

Science Curriculum

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1. Overview

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1.1 Primary 1

Plants

Students should be taught to:

- Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.
- Identify and describe the basic structure of a variety of common flowering plants and trees including leaves, flowers (blossom), petals, fruit, roots, bulb, seed, trunk, branches, stem.
- Use the local environment throughout the year to explore and answer questions about plants growing in their habitat.
- Observe the growth of flowers and vegetables that they have planted.
- Work scientifically by: observing closely, perhaps using magnifying glasses, and comparing and contrasting familiar plants; describing how they were able to identify and group them, and drawing diagrams showing the parts of different plants including trees.
- Keep records of how plants have changed over time, for example, the leaves falling off trees and buds opening; and compare and contrast what they have found out about different plants.

Animals, Including Humans

Students should be taught to:

- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals.
- Identify and name a variety of common animals that are carnivores, herbivores and omnivores.
- Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets).
- identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense including head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth.
- Use the local environment throughout the year to explore and answer questions about animals in their habitat.
- Compare and contrast animals at first hand or through videos and photographs, describing how they identify and group them; grouping animals according to what they eat; and using their senses to compare different textures, sounds and smells.

Everyday Materials

Students should be taught to:

- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.
- Describe the simple physical properties of a variety of everyday materials: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.
- Explore and experiment with a wide variety of materials including: brick, paper, fabrics, elastic, foil.
- Work scientifically by: performing simple tests to explore questions, for example: 'What is the best material for an umbrella? ... for lining a dog basket? ... for curtains? ... for a bookshelf? ... for a gymnast's leotard?'

Seasonal Changes

Students should be taught to:

- Observe changes across the 4 seasons.
- Observe and describe weather associated with the seasons and how day length varies.
- Make tables and charts about the weather.
- Make displays of what happens in the world around them (i.e. seasonal changes, length of days).

1.2 Primary 2

Plants

Students should be taught to:

- Observe and describe how seeds and bulbs grow into mature plants.
- Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.
- Recognise the requirements of plants for germination, growth and survival, as well as the processes of reproduction and growth in plants (seeds and bulbs need water to grow but most do not need light; seeds and bulbs have a store of food inside them).
- Observe and record, with some accuracy, the growth of a variety of plants as they change over time from a seed or bulb, or observing similar plants at different stages of growth as well as setting up a comparative test to show that plants need light and water to stay healthy.

Animals, Including Humans

Students should be taught to:

- Notice that animals, including humans, have offspring which grow into adults. The following examples might be used: egg, chick, chicken; egg, caterpillar, pupa, butterfly; spawn, tadpole, frog; lamb, sheep. Growing into adults can include reference to baby, toddler, child, teenager, adult.
- Find out about and describe the basic needs of animals, including humans, for survival (water, food and air).
- Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.
- Observe, through video or first-hand observation and measurement, how different animals, including humans, grow.
- Ask questions about what things animals need for survival and what humans need to stay healthy; and suggesting ways to find answers to their questions.

Use of Everyday Materials

Students should be taught to:

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses and become familiar with how some materials are used for more than one thing (metal can be used for coins, cans, cars and table legs; wood can be used for matches, floors, and telegraph poles) or different materials are used for the same thing (spoons can be made from plastic, wood, metal, but not normally from glass).
- Identify how the properties of materials make them suitable or unsuitable for particular purposes and they should be encouraged to think about unusual and creative uses for everyday materials.
- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.
- Compare the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs).
- Observe closely, identify and classify the uses of different materials, and recording their observations.

Living Things and Their Habitats

Students should be taught to:

- Explore, compare, sort and classify things that are living, dead, and things that have never been alive.

- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.
- Identify and name a variety of plants and animals in their habitats, including microhabitats.
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.
- Identify that all living things have certain characteristics that are essential for keeping them alive and healthy.
- Raise and answer questions that help them to become familiar with the life processes that are common to all living things.
- Recognise the terms 'habitat' (a natural environment or home of a variety of plants and animals) and 'microhabitat' (a very small habitat, for example for woodlice under stones, logs or leaf litter).
- Raise and answer questions about the local environment that help them to identify and study a variety of plants and animals within their habitat and observe how living things depend on each other, for example, plants serving as a source of food and shelter for animals.
- Compare animals in familiar habitats with animals found in less familiar habitats, for example, on the seashore, in woodland, in the ocean, in the rainforest.

1.3 Primary 3

Plants

Students should be taught to:

- Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers.
- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant.
- Investigate the way in which water is transported within plants.
- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
- Discuss the relationship between structure and function: the idea that every part has a job to do.
- Explore questions that focus on the role of the roots and stem in nutrition and support, leaves for nutrition and flowers for reproduction (Students can be introduced to the idea that plants can make their own food, but at this stage they do not need to understand how this happens).
- Compare the effect of different factors on plant growth, for example, the amount of light, the amount of fertiliser; discovering how seeds are formed by

observing the different stages of plant life cycles over a period of time; looking for patterns in the structure of fruits that relate to how the seeds are dispersed.

- Observe how water is transported in plants, for example, by putting cut, white carnations into coloured water and observing how water travels up the stem to the flowers.

Animals, Including Humans

Students should be taught to:

- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.
- Identify and group animals with and without skeletons and observing and comparing their movement; exploring ideas about what would happen if humans did not have skeletons.
- Compare and contrast the diets of different animals (including their pets) and decide ways of grouping them according to what they eat.
- Research different food groups and how they keep us healthy, and design meals based on what they find out.

Rocks

Students should be taught to:

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock.
- Recognise that soils are made from rocks and organic matter.
- Explore different kinds of rocks and soils, including those in the local environment.
- Observe rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time.
- Use a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them.
- Research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed.
- Explore different soils and identify similarities and differences between them and investigate what happens when rocks are rubbed together or what changes occur when they are in water.
- Raise and answer questions about the way soils are formed.

Light

Students should be taught to:

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the size of shadows change.
- Observe and measure, shadows, and find out how they are formed and what might cause the shadows to change, looking for patterns in what happens to shadows when the light source moves or the distance between the light source and the object changes.

Forces and Magnets

Students should be taught to:

- Compare how things move on different surfaces.
- Notice that some forces need contact between 2 objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials.
- Describe magnets as having 2 poles.
- Predict whether 2 magnets will attract or repel each other, depending on which poles are facing.
- Compare how different things move and group them.
- Raise questions and carry out tests to find out how far things move on different surfaces, and gathering and recording data to find answers to their questions.
- Explore the strengths of different magnets and finding a fair way to compare them.
- Sort materials into those that are magnetic and those that are not.
- Observe patterns in the way that magnets behave in relation to each other and what might affect this, for example, the strength of the magnet or which pole faces another.
- Identifying how these properties make magnets useful in everyday items and suggesting creative uses for different magnets.

1.4 Primary 4

Animals, Including Humans

Students should be taught to:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.
- Recognise the main body parts associated with the digestive system, for example: mouth, tongue, teeth, oesophagus, stomach, and small and large intestine, and explore questions that help them to understand their special functions.
- Compare the teeth of carnivores and herbivores and suggesting reasons for differences; finding out what damages teeth and how to look after them.
- Discuss their ideas about the digestive system and compare them with models or images.

Living Things and Their Habitats

Students should be taught to:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose dangers to living things.
- Use the local environment throughout the year to raise and answer questions that help them to identify and study plants and animals in their habitat and identify how the habitat changes throughout the year.
- Explore possible ways of grouping a wide selection of living things that include animals, flowering plants and non-flowering plants including beginning to put vertebrate animals into groups, for example: fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects; plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, for example ferns and mosses.
- Explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population and development, litter or deforestation.

States of Matter

Students should be taught to:

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.
- Explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container).
- Observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.
- Group and classify a variety of different materials; explore the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party).
- Research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid.
- Observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line, and investigate the effect of temperature on washing drying or snowmen melting.

Sound

Students should be taught to:

- Identify how sounds are made, associating some of them with something vibrating.
- Recognise that vibrations from sounds travel through a medium to the ear.
- Find patterns between the pitch of a sound and features of the object that produced it.
- Find patterns between the volume of a sound and the strength of the vibrations that produced it.
- Recognise that sounds get fainter as the distance from the sound source increases.
- Find patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses.
- Create ways to block sound such as make earmuffs from a variety of different materials to investigate which provides the best insulation against sound.

Electricity

Students should be taught to:

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.
- Recognise some common conductors and insulators, and associate metals with being good conductors.
- Construct simple series circuits, trying different components, for example, bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices.
- Draw the circuit as a pictorial representation (not necessarily using conventional circuit symbols at this stage; these will be introduced in Grade 6).
- Observe patterns, for example, that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit.

1.5 Primary 5

Animals, Including Humans

Students should be taught to:

- Describe the changes as humans develop to old age.
- Draw a timeline to indicate stages in the growth and development of humans.
- Know about the changes experienced in puberty.
- Research 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.

Living Things and Their Habitats

Students 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.
- Study and raise questions about their local environment throughout the year.
- 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.
- Research the work of naturalists and animal behaviourists, for example, David Attenborough and Jane Goodall.

- Discuss the different types of reproduction, including sexual and asexual reproduction in plants, and sexual reproduction in animals.
- Observe and compare 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.
- Grow new plants from different parts of the parent plant, for example, seeds, stem and root cuttings, tubers, bulbs.
- Observe changes in an animal over a period of time (for example, by hatching and rearing chicks), comparing how different animals reproduce and grow.

Properties and Changes of Materials

Students 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.
- 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.
- Explore and demonstrate that dissolving, mixing and changes of state are reversible changes and recognise that melting and dissolving are different processes.
- Explore and 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, the action of acid on bicarbonate of soda, rusting, vinegar with bicarbonate of soda and other reactions.
- Research how chemists create new materials, for example, Spencer Silver, who invented the glue for sticky notes or Ruth Benerito, who invented wrinkle-free cotton.
- Carry 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?'
- Compare materials in order to make a switch in a circuit.
- Observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes.
- 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.

Earth and Space

Students should be taught to:

- 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.
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.
- Compare 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

Students 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.
- Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect.
- Explore 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.
- Explore resistance in water by making and testing boats of different shapes.
- Design and make products that use levers, pulleys, gears and/or springs and explore their effects.

1.6 Primary 6

Animals, Including Humans

Students should be taught to:

- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.
- Describe the ways in which nutrients and water are transported within animals, including humans.
- Explore the work of scientists and scientific research about the relationship between diet, exercise, drugs, lifestyle and health.

Light

Students should be taught to:

- Recognise that light appears to travel in straight lines.
- 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.
- 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.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
- Investigate the importance of reflected light in driving a car through experimenting where to place rear-view mirrors on cars; designing and making a periscope and using the idea that light appears to travel in straight lines to explain how it works.
- Investigate the relationship between light sources, objects and shadows by using shadow puppets and extend their experience of light by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water, and coloured filters (they do not need to explain why these phenomena occur).

Electricity

Students should be taught to:

- Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.
- 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.
- Use recognised symbols when representing a simple circuit in a diagram.
- Systematically identify the effect of changing one component at a time in a circuit; designing and making a set of traffic lights, a burglar alarm or some other useful circuit.

Evolution and Inheritance

Students should be taught to:

- Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.
- Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.
- Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

- Discuss that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, labradors are crossed with poodles.
- Observe variation in offspring over time can make animals more or less able to survive in particular environments, for example, by exploring how giraffes' necks got longer, or the development of insulating fur on the arctic fox.
- Research the work of palaeontologists such as Mary Anning and about how Charles Darwin and Alfred Wallace developed their ideas on evolution.
- Observe and raise questions about local animals and how they are adapted to their environment; comparing how some living things are adapted to survive in extreme conditions, for example, cactuses, penguins and camels and analyse the advantages and disadvantages of specific adaptations, such as being on 2 feet rather than 4, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers.