

Cambridge Primary

Science Curriculum Framework

Cambridge
Primary



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Introduction

Welcome to the Cambridge Primary Science curriculum framework.

This framework provides a comprehensive set of progressive learning objectives for science. The objectives detail what the learner should know or what they should be able to do in science in each year of primary education. They provide a structure for teaching and learning and a reference against which learners' ability and understanding can be checked.

The Cambridge Primary Science curriculum is presented in four content areas: *Scientific enquiry*, *Biology*, *Chemistry* and *Physics*. *Scientific enquiry* is about considering ideas, evaluating evidence, planning investigative work and recording and analysing data. The *Scientific enquiry* objectives underpin *Biology*, *Chemistry* and *Physics*, which are focused on developing confidence and interest in scientific knowledge. Environmental awareness and some history of science are also incorporated. The Cambridge Primary Science curriculum framework provides a solid foundation upon which the later stages of education can be built.

The Cambridge Curriculum is founded on the values of the University of Cambridge and best practice in schools. The curriculum is dedicated to developing learners who are confident, responsible, innovative and engaged. Each curriculum framework for English, mathematics and science is designed to engage learners in an active and creative learning journey.

Stage 1

Scientific enquiry

Ideas and evidence

- Try to answer questions by collecting evidence through observation.

Plan investigative work

- Ask questions and contribute to discussions about how to seek answers.
- Make predictions.
- Decide what to do to try to answer a science question.

Obtain and present evidence

- Explore and observe in order to collect evidence (measurements and observations) to answer questions.
- Suggest ideas and follow instructions.
- Record stages in work.

Consider evidence and approach

- Make comparisons.
- Compare what happened with predictions.
- Model and communicate ideas in order to share, explain and develop them.

Biology

Plants

- Know that plants are living things.
- Know that there are living things and things that have never been alive.
- Explore ways that different animals and plants inhabit local environments.
- Name the major parts of a plant, looking at real plants and models.
- Know that plants need light and water to grow.
- Explore how seeds grow into flowering plants.

Humans and animals

- Recognise the similarities and differences between each other.
- Recognise and name the main external parts of the body.
- Know about the need for a healthy diet, including the right types of food and water.
- Explore how senses enable humans and animals to be aware of the world around them.
- Know that humans and animals produce offspring which grow into adults.

Stage 1

Chemistry

Material properties

- Use senses to explore and talk about different materials.
- Identify the characteristics of different materials.
- Recognise and name common materials.
- Sort objects into groups based on the properties of their materials.

Physics

Forces

- Explore, talk about and describe the movement of familiar things.
- Recognise that both pushes and pulls are forces.
- Recognise that when things speed up, slow down or change direction there is a cause.

Sound

- Identify many sources of sound.
- Know that we hear when sound enters our ear.
- Recognise that as sound travels from a source it becomes fainter.

Scientific enquiry

Ideas and evidence

- Collect evidence by making observations when trying to answer a science question.
- Use first hand experience, e.g. observe melting ice.
- Use simple information sources.

Plan investigative work

- Ask questions and suggest ways to answer them.
- Predict what will happen before deciding what to do.
- Recognise that a test or comparison may be unfair.

Obtain and present evidence

- Make suggestions for collecting evidence.
- Talk about risks and how to avoid danger.
- Make and record observations.
- Take simple measurements.
- Use a variety of ways to tell others what happened.

Consider evidence and approach

- Make comparisons.
- Identify simple patterns and associations.
- Talk about predictions (orally and in text), the outcome and why this happened.
- Review and explain what happened.

Biology

Living things in their environment

- Identify similarities and differences between local environments and know about some of the ways in which these affect the animals and plants that are found there.
- Understand ways to care for the environment. Secondary sources can be used.
- Observe and talk about their observation of the weather, recording reports of weather data.

Chemistry

Material properties

- Recognise some types of rocks and the uses of different rocks.
- Know that some materials occur naturally and others are man-made.

Material changes

- Know how the shapes of some materials can be changed by squashing, bending, twisting and/or stretching.
- Explore and describe the way some everyday materials change when they are heated or cooled.
- Recognise that some materials can dissolve in water.

Physics

Light and dark

- Identify different light sources including the sun.
- Know that darkness is the absence of light.
- Be able to identify shadows.

Electricity

- Recognise the components of simple circuits involving cells (batteries).
- Know how a switch can be used to break a circuit.

The Earth and beyond

- Explore how the sun *appears* to move during the day and how shadows change.
- Model how the spin of the Earth leads to day and night, e.g. with different sized balls and a torch.

Stage 3

Scientific enquiry

Ideas and evidence

- Collect evidence in a variety of contexts to answer questions or test ideas.

Plan investigative work

- Suggest ideas, make predictions and communicate these.
- With help, think about collecting evidence and planning fair tests.

Obtain and present evidence

- Observe and compare objects, living things and events.
- Measure using simple equipment and record observations in a variety of ways.
- Present results in drawings, bar charts and tables.

Consider evidence and approach

- Draw conclusions from results and begin to use scientific knowledge to suggest explanations.
- Make generalisations and begin to identify simple patterns in results.

Biology

Plants

- Know that plants have roots, leaves, stems and flowers.
- Explain observations that plants need water and light to grow.
- Know that water is taken in through the roots and transported through the stem.
- Know that plants need healthy roots, leaves and stems to grow well.
- Know that plant growth is affected by temperature.

Humans and animals

- Know life processes common to humans and animals include nutrition (water and food), movement, growth and reproduction.
- Describe differences between living and non-living things using knowledge of life processes.
- Explore and research exercise and the adequate, varied diet needed to keep healthy.
- Know that some foods can be damaging to health, e.g. very sweet and fatty foods.
- Explore human senses and the ways we use them to learn about our world.
- Sort living things into groups, using simple features and describe rationale for groupings.

Stage 3

Chemistry

Material properties

- Know that every material has specific properties, e.g. hard, soft, shiny.
- Sort materials according to their properties.
- Explore how some materials are magnetic but many are not.
- Discuss why materials are chosen for specific purposes on the basis of their properties.

Physics

Forces and motion

- Know that pushes and pulls are examples of forces and that they can be measured with forcemeters.
- Explore how forces can make objects start or stop moving.
- Explore how forces can change the shape of objects.
- Explore how forces, including friction, can make objects move faster or slower or change direction.

Stage 4

Scientific enquiry

Ideas and evidence

- Collect evidence in a variety of contexts.
- Test an idea or prediction based on scientific knowledge and understanding.

Plan investigative work

- Suggest questions that can be tested and make predictions; communicate these.
- Design a fair test and plan how to collect sufficient evidence.
- Choose apparatus and decide what to measure.

Obtain and present evidence

- Make relevant observations and comparisons in a variety of contexts.
- Measure temperature, time, force and length.
- Begin to think about the need for repeated measurements of, for example, length.
- Present results in drawings, bar charts and tables.

Consider evidence and approach

- Identify simple trends and patterns in results and suggest explanations for some of these.
- Explain what the evidence shows and whether it supports predictions. Communicate this clearly to others.
- Link evidence to scientific knowledge and understanding in some contexts.

Biology

Humans and animals

- Know that humans (and some animals) have bony skeletons inside their bodies.
- Know how skeletons grow as humans grow, support and protect the body.
- Know that animals with skeletons have muscles attached to the bones.
- Know how a muscle has to contract (shorten) to make a bone move and muscles act in pairs.
- Explain the role of drugs as medicines.

Stage 4

Biology (continued)

Living things in their environment

- Investigate how different animals are found in different habitats and are suited to the environment in which they are found.
- Use simple identification keys.
- Recognise ways that human activity affects the environment e.g. river pollution, recycling waste.

Chemistry

States of matter

- Know that matter can be solid, liquid or gas.
- Investigate how materials change when they are heated and cooled.
- Know that melting is when a solid turns into a liquid and is the reverse of freezing.
- Observe how water turns into steam when it is heated but on cooling the steam turns back into water.

Physics

Sound

- Explore how sounds are made when objects, materials or air vibrate and learn to measure the volume of sound in decibels with a sound level meter.
- Investigate how sound travels through different materials to the ear.
- Investigate how some materials are effective in preventing sound from travelling through them.
- Investigate the way *pitch* describes how high or low a sound is and that high and low sounds can be loud or soft. Secondary sources can be used.
- Explore how pitch can be changed in musical instruments in a range of ways.

Electricity and magnetism

- Construct complete circuits using switch, cell (battery), wire and lamps.
- Explore how an electrical device will not work if there is a break in the circuit.
- Know that electrical current flows and that models can describe this flow, e.g. particles travelling around a circuit.
- Explore the forces between magnets and know that magnets can attract or repel each other.
- Know that magnets attract some metals but not others.

Stage 5

Scientific enquiry

Ideas and evidence

- Know that scientists have combined evidence with creative thinking to suggest new ideas and explanations for phenomena.
- Use observation and measurement to test predictions and make links.

Plan investigative work

- Make predictions of what will happen based on scientific knowledge and understanding, and suggest and communicate how to test these.
- Use knowledge and understanding to plan how to carry out a fair test.
- Collect sufficient evidence to test an idea.
- Identify factors that need to be taken into account in different contexts.

Obtain and present evidence

- Make relevant observations.
- Measure volume, temperature, time, length and force.
- Discuss the need for repeated observations and measurements.
- Present results in bar charts and line graphs.

Consider evidence and approach

- Decide whether results support predictions.
- Begin to evaluate repeated results.
- Recognise and make predictions from patterns in data and suggest explanations using scientific knowledge and understanding.
- Interpret data and think about whether it is sufficient to draw conclusions.

Biology

Plants

- Know that plants need energy from light for growth.
- Know that plants reproduce.
- Observe how seeds can be dispersed in a variety of ways.
- Investigate how seeds need water and warmth for germination, but not light.
- Know that insects pollinate some flowers.
- Observe that plants produce flowers which have male and female organs; seeds are formed when pollen from the male organ fertilises the ovum (female).
- Recognise that flowering plants have a life cycle including pollination, fertilisation, seed production, seed dispersal and germination.

Chemistry

States of matter

- Know that evaporation occurs when a liquid turns into a gas.
- Know that condensation occurs when a gas turns into a liquid and that it is the reverse of evaporation.
- Know that air contains water vapour and when this meets a cold surface it may condense.
- Know that the boiling point of water is 100°C and the melting point of ice is 0°C.
- Know that when a liquid evaporates from a solution the solid is left behind.

Physics

Light

- Observe that shadows are formed when light travelling from a source is blocked.
- Investigate how the size of a shadow is affected by the position of the object.
- Observe that shadows change in length and position throughout the day.
- Know that light intensity can be measured.
- Explore how opaque materials do not let light through and transparent materials let a lot of light through.
- Know that we see light sources because light from the source enters our eyes.
- Know that beams/rays of light can be reflected by surfaces including mirrors, and when reflected light enters our eyes we see the object.
- Explore why a beam of light changes direction when it is reflected from a surface.

Stage 5

Physics (continued)

The Earth and beyond

- Explore, through modeling, that the sun does not move; its *apparent* movement is caused by the Earth spinning on its axis.
- Know that the Earth spins on its axis once in every 24 hours.
- Know that the Earth takes a year to orbit the sun, spinning as it goes.
- Research the lives and discoveries of scientists who explored the solar system and stars.

Scientific enquiry

Ideas and evidence

- Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena.
- Collect evidence and data to test ideas including predictions.

Plan investigative work

- Discuss how to turn ideas into a form that can be tested.
- Make predictions using scientific knowledge and understanding.
- Choose what evidence to collect to investigate a question, ensuring that the evidence is sufficient.
- Identify factors that are relevant to a particular situation.
- Choose which equipment to use.

Obtain and present evidence

- Make a variety of relevant observations and measurements using simple apparatus correctly.
- Decide when observations and measurements need to be checked by repeating to give more reliable data.
- Use tables, bar charts and line graphs to present results.

Consider evidence and approach

- Make comparisons.
- Evaluate repeated results.
- Identify patterns in results and results that do not appear to fit the pattern.
- Use results to draw conclusions and to make further predictions.
- Suggest and evaluate explanations for predictions using scientific knowledge and understanding and communicate these clearly to others.
- Say if and how evidence supports any prediction made.

Stage 6

Biology

Humans and animals

- Use scientific names for some major organs of body systems.
- Identify the position of major organs in the body.
- Describe the main functions of the major organs of the body.
- Explain how the functions of the major organs are essential.

Living things in their environment

- Explore how humans have positive and negative effects on the environment, e.g. loss of species, protection of habitats.
- Explore a number of ways of caring for the environment, e.g. recycling, reducing waste, reducing energy consumption, not littering, encouraging others to care for the environment.
- Know how food chains can be used to represent feeding relationships in a habitat and present these in text and diagrams.
- Know that food chains begin with a plant (the producer), which uses energy from the sun.
- Understand the terms *producer*, *consumer*, *predator* and *prey*.
- Explore and construct food chains in a particular habitat.

Chemistry

Material changes

- Distinguish between reversible and irreversible changes.
- Explore how solids can be mixed and how it is often possible to separate them again.
- Observe, describe, record and begin to explain changes that occur when some solids are added to water.
- Explore how, when solids do not dissolve or react with water, they can be separated by filtering, which is similar to sieving.
- Explore how some solids dissolve in water to form solutions and, although the solid cannot be seen, the substance is still present.

Physics

Forces and motion

- Distinguish between mass measured in kilograms (kg) and weight measured in Newtons, noting that kilograms are used in everyday life.
- Recognise and use units of force, mass and weight and identify the direction in which forces act.
- Understand the notion of energy in movement.
- Recognise friction (including air resistance) as a force which can affect the speed at which objects move and which sometimes stops things moving.

Electricity and magnetism

- Investigate how some materials are better conductors of electricity than others.
- Investigate how some metals are good conductors of electricity while most other materials are not.
- Know why metals are used for cables and wires and why plastics are used to cover wires and as covers for plugs and switches.
- Predict and test the effects of making changes to circuits, including length or thickness of wire and the number and type of components.
- Represent series circuits with drawings and conventional symbols.

Safety issues

An essential part of this programme is that learners develop skills in scientific enquiry. This includes the collection of primary data by experiment. Scientific experiments are engaging and provide opportunities for first hand exploration. However, they must, at all times, be conducted with the utmost respect for safety, specifically:

- It is the responsibility of the teacher in charge to adhere and conform to any national, regional and school regulation in place with respect to safety of scientific experimentation.
- It is the responsibility of the teacher in charge to make a risk assessment of the hazards involved with any particular class or individual when undertaking a scientific experiment that conforms to these regulations.

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