United Curriculum

Primary Science

Information for School Websites





Principles of the Science Curriculum



The United Curriculum for science provides all pupils, regardless of their background, with:

Substantive knowledge:

- Ensuring pupils master core content through the development of key concepts and timely revisiting of key knowledge
- Sequencing the curriculum and selecting knowledge to allow for gradual development of vertical concepts the 'big ideas' in science to provide firm foundations for KS3 and KS4
- **Preventing common misconceptions** that are often formed at an early age and prove problematic at the later stages of pupils' science education
- Purposefully teaching appropriate knowledge that **goes beyond the KS1 and KS2 national curriculum**, to aid current and future understanding, and to smooth the transition to KS3
- Encouraging pupils to apply and make connections between the disciplines of science, the wider curriculum and the wider world

Disciplinary knowledge:

- Sequencing Working Scientifically elements so that they are **explicitly taught** and practised alongside the substantive knowledge, and regularly reviewed and built upon across the years and key stages
- Making deliberate and explicit links to other curriculum areas particularly geography and mathematics to ensure there is a
 consistent approach to teaching content, and that pupils are always first taught content in the most relevant subject. For example,
 pupils are taught how to construct bar charts or calculate the mean in mathematics before they are applied in science
- Planning practical tasks that have a **clear purpose**: to demonstrate or prove substantive concepts, or to allow pupils to deliberately practice working scientifically skills in a relevant context

Curiosity and excitement about science:

- Selecting examples and applications of science that inspires pupils' curiosity about the world and natural phenomena
- Ensuring that all pupils **can see themselves reflected** in the science curriculum, by highlighting present-day role models and the contributions of scientists from a wide range of backgrounds; and considering social and cultural values around scientific ideas

United Curriculum: Science





United Curriculum: Science



| | N3-4 | Reception | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|----------|---|---|---|---|--|---|--|---|
| Autumn 1 | It's getting cold outside / Bears Weather where we live, habitats where bears live | | BIOLOGY Plants Identifying and naming common plants and describing basic structures | BIOLOGY Plant growth Plants grow from seeds, and require water, light and a suitable temperature | CHEMISTRY Rocks Comparisons of types of rocks and how fossils are formed | BIOLOGY Classifying organisms Introduction to classifying animals and their environment | CHEMISTRY Separating mixtures Identifying and separating mixtures; reversible and non- reversible changes | PHYSICS Electricity Investigating variations in series and parallel circuits, and how electricity is generated |
| Autumn 2 | Polar express / Special days Melting and freezing; natural and artificial materials | | BIOLOGY / PHYSICS Seasonal changes Observing changes across four seasons and describing associated weather | BIOLOGY Needs of animals Animals need water, food and air to survive and to have offspring | PHYSICS Light Relationship between light and how we see; the formation of shadows | BIOLOGY Food & digestion The human digestive system and food relationships in ecosystems | BIO / CHEM / PHYSICS Energy Introducing the concept of energy stores and energy transfers; relate this to prior knowledge | BIOLOGY Evolution Fossils; introduction to the idea that adaptation may lead to evolution |
| Spring 1 | On the Move / Toys Exploring pushes, pulls and magnets | | CHEMISTRY Everyday materials Distinguishing objects from their material, and describing simple properties | CHEMISTRY Uses of materials Comparisons of an object's material with its use; impact of bending, twisting on solid objects | BIOLOGY Organisms The role of muscles and skeletons; the importance of nutrients | CHEMISTRY Particle model and states of matter States of matter in relation to particle arrangement | BIOLOGY Life cycles Life cycles of a mammal, amphibian, insect, bird, and some reproduction processes | PHYSICS Light How light travels and is reflected, and how this allows us to see |
| Spring 2 | On the Farm / Food Glorious Food Life cycles of farm animals and plants | Spring in our step Wildlife and weather in spring and winter; habitats around our school | Consolidation and review | BIOLOGY Living things & habitats Introduction to habitats, micro-habitats, and simple food chains | BIOLOGY Plants Features of flowering plants and what they need to survive | PHYSICS Sounds Relationship between strength of vibrations and volume of sound | BIOLOGY Human development Human development to old age | BIOLOGY Further classification Further classification of organisms based on characteristics |
| Summer 1 | Once upon a time 1 / 2 Properties of materials and exploring mixtures | | BIOLOGY Animals Naming reptiles, fish, amphibians, birds and mammals; carnivores, herbivores, omnivores | CHEMISTRY Solids, liquids and gases How the same substances can exist as solids, liquids and gases | PHYSICS Forces & motion Introducing pushes and pulls; opposing forces, and balanced forces | PHYSICS Electricity Simple series circuits | PHYSICS Forces Gravity, air and water resistance and friction; introduction to pulleys | BIOLOGY Functions of the human body Human circulatory system; transport of nutrients within the body |
| Summer 2 | All creatures great and small 1 / 2 Life cycles of animals in trop. rainforests, sea, and grasslands | Science detectives Properties of materials and habitats around the world | BIOLOGY Humans Human body parts and senses | Consolidation and review | PHYSICS Magnetism Contact and non- contact forces, including friction and magnetism | CHEMISTRY Properties of materials Considering physical and chemical properties | PHYSICS Earth and space Movements of planets and the Moon, and relationship to day and night | CHEMISTRY Physical and chemical changes Identifying physical and chemical changes |

Science in Context



Science is taught in 6-lesson units, two a term. Science is taught for two hours each week.

The United Curriculum is sequenced so that meaningful links are made between subjects, and the order of units allows these connections to be made.

The United Curriculum for Science has been adapted for Glenfield Primary School by considering the context of our pupils and the community.

For example:

- Pupils learn about habitats, ecosystems, species (both plant and animal) and nature reserves that are found in our local area. This is incorporated into all units where the natural world is studied to include Y1: Plants, Year 1: Animals, Year 2: Living things and their habitats, Year 3: Plants, Year 4: Classifying organisms, and Year 6: Further classification.
- Pupils learn about materials that are sourced in our local area and industries that make products from these materials locally in Year 1: Everyday materials, to make objects and Year 2: Uses of everyday materials.
- Pupils look at pictures of local rock formations, rock types and fossils found locally in Year 3: Rocks.
- Pupils learn about local sustainability initiatives such as recycling facilities in Year 2: Everyday materials and examples of renewable energy found locally in Year 6: Electricity.
- Pupils learn about extreme weather observed in our local area in Year 1: Seasonal changes.
- Pupils learn about foods that are grown in the local area in Year 2: Plant Growth
- Pupils learn about local scientists and their work, both past and present e.g cardiologist visit in Year 6.









Physics



3. Forces act in pairs. Forces acting against each other are

If opposing forces equal, they are **balanced**, and the object's motion will stay the same; this includes staying stationary. If opposing forces are unequal, they are unbalanced will change an object's speed, direction or shape.

N 3/4

It's Getting Cold Outside

/ Bears

Polar Express

k Special Days

On the Move

/ Toys

On the Farm /

Once Upon

a Time 1/2

Glorious Food

Biology

Animals

Biology

4

Humans

Year 2

Biology

Plant Growth

Biology

Needs of

Animals

Chemistry

Uses of

Materials

Biology

Living Things

& Habitats

Chemistry

Solids,

iquids 8

Year

Chemistr

Everyday

Materials

Biology / Physics

Changes

Biology

Plants

Year 1

Science

Detectives

Me and

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Creatures

Great &

Small 1/2

2. The non-contact force of magnetism mean magnets can attract or repel other magnets and attract objects made of magnetic materials.

3. Friction is an example of a contact force.

Biology Classifying Organisms Biology Biology Year Further Food & Classification Digestion Biology Physics Physics Electricity Chemistry The Human article Mod Magnetism Body Physics Chemistry Physics Year 6 Physical & hemical Change Forces Sounds & Motion Biology Physics Physics Key Stage Earth & Space Plants Electricity Chemistry Biology Physics roperties o Organisms Forces Materials Biolog Physics Year 5 Huma Liaht Developm Biology Chemistry Chemistr Separating Life Rocks Mixtures Cycles Physics Energy

2. Sound comes from objects that vibrate and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears.

> 2. There is attraction and repulsion between objects that are electrically charged. Visible light and other forms of radiation can travel through any empty space.

> 3. How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia).

3. The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth.

2. The non-contact force of **gravity** pulls objects towards the centre of the Earth.

3. There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass. The greater the mass, the greater the gravitational force.

Objects on Earth are pulled to the centre of the Earth because the Earth's mass and therefore gravitational force is much larger than that of the objects.

3. We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials.

2. Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away.

Physics

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.

4.

6.

Our solar system is a very small part of one of millions of galaxies in our universe.



Energy resources - but not energy - can be depleted.



Earth Science & Geology

5 (A) The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate. **Geography**: Features of hot deserts include rocks, sand dunes and oases. Features of cold deserts include mountains and ice sheets.

Rivers travel from highland areas to lowland areas. Physical features around rivers include valleys, mountains, hills and vegetation.

N 3/4

It's Getting Cold Outside

/ Bears

Polar Express

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Everyday

Materials

Biology / Physics

Changes

Biology

Plants

Year 1

Science

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Biology

Humans

Year 2

Biology

Plant Growth

Biology

Needs of

Animals

Chemistry

Uses of

Materials

Biology

Living Things

& Habitats

Chemistru

Solids

Liquids 8



natural things in our local area.

Some plants grow in soil

Geography: We live on the Earth. Physical features occur in nature and include river, forest, soil and hill.

Coastal areas are areas of land that are near the sea. Features in coastal areas include beach, cliff, sea and ocean.

Geographical features include beach, hill, forest, sea and river.

Geography: There are several mountain ranges in the UK.

The Earth has four layers. Its upper layer of tectonic plates move.

Shield and composite volcanoes can form at plate boundaries, which produce lava, pyroclastic flows and lahars.

Soil is rich with nutrients around volcanoes.

Rocks are formed when placed under pressure.

Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients.

Geography: Use of fossil fuels to create

Physics

Light

Biology

Evolution

Phusics

Electricity

Year 6

Physics

Earth & Space

Physics

Forces

Biology

Human

Development

ology

Biology

Further

Classification

Biology

The Humar

Body

Chemistry

Physical & nemical Chang

Key Stage

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Biology

Food &

Digestion

Chemistry

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Physics

Sounds

Physics

Electricity

Chemistry

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Materials

Year 5

Chemistry

Separating

Mixtures

Physics

Energy

on the Earth.

Year

4

Physics

Magnetism

Physics

Forces

& Motion

Biology

Plants

Biology

Organisms

Physics

Light

Chemistry

Rocks

Year

Biology

Classifying

Oraanisms

There are three main kinds of rock: igneous, sedimentary and metamorphic, which each have different composition and properties.



Radioactive decay of material inside the Earth since it was formed is its internal source of energy. Understanding the use of Earth's energy resources in terms of energy stores and transfers.

Geography: Examples of natural resources include wood, food, water and fossil fuels. Fossil fuels are materials made from fossils over millions of years, like coal and oil. Humans use these to run cars and electrical items.

Natural resources are unevenly distributed across the world and can be renewable or non-renewable (finite).

The upper course of a river is in high, mountains ground and the river is narrow and fast flowing. The lower course of a river is in low, flat ground and the river is wide and slow flowing. The middle course is between the two. Rivers erode, transport and deposit to form waterfalls, meanders and floodplains.



Environmental Science



Geography: The amount of water on Earth is constant. Most is saltwater stored in oceans, and most freshwater is stored as ice or underground.

Water cycle: Evaporation from the air and transpiration from plants means that water vapour rises in the air. It condenses to form clouds and precipitation occurs when the clouds get heavy. Surface runoff is the flow of water overground; throughflow is the flow of water underground.

Climate zones share long-term weather patterns. There are six main climate zones: polar, temperate, arid, tropical, Mediterranean and mountains.

Biomes are areas of the world that, because of similar climates, have similar landscapes, flora and fauna. The major biomes of the world are tundra, tropical rainforests, coral reefs, temperate forests and hot deserts.

The natural greenhouse effect, the enhanced greenhouse effect, global warming and resulting climate change.

The increase in frequency of extreme weather events like heatwaves and drought as a result of climate change.



Biology







10. Variation exists within species. caused by genetic and environmental factors.

Living things are found in certain environments because they have the features that enable them to survive there. This adaptation to their environment has come about because of the small differences that occur during reproduction. resulting in some individuals being better suited to the environment than others. In the competition for materials and food, those that are better adapted will survive and are more likely to pass on their adapted feature to their offspring. Fossils are evidence of evolution.

9. In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and

10. The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago. Multi-cellular organisms evolved around 2 billion years ago.

10. Biodiversity describes all the different living things in an area.

Living things are adapted to their environments. If the environment changes, the organisms may no longer be adapted and may struggle to survive.

and dead species from fossils. These are the preserved remains (or traces) of organisms that lived many years ago.

9. An organism's genome is the information that controls how that individual organism

In sexual reproduction, two parents contribute to the formation of offspring. They each pass down half their genome through specialised cells called sex cells. The two halves are combined during fertilisation. While it inherits genetic information from both parents, the offspring's genome is distinct, which means the offspring is not identical to a parent.

Asexual reproduction involves only one parent. In this process, the offspring's genome is an exact copy of the parent's genome. The offspring is identical to the parent.



11. Visual impairments include long and

Biology



11. The biological causes and effects of diseases (e.g. coeliac disease and emphysema). exercise, lifestyles (e.g. vaping) and deficiencies on the body. Pathogens, their transmission and how transmission can be

11. Healthy development includes cognitive, physical, social and emotional development. Most of this happens during infancy and childhood. Ageing happens naturally, and can be sped up by environmental factors like

Some adults are unable to become pregnant. IVF and other treatments can be used.

11. Some substances are toxic: this means they organisms need to avoid these to stay healthy.

Alignment to the National Curriculum



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|----------|---|--|---|---|--|---|
| | BIOLOGY | BIOLOGY CHEMISTRY | | BIOLOGY | CHEMISTRY | PHYSICS |
| Autumn 1 | Plants | Plant growth | Rocks | Classifying organisms | Separating mixtures | Electricity |
| | Identifying and naming common plants and describing basic structures | Plants grow from seeds, and require water, light and a suitable temperature | Comparisons of types of rocks and how fossils are formed | Introduction to classifying animals and their environment | Identifying and separating mixtures; difference between reversible and non-reversible changes | Investigating variations in series and parallel circuits, and how electricity is generated |
| Autumn 2 | BIOLOGY / PHYSICS | BIOLOGY | PHYSICS | BIOLOGY | BIOLOGY, CHEMISTRY, PHYSICS | BIOLOGY |
| | Seasonal changes | Needs of animals | Light | Food & digestion | Energy | Evolution |
| | Observing changes across four seasons and describing associated weather | Animals need water, food and air to survive and to have offspring | Relationship between light and how we see; the formation of shadows | The human digestive system and simple food chains | Introducing the concept of energy stores and energy transfers, and relating this to prior knowledge | Fossils; introduction to the idea that adaptation may lead to evolution |
| Spring 1 | CHEMISTRY | CHEMISTRY | BIOLOGY | CHEMISTRY | BIOLOGY | PHYSICS |
| | Everyday materials | Uses of everyday materials | Organisms | Particle model and states of | Life cycles | Light |
| | Distinguishing objects from the material it's made from, and describing simple properties | Comparisons of an object's material with its use; impact of bending, twisting on solid objects | The role of muscles and skeletons; the importance of nutrients | matter States of matter in relation to particle arrangement | Life cycles of a mammal, amphibian, insect and bird, and some reproduction processes | How light travels and is reflected, and how this allows us to see |
| Spring 2 | | BIOLOGY | BIOLOGY | PHYSICS | BIOLOGY | BIOLOGY |
| | | Living things & their habitats | Plants | Sounds | Human development | Further classification |
| | Consolidation and review | Basic introduction to habitats and micro-habitats, and simple food chains | The key features of flowering plants and what they need to survive | Relationship between strength of vibrations and volume of sound | Human development to old age | Further classification of organisms based on characteristics |
| Summer 1 | BIOLOGY | CHEMISTRY | PHYSICS | PHYSICS | PHYSICS | BIOLOGY |
| | Animals | Solids, liquids and gases | Forces & motion | Electricity | Forces | Functions of the human body |
| | Identifying and naming fish, | Understanding how the same | Introducing pushes and | Simple series circuite | Orarity, air and water resistance | Human circulatory system; |
| | amphibians, reptiles, birds and mammals; carnivores, herbivores and omnivores | substances can exist as solids. liquids and gases | balanced forces | | and friction; introduction to pulleys | transport of nutrients within the body |
| Summer 2 | BIOLOGY | | PHYSICS | CHEMISTRY | PHYSICS | CHEMISTRY |
| | Humans | ionsolidation and review | Friction & magnetism | Properties of materials | Earth and space | Physical and chemical |
| | Human body parts and senses | | Contact and non-contact forces, including friction and magnetism | Considering physical and chemical properties | Movements of planets and the Moon, and relationship to day and night | changes Identifying physical and chemical changes |

There are opportunities for pupils to consolidate or review knowledge in KS1, to ensure that these early concepts are fully mastered before KS2. They also allow time for pupils to revisit ideas in different seasons (e.g. observing changes in spring from autumn).

Disciplinary knowledge (working scientifically)

As specified in the National Curriculum, disciplinary knowledge is not taught as a separate strand. Instead, very specific aspects of disciplinary knowledge (for example, recognising and managing risk; or measuring using a Newtonmeter) are explicitly taught as part of the units set out here. They are deliberately practiced in the context of relevant and appropriate experiments, and then reviewed at regularly intervals across the key stages.

Substantive knowledge

The units that are not highlighted in colour align directly to the topics in the <u>Programmes of Study</u> and cover – at a minimum – the statutory content set out.

The statutory content in some topics in the Programmes of Study is substantial. Where this is the case, more time has been dedicated to it and the content is split into two complementary units. This allows sufficient time for mastery.

Three additional units purposefully take pupils beyond the **7** Programmes of Study:

- Year 2: Solids, liquids and gases. This introduces pupils to the idea that familiar substances (like water or chocolate) can exist as solids, liquids or gases. It will support understanding of states of matter and the particle model in Year 4, and preempts the misconception that substances only ever exist in one state.
- Year 5: Energy. This introduces pupils to energy stores and transfers at a very basic level, and has been designed to preempt misconceptions that need to be unpicked at secondary. It also allows pupils to review content from previous topics across biology, chemistry and physics (like food webs, electricity, and states of matter), and consider them through the lens of energy.
- Year 6: Physical & chemical changes. This unit gives pupils the opportunity to run more sophisticated practical investigations. It provides a good transition to Year 7.

Implementation



The implementation of the United Curriculum for Science reflects our broader teaching and learning principles, found here:

For Science in particular:

- Content is always carefully situated within existing schemas. Every unit considers the prior knowledge that is prerequisite for that unit and builds on that knowledge to develop a deeper understanding of that concept.
- Vertical concepts are used within lessons to connect aspects of learning. For example, in Year 1 pupils learn that different
 objects have a specific purpose, in Year 2 they learn that objects are made from different materials because these materials have
 different properties which make them suitable for a different purpose and in Year 4 they learn that some of the properties of
 different materials can be classified as chemical or physical.
- Disciplinary knowledge is explicitly taught to pupils and carefully sequenced to ensure pupils are provided with opportunities to practice these skills throughout the curriculum.
- Sustainability forms an integral part of the science and geography curriculum. An appreciation and understanding of key aspects of sustainability are carefully sequenced and interweaved for the most part through science and geography lessons.
- Opportunities for extended, scholarly writing appear throughout the curriculum. These have a clear purpose and audience and, crucially, allow pupils to write as a scientist. For example, in Year 4 pupils write a letter to an elderly relative to explain the solutions that exist to help with hearing loss.

Impact



The careful sequencing of the curriculum – and how concepts are gradually built over time – is the progression model. If pupils are keeping up with the curriculum, they are making progress. Formative assessment is prioritised and is focused on whether pupils are keeping up with the curriculum.

In general, this is done through:

- Questioning in lessons. Teachers check understanding so they can fill gaps and address misconceptions as required.
- Pupil Vioice. Subject leads and SLT talk to pupils about what they have learnt both substantive and disciplinary knowledge – and how this connects to the vertical concepts that they have been developing in previous years and other subjects.
- Post-learning quizzes at the end of each unit. These give teachers an understanding of the knowledge that pupils can recall at the end of the unit, and can be used to identify any remaining gaps to be filled.
- Pre-learning quizzes at the start of each unit. These assess pupils' understanding of the prior knowledge that is required to access the new content in the unit. These are used to identify gaps to be filled prior to teaching the new unit.