter has four large moons and numerous smaller ones).

Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses. Pupils should 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 by considering the work of scientists such as Ptolemy, Alhazen and Copernicus.

Pupils might 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.

Forces – Effects on Movement

Pupils should be taught to:

- 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 (causing things to slow down)
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
  - There are different types of forces (push, pull, friction, air resistance, water resistance, magnetic forces, gravity) which have different effects on objects
  - Gravity can act without direct contact between the Earth and an object.
  - Friction, air resistance and water resistance can be useful or unwanted.
  - The effects of friction, air resistance and water resistance can be reduced or increased for a preferred effect.
  - More than one force can act on an object simultaneously (either reinforcing or opposing each other).

Notes and Guidance (non-statutory):

Pupils should 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. Pupils should 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. Pupils should explore the effects of levers, pulleys and simple machines on movement. Pupils might find out how scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.

Pupils might work scientifically by:

- **Exploring** falling paper cones or cup-cake cases.
- **Designing and making [exploring]** a variety of parachutes.
- **Carrying out fair tests** to determine which designs are the most effective.
- **Exploring** resistance in water by making and testing boats of different shapes.
- **Design and make [create/invent/design]** artefacts that use simple levers, pulleys, gears and/or springs and explore their effects.

Year Group Expectations: Year 5

Exploring / Observing *UKS2 - developing a deeper understanding of a wide range of scientific ideas and encountering more abstract ideas*	Grouping and Classifying *UKS2 - Compare and contrast a variety of examples linked to UKS2 PoS*	Questioning *UKS2 - asking their own questions about scientific phenomena*	Researching *UKS2 – summarise research from a wide variety of sources and recognising that scientific ideas change and develop over time*	Modelling *using dance, drama or a visual aid to represent science in the real world*	Collaborating *interacting effectively as part of a group*
▪ Use their developing scientific knowledge and understanding and relevant scientific language and terminology to discuss, communicate and explain their observations (incl. more abstract ideas from Y5 PoS (e.g. friction, air resistance, forces, Earth and space, reversible and irreversible changes). ▪ Evaluate their observations and suggest a further test, offer another question or make a **prediction** ▪ Observe (including changes over time) and suggest a reason for what they notice	▪ Suggest reasons for similarities and differences ▪ Compare and contrast things beyond their locality and use these similarities and differences to help to classify *(e.g. features of animals, life cycles of different living things, melting compared with dissolving, etc).* ▪ Use secondary sources of information to identify and classify. ▪ Decide which sources of information (and/or equipment and/or test) to help identify and classify	▪ Recognise scientific questions that do not yet have definitive answers. (linked to Y5 PoS) ▪ Refine a scientific question so that it can be tested e.g. 'What would happen to… if we changed…?' ▪ Decide whether their questions can be answered by researching or by testing ▪ Independently ask their own scientific questions taking some ownership for finding out the answers	▪ Find out how scientific ideas have changed/developed over time (linked to Y5 PoS) ▪ Articulate and explain findings from their research using scientific knowledge and understanding (see 'Communicating' box below re vocabulary) ▪ Make decisions about which information to use from a wide range of sources	▪ Perform / create simple models to exemplify scientific ideas using scientific terminology where appropriate *(e.g. spheres to represent movements of the Sun and Earth, solar system models, shadow clocks, a simple lever or mechanism).*	▪ Propose their own ideas and make decisions with agreement in a group ▪ Support, listen to and acknowledge others in the group e.g. Yes. I prefer that one too ▪ Check the clarity of each other's suggestions e.g. are you saying you think this one is a herbivore? ▪ Build on / add to someone else's idea to improve a plan or suggestion ▪ Understand that it is okay to disagree with their peers and offer a reasons for their opinion

Planning and Testing *UKS2 - using different types of scientific enquiry making decisions about and explaining choices for testing*	Using Equipment and Measures *UKS2 - increasing complexity and increasing accuracy and precision make their own decisions about the data to collect*	Communicating *Reporting findings, recording data, presenting findings* *Read, spell and pronounce scientific vocabulary correctly linked to the relevant Yr Grp*	Considering the results of an investigation / writing a conclusion		
			Describing results / Looking for patterns *UKS2 - Looking for patterns analysing functions, relationships and interactions more systematically*	Explaining results *UKS2 - draw conclusions based on / supported by evidence*	Trusting results *UKS2 - comment on how reliable the data is*
▪ Carry our **fair tests** and other investigations with increasing independence ▪ Suggest more than one possible prediction and begin to suggest which is the most likely. Justify their reason with some knowledge and understanding of the concept ▪ Make decisions about which **variable**s to change, measure and keep the same (linked to the appropriate units in the Y5 PoS) ▪ Make most of the planning decisions for an investigation. ▪ Recognise when it is appropriate to carry out a **fair test**.	▪ Make their own decisions about what observations to make or measurements to use and how long to take them for (recognising the need for repeat readings on some occasions). ▪ Take measurements using a range of scientific equipment with increasing accuracy and using more complex scales / **units** ▪ Identify possible risks to themselves and others and suggest ways of reducing these ▪ Choose the most appropriate equipment and make **accurate** measurements	▪ Use their developing scientific knowledge and understanding and relevant scientific language and terminology to communicate more abstract concepts (linked to Y5 PoS) ▪ Present and explain their findings through talk, in written forms or in other ways (e.g. using technology) for a range of audiences / purposes ▪ Record data and results of increasing complexity using different formats e.g. tables, annotated scientific diagrams, classification keys, graphs and models ▪ Make decisions about the most appropriate way of recording data	▪ Describe straightforward patterns in results linking cause and effect e.g. using er…er or the word 'more' *(e.g. the longer, thinner shapes move through the water more quickly OR the larger the wings, the longer it takes the spinner to fall)* ▪ Look for / notice relationships between things and begin to describe these. ▪ Comment on the results and whether they **support** the initial **prediction**	▪ Use their scientific KandU and appropriate scientific language and terminology (linked to Y5 PoS) to explain their findings and data and answer their initial question ▪ Draw a valid **conclusion** (explain *why* it happened) based on their data and observations (from Y5 PoS)	▪ Begin to recognise how repeated readings improve the **reliability** of results ▪ Compare results with others and comment on how **reliable** they are