Science Progression in Knowledge (Substantive Knowledge)

Elmhurst School

D. Hanwell - Version 2

Science Knowledge Progression

The substantive knowledge builds progressively to develop children's understanding of concepts, models, laws and theories.
It is organised into the following four areas:

Biology
Living things and their environment
Reproduction, inheritance and evolution

Chemistry
States of matter
Materials (properties and changes)

Physics
Energy
Forces

Earth Science
Earth and space

Science Knowledge Progression

Key concepts:
Through the science curriculum, pupils will develop an understanding of the following key concepts. These concepts are revisited through different units as pupils move through the school.

By the end of primary school, children will know and understand these key concepts.

Biology

- **Organisms require a supply of energy and materials:** Living things are special collections of matter that reproduce, use energy and grow. Food provides materials and energy for life and growth. Plants and bacteria use energy from the sun to generate food. Animals break down food and are ultimately dependant on green plants for energy. In any ecosystem there is competition for the energy and materials needed to live and reproduce.

- **Genetic information:** Genetic information is passed down from one generation of organisms to another. Genes determine the development and structure of organisms.

- **Evolution:** The diversity of organisms is the result of evolution. Different kinds of life, animals, plans and microorganisms, have evolved into different forms best suited to the environments in which they live. Organisms not able to respond sufficiently to changes in their environment become extinct

Science Knowledge Progression

Chemistry

- All matter (stuff) in the universe is made of tiny building blocks.

- **Materials (properties and changes):** The arrangement movement and types of blocks of matter, and the forces that hold them together/push them apart, explain all the properties of matter (e.g.: hot/cold, soft/hard, light/heavy etc…)

- **States of matter:** Matter can change if the arrangement of these building blocks change (e.g.: chemical reactions)

Physics

- The universe follows unbreakable rules that are all about forces, matter and energy.

- **Forces** are different kinds of pushes and pulls that act on all the matter in the universe. Changing the movement of an object requires a force to be acting on it. Gravity is a universal force of attraction between all objects, however large or small.

- **Energy:** There are many different forms of energy e.g.: light, sound, electricity, heat and wind. Energy can be transferred from one object to another and can cause changes. The total amount of energy in the universe is always the same but energy can be transformed when things change or are made to happen

Earth Science

• The earth in relation to the universe: The Earth is one of 8 planets orbiting the sun. Our solar system is a very small part of one of millions of galaxies
in the universe.

• The earth spins on its axis: The Earth is tilted and spins on its axis leading to day and night, the seasons and climate

Science Knowledge Progression

Earth Science

- **The earth in relation to the universe:** The Earth is one of 8 planets orbiting the sun. Our solar system is a very small part of one of millions of galaxies in the universe.

- **The earth spins on its axis:** The Earth is tilted and spins on its axis leading to day and night, the seasons and climate

ANIMALS INCLUDING HUMANS

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

- Notice that animals, including humans, have offspring which grow into adults.
- 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.
- 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. (Y2 - Living things and their habitats)

Year 6

- 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.
- 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. (Y6 - Living things and their habitats)
- Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)

Year 5

- Describe the changes as humans develop to old age.
- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (Y5 - Living things and their habitats)
- Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)

Year 4

- 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.

KS2

Year 3

- 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.

Year 2

Year 1

- 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.

KS1

Reception

- Talk about members of their immediate family and community.
- Name and describe people who are familiar to them.
- Recognise some environments that are different to the one in which they live.

Nursery

- Use all their senses in hands-on exploration of natural materials.
- Begin to make sense of their own life-story and family's history.
- Understand the key features of the life cycle of a plant and an animal.
- Begin to understand the need to respect and care for the natural environment and all living things.

EYFS

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EARTH AND SPACE

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

Year 5

- 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.

Year 4

Year 3

KS2

Year 2

Year 1

- Observe changes across the four seasons. (Y1 – Seasonal changes)
- Observe and describe weather associated with the seasons and how day length varies. (Y1 – Seasonal changes)

KS1

Reception

- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.

Nursery

EYFS

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ELECTRICITY

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- 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.

Year 5

- 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.

Year 4

Year 3

KS2

Year 2

Year 1

KS1

Reception

Nursery

- Explore how things work.

EYFS

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EVOLUTION AND INHERITANCE

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- 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.

Year 5

- Describe the life process of reproduction in some plants and animals. (Living things and their habitats - Y5)

Year 4

- Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats) Year

Year 3

- Describe in simple terms how fossils are formed when things that have lived are trapped within rock. (Y3 - Rocks)
- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants) Year

KS2

Year 2

- 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. (Y2 - Living things and their habitats)
- Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals, including humans)

Year 1

KS1

Reception

- Recognise some environments that are different to the one in which they live. (Reception – Living things and their habitats) Year

Nursery

- Begin to understand the need to respect and care for the natural environment and all living things. (Nursery – Living things and their habitats)

EYFS

FORCES

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

Year 5

- 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.

Year 4

- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.

Year 3

KS2

- 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 two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

Year 2

- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)

Year 1

KS1

Reception

- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.

Nursery

- Explore how things work.
- Explore and talk about different forces they can feel.
- Talk about the differences between materials and changes they notice.

EYFS

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LIGHT

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- 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.

Year 5

- 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. (Y5 - Properties and changes of materials)

Year 4

Year 3

KS2

Year 2

- 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 an opaque object.
- Find patterns in the way that the size of shadows change.

Year 1

- Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans)
- Describe the simple physical properties of a variety of everyday materials. (Y1 - Materials)

KS1

Reception

- Describe what they see, hear and feel whilst outside.

Nursery

- Explore how things work.
- Talk about the differences in materials and changes they notice.

EYFS

LIVING THINGS AND THEIR HABITATS

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics.
- Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. (Y6 - Evolution and inheritance)
- Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. (Y6 - Evolution and inheritance)

Year 5

- 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.

Year 4

- 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.
- Construct and interpret a variety of food chains, identifying producers, predators and prey. (Y4 - Animals, including humans) .

Year 3

- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants)

KS2

Year 2

- Explore and compare the differences between 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.
- Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals including humans)

Year 1

- Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. (Y1 - Plants)
- Identify and describe the basic structure of a variety of common flowering plants, including trees. (Y1 - Plants)
- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. (Y1 - Animals including humans)
- Identify and name a variety of common animals that are carnivores, herbivores and omnivores. (Y1 - Animals including humans)
- Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). (Y1 – Animals, including humans)
- Observe changes across the four seasons. (Y1 - Seasonal change) Year

KS1

Reception

- Draw information from a simple map.
- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.
- Recognise some environments that are different to the one in which they live.

Nursery

- Use all their senses in hands-on exploration of natural materials.
- Explore collections of materials with similar and/or different properties.
- Begin to understand the need to respect and care for the natural environment and all living things.

EYFS

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MATERIALS

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- 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.

Year 5

- 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.

Year 4

- 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.
- Recognise some common conductors and insulators, and associate metals with being good conductors. (Y4 - Electricity)

KS2

Year 3

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. (Y3 - Rocks)
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock. (Y3 - Rocks)
- 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. (Y3 - Forces and magnets)

Year 2

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Year 1

- 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.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.

KS1

Reception

- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.

Nursery

- Use all their senses in hands-on exploration of natural materials.
- Explore collections of materials with similar and/or different properties.
- Talk about the differences between materials and changes they notice.

EYFS

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PLANTS

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- 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. (Y6 - Living things and their habitats)
- Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)

Year 5

- Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)

Year 4

- Recognise that living things can be grouped in a variety of ways. (Y4 - Living things and their habitats)
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (Y4 - Living things and their habitats)
- Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)

Year 3

- 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.

KS2

Year 2

- 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.
- Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)

Year 1

- 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, including trees.

KS1

Reception

- Draw information from a simple map. (Reception – Living things and their habitats)
- Explore the natural world around them. (Reception – Living things and their habitats)
- Describe what they see, hear and feel whilst outside. (Reception – Living things and their habitats)
- Recognise some environments that are different to the one in which they live. (Reception – Living things and their habitats)
- Understand the effect of changing seasons on the natural world around them. (Reception – Seasonal changes)

Nursery

- Use all their senses in hands-on exploration of natural materials.
- Explore collections of materials with similar and/or different properties.
- Plant seeds and care for growing plants.
- Understand the key features of the life cycle of a plant and an animal.
- Begin to understand the need to respect and care for the natural environment and all living things.

EYFS

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ROCKS

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

- Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. (Y6 - Evolution and inheritance)

Year 5

Year 4

KS2

Year 3

- 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.

Year 2

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)

Year 1

KS1

- Distinguish between an object and the material from which it is made. (Y1 - Everyday materials)
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials)
- Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials)
- Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials)

Reception

- Explore the natural world around them. (Reception – Living things and their habitats)
- Describe what they see, hear and feel whilst outside. (Reception – Living things and their habitats

Nursery

- Use all their senses in hands-on exploration of natural materials. (Nursery – Living things and their habitats)
- Explore collections of materials with similar and/or different properties. (Nursery – Living things and their habitats)

EYFS

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SEASONAL CHANGES

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

Year 5

- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky. (Y5 - Earth and space) Year

Year 4

Year 3

KS2

- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (Y3 - Light)

Year 2

Year 1

KS1

- Observe changes across the four seasons.
- Observe and describe weather associated with the seasons and how day length varies.

Reception

- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.
- Understand the effect of changing seasons on the natural world around them.

Nursery

- Understand the key features of the life cycle of a plant and an animal. (Nursery – Plants & Animals, excluding humans)

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SOUND

National Curriculum statements in blue are from other linked topics.

Transition to Year 7

Year 6

Year 5

- 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.

Year 4

Year 3

KS2

Year 2

Year 1

KS1

- Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans)

Reception

- Describe what they see, hear and feel whilst outside.

Nursery

- Explore how things work.

EYFS