Science

Skills

Observe carefully in order to gather data.

Learner will

? Examine objects and living things to find out more about them.

? Observe and manipulate objects by using all their senses as appropriate.

? Observe changes in living things, objects and events over a period of time.

? Distinguish between significant and less significant observations.

? Record observations in a systematic way.

Phase 1

K1, K2, Year 1

Explore their environment to identify an attribute.

Manipulate objects to explore its properties (e.g. explore playdough for its physical properties).

Record data using simple pictures (or mark making) and charts (tally).

Explore objects for specific attributes.

Observe changes over time (e.g. seed-seedling-fully grown plant).

Phase 2

Year 2, Year 3

Examine objects for specific attributes (with specific objectives - e.g. is it watertight?)

Observe **and record** changes over time (sequence of a decaying plant).

Examine objects for **specific** properties **and investigate their changing states (e.g. How does water change when it is frozen?)**

Record data using a variety of strategies (e.g. flow charts, picture sequencing, key words and **labelled diagrams**)

Take relevant observations and use standard measuring equipment for quantities e.g. temperature, volume.

Record data orally, in pictures and/or in written words or sentences

Phase 3

Year 4, Year 5

Take series of observations

Record and organizes data using standard measurements in sentences, lists and/or simple labeled diagrams

Take detailed observations over time

Record and organizes data using standard measurements in simple tables, graphs, charts or in labeled diagrams

Take repeat readings to determine experiment accuracy

Phase 4

Year 6

Record and organize data using standard measurements in simple tables, graphs, charts or in labeled diagrams

Take repeat readings when required for unusual or inaccurate readings

Use a variety of instruments and tools to measure data accurately.

Learner will
? Use a range of tools and techniques with increasing competency.
? Use standard and non-standard units for measurement.
? Measure, compare and record data including mass, weight, time and temperature.
? Select appropriate tools and measurement units.

Phase 1

K1, K2, Year 1

Make comparisons in measurement during structured activities.

Use non-standard units for measurement and record.

Make comparisons of measurement between mass, weight and temperature.

Use observation and scientific tools during structured and unstructured scientific investigations.

Choose appropriate equipment from a prescribed range.

Phase 2

Year 2, Year 3

Use **appropriate** scientific tools during structured scientific investigations.

Use **standard** units for measurement and record in variety of ways.

Make comparisons of measurement between mass, weight, temperature and **time.**

Select and safely use tools and equipment to extend the sense for observation.

Select and safely use tools and equipment to observe and measure -Range of materials or object chosen by students to suit investigations e.g. 3 to 4 parachutes

Intervals may use non-standard units e.g. coarse, medium, fine

Use various measuring devices appropriately with some teacher guidance.

Phase 3

Year 4, Year 5

Select and safely use tools and equipment to observe and measure

Use a range of tools according to context e.g. weighing scales, thermometers

Identify Intervals used in standard or non-standard units

Make comparisons, rank objects, estimate within reason and uses standard measuring instruments accurately.

Select and safely use tools and equipment to observe and measure

Consider the scale and the degree of accuracy required with measuring equipment (with support)

Range used independently and with standard and non-standard units of measurement

Makes comparisons, ranks objects, estimates with increased precision and uses standard measuring instruments accurately.

Phase 4

Year 6

Select and safely use tools and equipment to observe and measure

Account for the scale and the degree of accuracy required on measuring equipment

Pupils use appropriate range to enable patterns and trends to be identified

Uses standard units for measurement

Make comparisons, rank objects, estimate with precision and use measuring instruments accurately

Use scientific vocabulary to explain their observations and experiences.

Learner will
?Talk about what is observed.
?Describe simple features of objects and events.
?Describe what is happening using an increasing scientific vocabulary.
? Record and present findings and conclusions using a variety of strategies and appropriate scientific vocabulary

Phase 1

K1, K2, Year 1

Discuss what is observed

Respond to questions regarding attributes of objects (e.g. What colour is it? What does it feel like? What can you do with it? Where does it come from?).

Discuss what is happening in a scientific investigation (initially using non scientific language, then with some scientific language (e.g. 'I saw the reflection get lighter/darker') with initial teacher modeling of scientific vocabulary.

Discuss what is observed with a teacher/peers using specific scientific vocabulary (e.g. float/sink).

Name and describe several attributes of an object and event (e.g. 'When the towel was absorbing water, I saw it go inside.').

Share findings using scientific vocabulary (e.g. 'This is heavier because it has more weight').

Phase 2

Year 2, Year 3

Discuss in small group situations what is observed with specific scientific vocabulary (e.g. This material is translucent and allows light to pass through).

Name and describe several attributes of an object and events **in the context of a specific scientific investigation. (e.g. when I exercise my heart beats faster and I burn more energy).**

Students talk about what is happening in a scientific investigation using teacher modelled scientific vocabulary

Record findings using relevant scientific vocabulary.

Students report back and try to explain their observations and findings.

Use scientific vocabulary when planning, recording and explaining findings e.g. dissolving, evaporating, prediction, evidence.

Discuss/describe findings or learning through pictures, simple tables and graphs.

Use evidence to support findings.

Phase 3

Year 4, Year 5

Share and explain findings using relevant scientific vocabulary.

Use a range of presentation formats to present findings.

Use evidence to support findings.

Share using all relevant details and uses scientific vocabulary effectively to explain findings and identify trends.

Use a range of presentation formats to present findings.

Use evidence to support those findings

Explore bias e.g. validity, reliability, social acceptance and credibility

Phase 4

Year 6

Share using all relevant details and use scientific vocabulary effectively to explain findings and identify trends.

Communicate through presentations in the form of written reports, models, charts graphs, films etc.

Provide supporting evidence.

Is aware of bias e.g. validity, reliability, social acceptance and credibility.

Identify or generate a question or problem to be explored.

Learner will
?Ask questions or show curiosity about the natural and physical environment.
?Ask questions or identify problems that may lead to investigations.
?Pose questions and define problems that will facilitate effective investigations or inquiries.

Phase 1

K1, K2, Year 1

Respond to the world around them by using their senses.

Engage in scientific investigations by making observations (e.g. How does this work? What can you see happening? What makes it do that?).

Ask questions about the world around them, including about the scientific inquiry e.g. How? What will happen if? Why?

Recall scientific investigations.

Discuss scientific ideas and, with teacher support, ask questions.

Recall scientific investigations by identifying the problem investigated and suggest next steps.

Phase 2

Year 2, Year 3

Ask their own questions about the scientific inquiry (e.g. What do I need to carry out this investigations)

Use wonderings to build a scientific investigation upon (by identifying a problem suggest next steps)

Discuss scientific ideas and **ask questions.**

Ask questions related to the specific topic that lead to further scientific inquiry

Recall teacher led scientific investigations

Use scientific ideas to pose problems

Phase 3

Year 4, Year 5

Ask questions related to the specific topic that lead to further scientific inquiry

Recognise the need for a scientific investigation.

Generate questions to investigate.(with support)

Design and ask questions specifically related to the topic.

Identify a problem that can lead to a scientific investigation.

Pose questions to clarify practical problems or inform a scientific explanation.

Phase 4

Year 6

Design and asks questions specifically related to the topic

Identify a problem that can lead to a scientific investigation.

Poses questions to clarify practical problems or inform a scientific explanation.

Evaluate the need to design further tests.

Plan and carry out systematic investigations, manipulating variables as necessary.

Learner will
?Identify variables
?Collect information and data from a range of sources.
?Suggest approaches and methods for solving problems
?Identify one or two variables relevant to an investigation.
?Recognize the way in which an experiment is unfair if the relevant variables are not controlled.
?Reflect on methods used in investigations and their effectiveness

Phase 1

K1, K2, Year 1

Identify changes in their immediate environment.

Use methods to collect information from observations.

Identify problems to solve during scientific investigations.

Begin to think of ways they can solve scientific problems.

Begin to think of ways to change outcomes in a scientific investigation (variables)

Identify variables within a scientific investigation.

Phase 2

Year 2, Year 3

Identify variables within a scientific investigation.

Identify and think of ways to solve problems during scientific investigations.

Recognize ways scientific experiments can be unfair.

Use appropriate methods to collect information from a scientific investigation.

Recognize ways scientific experiments can be unfair.

Plan the main steps of an investigation, building fair testing elements into the plans (with support).

Suggest observations and measurements required.

Recognize the variables within a fair test with teacher support e.g. measured, keep the same, change.

Phase 3

Year 4, Year 5

Create a plan to investigate a scientific problem or question.

Build fair testing elements into the plans for an experimental procedure.

Compare and contrast observations and measurements to determine accuracy of results

Create a plan to find an answer to the question he or she has formulated

Plan an investigation knowing how to manipulate the variables e.g. constant, independent and dependent.

Consider whether to take repeat readings (with support)

Phase 4

Year 6

Create a plan to find an answer to the question he or she has formulated

Plan an investigation knowing how to manipulate the variables e.g. constant, independent and dependent.

Consider whether enough evidence will be yielded for the task and whether repeat readings may be required.

Make and test predictions.

Learner will
?Observe similarities and differences.
?Guess and suggest what will happen next in structured situations.
?Based on prior learning and/or observations, suggest outcomes of an investigation.
?Make justified predictions.
? Propose ideas or simple theories that may be explored or tested

Phase 1

K1, K2, Year 1

Identify ways their environment can be the same and different.

Guess an outcome during structured activity working towards predicting a reasonable outcome during a structured experience.

Propose simple ideas to test during exploration (scientific or otherwise).

Identify similarities and differences in a range of contexts.

Make a prediction based on observations during a scientific investigation.

Phase 2

Year 2, Year 3

Identify similarities and differences in a range of contexts using **scientific vocabulary** (e.g. properties: rough/smooth; hot/cold).

Make an **informed** prediction **with explanations** based on observations during scientific investigations.

Propose simple **theories** to test out during scientific **investigations.**

Discuss and describe similarities and differences in a range of contexts using **scientific vocabulary** (e.g. properties: rough/smooth; hot/cold).

Predict outcomes of investigations using their personal experiences.

Propose simple **hypothesis** to test out during scientific **investigations**.

Phase 3

Year 4, Year 5

Justify predictions, based on the results of an investigation

Propose simple **hypothesis** to test out during scientific **investigations**

Justify predictions, based on the results of an investigation

Suggest relevant reasons for their predictions using prior knowledge and understanding

Develop a hypothesis using a statement.

Phase 4

Year 6

Suggest reasons to justify their predictions using scientific knowledge

Offer predictions about possible patterns in results

Discuss how changing the variables will affect the outcome of a given hypothesis

Interpret and evaluate data gathered in order to draw conclusions.

Learner will
?Sort and classify according to observable features or selected criteria.
?Look for and recognize patterns in observations.
?Compare results of different investigations.
?Interpret information and offer explanations.

Phase 1

K1, K2, Year 1

Sort and classify by teacher/student selected criteria and draw a simple conclusion (e.g. collect smooth/rough stones and observing that not all rocks feel the same).

Recognise general patterns (e.g. If I water the plant it will grow) and patterns with specific criteria (e.g. most fabrics are absorbent).

Interpret information and offer simple explanations with one or two variables (e.g. the ball rolls fast because it is going down a hill).

Interpret information from a **scientific learning engagement and offer their own explanations and predictions** (e.g. this boat will sink because I put a heavy stone on top **and now I will try a lighter stone to see if it sinks).**

Compare results by observing another's investigation (e.g. My boat floated, but his boat sank when he pushed it under the water).

Phase 2

Year 2, Year 3

Recognise repeated patterns in teacher-directed experiments (e.g. all types of elastic are stretchy).

Compare results by observing another's investigation **and offer explanations (e.g. my cup held water because it is made of glass, my cup didn't because it is made of cardboard).**

Identify where to go next.

Identify patterns in the data and summarize the data

Draw a simple conclusion on the basis of observations

Locate information from simple charts and graphs -Describe observations in detail and provide explanations for them

Make a simple evaluation of the investigation

Develop ability to make simple judgements based on a given criteria.

Compare and classify using given criteria (begins to suggest criteria for comparisons).

Phase 3

Year 4, Year 5

Identify patterns and summarize the data -Draw conclusions on the basis of the data gathered and make further predictions

Evaluate the experimental procedure orally, in charts, graphs or diagrams and/or sentences

Use supporting evidence to defend judgements.

Identify patterns and discrepancies in the data, and summarize the data

Make decisions and judgements based on a given criteria e.g. comparisons, anomalies and patterns

Develop the use of supporting evidence to defend judgments.

Phase 4

Year 6

Identify patterns and discrepancies in the data, suggests explanations for discrepancies, and summarizes the data

Draw conclusions on the basis of the data gathered

Make decisions and judgements based on a given criteria e.g. comparisons, anomalies and patterns

Can explain and defend judgement.

Consider scientific models and applications of these models (including their limitations).

Learner will
?Share findings with peers informally.
?Represent findings using pictures and models.
?Reflect on and build upon their own current scientific theories and applications.
?Apply scientific knowledge to reconstruct or refine their understandings of the physical, chemical and biological worlds.
?Assess their understanding in light of new data or reconsideration of existing data.

Phase 1

K1, K2, Year 1

Discuss and show observations within a scientific investigation with teacher/peers (e.g. ‘Look, my water turned blue'.)

Demonstrate their understanding using concrete examples (e.g. make a ramp to make cars roll down faster) drawings and flow charts.

Draw simple conclusions and with teacher support and apply new scientific understandings to the current context (e.g. All living things need food, If I don't eat I will die because I'm a living thing).

Orally recounts steps in a scientific investigation to answer a specific question.

Phase 2

Year 2, Year 3

Discuss and demonstrate their understanding using concrete examples and drawings **and flow charts.**

Draw conclusions and with teacher support and apply new scientific understandings to the current context (e.g. All living things need food, If I don't eat I will die because I'm a living thing).

Recount steps in a scientific investigation using labelled diagrams.

Recognise the difficulties encountered. With support, suggests how the inquiry might be improved.

Present steps in and results of an experimental procedure orally and in charts, graphs or diagrams and/or sentences.

Use simple tables and graphs to record observations and results of experiments.

Can use pictures, labels, sentences, observational drawings and tallies.

Phase 3

Year 4, Year 5

Present steps in and results of an experimental procedure orally and in charts, graphs or diagrams and/or sentences

Suggest how the inquiry might be improved

Recognize some of the limitations of their evidence

Organise results using graphs, tables and diagrams.

Record data using tallies, lists, charts, drawings and notes. Realises a need for keeping records.

Present steps in and results of an experimental procedure orally and in charts, graphs or diagrams and/or sentences

Evaluate the experimental procedure, explains changes that could be made to improve it

Consider some of the pattern and the limitations of their evidence

Select and use appropriate format to record data

Record data using tallies, lists, charts drawings and notes.

Phase 4

Year 6

Present steps in and results of an experimental procedures using numeric, symbolic, graphical and/or linguistic methods

Evaluate the experimental procedure, explains changes that could be made to improve it, and give reasons for the changes

Consider the spread of repeated measurements -Recognizes some of the

Select and use appropriate format to record data using tallies, lists, charts drawings and notes

Conceptual Understandings

EARTH AND SPACE

The study of planet Earth and its position in the universe, particularly its relationship with the sun; the natural phenomenon and systems that shape the planet and the distinctive features that identify it; the infinite and finite resources of the planet.

Related concepts: atmosphere, climate, cycles, dynamic equilibrium, erosion, evidence, geography, geology, gravity, renewable and non-renewable energy sources, resources, seasons, space, sustainability, systems (solar, water cycle, weather), tectonic plate movement, theory of origin

The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate. (H)

At the Earth's surface, radiation from the Sun heats the surface and causes convection currents in the air and oceans, creating climates. Below the surface heat from the Earth's interior causes movements in the molten rock. The solid surface is constantly changing through the formation and weathering of rock.

The solar system is a very small part of one of millions of galaxies in the Universe. (H)

Our sun and eight planets and other smaller objects orbiting it comprise the solar system. Day and night and the seasons are explained by the orientation and rotation of the Earth as it moves round the Sun. The solar system is part of a galaxy of stars, one of many millions in the Universe, enormous distances apart, many of the stars having planets.

Phase 1

K1, K2, Year 1

Weather, Seasons & Cycles

Weather can be described (e.g., rainy, windy, sunny). (M)

The environment changes over the seasons. (M)

Daily and seasonal changes in our environment, including the weather, affect everyday life. (A)

Form of Earth

There are different materials on Earth (e.g., rock, water, soil). (M)

Earth materials have a number of properties. (M)

There is air all around the Earth's surface. (H)

Form of the Universe and Earth's place in it

The major features of sky can be described (e.g., clouds, Sun, moon). (M)

The Sun can only be seen in the daytime but the Moon can be seen sometimes at night, sometimes during the day. The Sun, Moon and stars all appear to move across the sky. (V)

There are many stars in our sky. Our Sun is one of many stars that make up the Universe. (H)

Phase 2

Year 2, Year 3

Weather, Seasons & Cycles

Short-term weather conditions (e.g., temperature, rain, snow) can change daily, and weather patterns change over the seasons. (M)

Water can be a liquid or a solid and can be made to change from one form to the other, but the amount of water stays the same. (M)

Form of the Universe and Earth’s place in it

The Sun and Moon have basic patterns (e.g., the Sun appears every day and the Moon appears sometimes at night and sometimes during the day; the Sun and Moon appear to move from east to west across the sky; the Moon appears to change shape over the course of a month; the Sun's position in the sky changes through the seasons). (M)

The stars are innumerable, unevenly dispersed, and of unequal brightness. (M)

The Earth moves round the Sun taking about a year for one orbit. (H)

The moon orbits the Earth taking about four weeks to complete an orbit. (H)

The Sun, at the centre of the solar system, is the only object in this solar system that is a source of visible light. (H)

Form of Earth

Earth materials consist of solid rocks, soils, liquid water, and the gases of the atmosphere. (M)

The solid material beneath the soil is rock. (H)

Rocks come in many different shapes and sizes (e.g., boulders, pebbles, sand). (M)

Much of the solid surface of the Earth is covered by soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. (H)

Earth's resources, including water, are used in a variety of ways. (A)

Phase 3

Year 4, Year 5

Weather, Seasons & Cycles

Water exists in the air in different forms (e.g., in clouds as fog as tiny droplets; in rain, snow and hail) and changes from one form to another through various processes (e.g., freezing, condensation, precipitation, evaporation). (M)

The Sun provides the light and heat necessary to maintain the temperature of the Earth. (M)

Air is a substance that surrounds us, takes up space, and moves around us as wind. (M)

Weather is determined by the conditions of the air. (H)

The temperature, pressure, direction and speed of movement and the amount of water vapour in the air combine to create the weather. (H)

Measuring these properties over time enables patterns to be found that can be used to predict the likelihood of different kinds of weather. (H)

The tilt of the Earth's axis gives rise to the seasons. (H)

Form of the Universe and Earth's place in it

The Earth rotates about an axis lying north to south and this motion makes it appear that the Sun, Moon and stars are moving round the Earth. (H)

Earth's rotation causes day and night as parts of the Earth's surface turn to face towards or away from the Sun. (H)

It takes a year for the Earth to pass round the Sun. (H)

The Earth is one of several planets that orbit the Sun and the Moon orbits the Earth. (M)

The patterns of stars in the sky stay the same, although they appear to slowly move from east to west across the sky nightly and different starts can be seen in different seasons. (M)

The Moon reflects light from the Sun and as it moves round the Earth. Only those parts illuminated by the Sun are seen, which accounts for the changes in how it appears at different times. (H)

The Earth's axis is tilted relative to the plane of its orbit round the Sun so that the length of day varies with position on the Earth's surface and time of the year. (H)

The Earth is one of eight (so far known) planets in our solar system that, along with many other smaller bodies, orbit the Sun, in roughly circular paths, at different distances from the Sun and taking different times to complete an orbit. (H)

Form of Earth

The Earth's surface changes over time as a result of natural processes and human activity (ACR) (e.g., mining, quarrying, weathering, erosion, transport and deposition of sediment caused by waves, wind, water, and ice; rapid processes, such as landslides, volcanic eruptions, and earthquakes). (M)

There are many different kinds of rock with different composition and particles. (H)

Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time. (M) [Living things]

Fertile soil also contains air, water, some chemicals from the decay of living things, particularly plants, and various other living things such as insects, works and bacteria. (H) [Living things]

Phase 4

Year 6

Weather, Seasons & Cycles

There are processes involved in the water cycle (e.g., evaporation, condensation, precipitation, surface run-off, percolation), which have effects on climatic patterns. (M)

The Sun is the principle energy source for phenomena on the Earth's surface (e.g., winds, ocean currents, the water cycle, plant growth). (M)

Factors can impact the Earth's climate (e.g., changes in the composition of the atmosphere; changes in ocean temperature; geological shifts such as meteor impacts, the advance or retreat of glaciers, or a series of volcanic eruptions). (M)

The tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns (i.e., heat falls more intensely on one part or another of the Earth's surface during its revolution around the Sun). (M)

There are ways in which clouds affect weather and climate (e.g., precipitation, reflection of light from the Sun, retention of heat energy emitted from the Earth's surface). (M)

Most of the Earth's surface is covered by water, most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers. (M)

Form of Earth

Sudden geological changes or extreme weather conditions can affect Earth's surface. (A)

The action of wind and water wears down rock gradually into smaller pieces - sand is made of small pieces of rock and mud of still smaller pieces. (H)

Landforms are created through a combination of constructive and destructive forces (e.g., constructive forces such as crustal deformation, volcanic eruptions, and deposition of sediment; destructive forces such as weathering and erosion). (M)

The Earth is composed of different layers that change due to pressure (H) i.e. including a core, mantle, lithosphere, hydrosphere, and atmosphere. (M)

The Earth's crust is divided into plates that move at extremely slow rates in response to movements in the mantle. (M)

Form of the Universe and Earth's place in it

Planets in our Solar System have unique characteristics and movement patterns (e.g., planets differ in size, composition, and surface features; planets move around the Sun in elliptical orbits; some planets have moons, rings of particles, and other satellites orbiting them). (M)

The regular and predictable motions of the Earth and Moon explain phenomena on Earth (e.g., the day, the year, phases of the Moon, eclipses, tides, shadows). (M)

Gravitational force keeps planets in orbit around the Sun and moons in orbit around the planets. (M)[Forces and energy]

Movements of objects within the solar system are mostly regular and predictable. (H)

The layer of air at the Earth's surface is transparent to most of the radiation coming from the Sun, which passes

through it. (H)

This radiation, absorbed at its surface, is the Earth's external source of energy. (H)

Radioactive decay of material inside the Earth since it was formed is its internal source of energy. (H)

Radiation from the Sun provides the energy for plants containing chlorophyll to make glucose through the process of photosynthesis. (H).

The radiation from the Sun absorbed by the Earth warms the surface that then emits radiation of longer wavelengths (infra-red) that does not pass through the atmosphere but is absorbed by it and keeps the Earth warm. This is called the greenhouse effect. (H)

Oxygen in the atmosphere, produced by plants during photosynthesis, indirectly protects Earth from the short wave (ultra-violet) part of the Sun's radiation which is harmful to man organisms (H).

The action of ultra-violet radiation on oxygen in the upper atmosphere produces ozone thus absorbing this harmful radiation. (H)

Certain chemicals resulting from human actions on Earth can break down ozone in the atmosphere. (H)

FORCES AND ENERGY

The study of energy, its origins, storage and transfer, and the work it can do; the study of forces; the application of scientific understanding through inventions and machines.
Related concepts:energy, dynamic equilibrium, cycles, conservation of energy, efficiency, equilibrium, forms of energy (electricity, heat, kinetic, light, potential, sound), magnetism, mechanics, physics, pollution, power, technical advances, transformation of energy
Objects can affect other objects at a distance (H)
Some objects have an effect on other objects at a distance. In some cases, such as sound and light, the effect is through radiation which travels out from the source to the receiver. In other cases action at a distance is explained in terms of the existence of a field of force between objects, such as a magnetic field or the universal gravitational field.
Changing the movement of an object requires a net force to be acting on it. (H)
Objects change their velocity only if there is net force acting on them. Gravity is a universal force of attraction between all objects however large or small, keeping the planets in orbit round the Sun and causing terrestrial objects to fall towards the centre of the Earth. (H3)
The total amount of energy in the Universe is always the same but energy can be transformed (or transferred) when things change or are made to happen. (H)
Many processes or events involve changes and require energy to make them happen. Energy can be transferred from one body to another in various ways. In these processes some energy is changed to a form that is less easy to use. Energy cannot be created or destroyed. Energy obtained from fossil fuels is no longer available in a convenient form for use. (H4) Energy flows; matter cycles.
Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms (H) ** also under Living Things strand

Phase 1

K1, K2, Year 1

Magnetism

Objects can have an effect on other objects even when they are not in contact with them. (H)

Magnets can be used to make some things move without being touched. (V)

Forces and motion

Forces can push, pull or twist objects, making them change their shape or motion. (H)

The way objects move depends on a variety of factors, including their size and shape. (A)

Objects move and can be moved in a number of ways (e.g., straight, zig zag, round and round, back and forth, and fast and slow, pushing, pulling, twisting, sinking). (M)

Energy

Energy is needed to make things change or move. (H)

Light, sound and heat are examples of energy.

Phase 2

Year 2, Year 3

Magnetism

Objects can have an effect on other objects even when they are not in contact with them. (H)

Magnets can be used to make some things move without being touched. (V)

Gravity

When things that are unsupported fall downwards they are being pulled by the attraction of the Earth, which holds all things on the Earth. (H)

Objects near the Earth fall to the ground unless something holds them up. (M)

Forces and motion

When forces acting on an object are not equal and opposite in direction, their resulting effect is to change the object's motion, to speed it up or slow it down. Conversely, things only change their motion if there is a net force acting on them.

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

Forces can be exerted by one object on another through direct contact or from a distance. (A)

Forces cause changes in speed or direction of motion. (V)

Forces cause changes in position and the shape of an object. (M)

Energy

Energy is needed to make things change and in the process of change, energy is transformed from one form to another (H)

An object which transfers energy to something else is called a source of energy. (H)

The Sun supplies heat and light to Earth (M)

Heat can be produced in many ways (e.g., burning, rubbing, mixing substances together) (M)

Energy cannot be created or destroyed. (H)

Energy can be transported by radiation, as sound in air or light in air or a vacuum (H)

Light and sound are produced by a range of sources (light: sun, stars, fire, artificial sources, etc.; sound: musical instruments, vocal cords, a door closing, etc.) and can be sensed (A)

Sound is produced by vibrating objects (M)

Light travels in a straight line until it strikes an object (M)

There are different forms of energy: chemical, kinetic, potential, mechanical, heat, light, sound and magnetic energy (H)

There are different ways of classifying energy: • Kinetic, potential • Heat, light, sound • Mechanical, elastic. magnetic

Phase 3

Year 4, Year 5

Magnetism

Magnets can pull things made of iron and attract or repel other magnets without touching them. (H)

Gravity

The Earth's gravity pulls any object toward it without touching it

The pull downward that makes an object fall when released is also the result of attraction at a distance between the object and the Earth. (H)

An object that stays at rest on/near the surface of the Earth has one or more forces acting on it counter balancing the force of gravity. (H)

Forces and motion

When forces acting on an object are not equal and opposite in direction, their resulting effect is to change the object's motion, to speed it up or slow it down. Conversely, things only change their motion if there is a net force acting on them.

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

Forces can be exerted by one object on another through direct contact or from a distance. (A)

Forces cause changes in speed or direction of motion. (V)

Forces cause changes in position and the shape of an object. (M)

Energy

There are different forms of energy: chemical, kinetic, potential, mechanical, heat, light, sound and magnetic energy. (H)

Energy can be transformed from one form to another. (H)

Energy can be stored in different ways (e.g. batteries or food). (H)

Energy can be conserved and used efficiently. (energy conservation is the act of using less energy or saving energy [like turning your lights off or setting your thermostat lower; energy efficiency describes products and actions that use less energy due to advanced technology and equipment.

There are renewable and non-renewable sources of energy.

Heat is always produced as a byproduct when one form of energy is converted to another form. (M)

Heat can move from one object to another by conduction. (M)

Light can be reflected, refracted, or absorbed. (M)

The pitch of a sound depends on the frequency of the vibration producing it. (M)

Electricity in circuits can produce light, heat, sound and magnetic effects. (M)

Phase 4

Year 6

Magnetism

There is an attraction and repulsion between objects that are electrically charged. (H)

Gravity

There is a gravitational force between all objects, which depends on their mass and distance apart. It is only felt when one or more of the objects has a very large mass, as in the case of the Earth pulling things towards it. (H)

An object that is not being subjected to a force will continue to move at a constant speed and in a straight line. (M)

Forces and motion

Change in motion is caused by unbalanced forces. If no net force is acting any motion will not change; the object will remain stationary or, if in motion, go on forever in a straight line (e.g., stars in the sky).

When opposing forces acting on a solid object are not in the same line, they act to turn or twist the object. (H)

An object's motion can be described by tracing and measuring its position over time. (M)

Friction always opposes motion and causes changes in the speed or direction of an object's motion. (M)

There is a relationship between the strength of a force and its effect on an object (e.g., the greater the force, the greater the change in motion; the more massive the object, the smaller the effect of a given force). (M)

Energy

Energy can be transferred from one system to another or from a system to its environment in different ways

Energy appears in different forms and can be transformed within a system.

Light travels and tends to maintain its direction of motion until it interacts with an object or material.

Electrical circuits provide a means of transferring and transforming electricity. (A)

Materials vary in how they respond to electric currents, magnetic forces, and visible light or other electromagnetic waves. (V)

Energy from a variety of sources, both renewable and non-renewable, can be used to generate electricity (A)

Energy passes through ecosystems. When food is used by organisms for life processes some is dissipated as heat but is replaced in the ecosystem by energy from the Sun being used to produce plant food. (H)[connection to ‘Living Things']

Energy flows; matter cycles.

Light and other electromagnetic waves can warm objects. (V)

LIVING THINGS

The study of the characteristics, systems and behaviours of humans and other animals, and of plants; the interactions and relationships between and among them, and with their environment.
Related concepts: adaptation, animals, biodiversity, biology, classification, conservation, cycles, dynamic equilibrium, ecosystems, evolution, genetics, growth, habitat, homeostasis, organism, plants, systems (digestive, nervous, reproductive, respiratory).
Organisms are organised on a cellular basis.
All organisms are constituted of one or more cells [link to 'Materials & Matter']. Multi-cellular organisms have cells that are differentiated according to their function. All the basic functions of life are the result of what happens inside the cells which make up an organism. Growth is the result of multiple cell divisions.
Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
Food provides materials and energy for organisms to carry out the basic functions of life and to grow. Some plants and bacteria are able to use energy from the Sun to generate complex food molecules. Animals obtain energy by breaking down complex food molecules and are ultimately dependent on green plants for energy. In any ecosystem there is competition among species for the energy and materials they need to live and reproduce.
Genetic information is passed down from one generation of organisms to another.
Genetic information in a cell is held in the chemical DNA in the form of a four-letter code. Genes determine the development and structure of organisms. In asexual reproduction all the genes in the offspring come from one parent. In sexual reproduction half of the genes come from each parent.
The diversity of organisms, living and extinct, is the result of evolution.
All life today is directly descended from a universal common ancestor that was a simple one-celled organism. Over countless generations changes resulted from natural diversity within a species which makes possible the selection of those individuals best suited to survive under certain conditions. Organisms not able to respond sufficiently to changes in their environment become extinct.

Phase 1

K1, K2, Year 1

Heredity

Living things produce offspring of the same kind, but in many cases offspring are not identical with each other or their parents. (H)

Plants can reproduce in different ways (e.g. cuttings).

Life cycles are different for different organisms. (M)

Form and function of cells and organisms

Living things (organisms) are distinguished from non-living things by their ability to move, reproduce and react to certain stimuli. (H)

Living things go through a process of growth and change. (M)

Most living things need water, food and air.

Plants need light to grow.

Living things respond to stimuli (i.e. senses help people respond to danger, plants grow toward light).

Cycles and systems

Plants and animals need certain resources for energy and growth (e.g., food, water, light, air, temperature conditions). (M)

Animals eat plants or other animals for food. (V)

Living things are found in certain environments because they have features that enable them to survive there. (H)

Evolution and adaptation

There are many different kinds of plants and animals in the world today and many kinds that once lived but are now extinct. We know about these from fossils. (H)

Living things can be grouped (e.g., by appearance, behaviour, plant, animal). (M)

Phase 2

Year 2, Year 3

Heredity

Living things produce offspring of the same kind, but in many cases offspring are not identical with each other or their parents. (H)

Plants can reproduce in different ways (e.g. cuttings).

Life cycles are different for different organisms. (M)

Form and function of cells and organisms

Living things need water, air, food and a way of getting rid of waste and an environment which stays within a particular range of temperature in order to survive. (H)

Plants and animals have features that help them live in different environments. (M)

Characteristics of living things include movement, respiration, sensitivity, growth, reproduction, excretion, nutrition and death.

Life cycles are different for different organisms. (M)

Cycles and systems

Plants containing chlorophyll can use sunlight to make the food they need and store food that they do not immediately use. (H)

Animals need food they can break down and which comes either directly by eating plants (herbivores) or by eating animals (carnivores), which have eaten plants, or other animals, or both plants and animals (omnivore). (H)

Some source of "energy" is needed for all organisms to stay alive and grow. (V) [Energy]

From food, people obtain energy and materials for body repair and growth. (V) [Energy]

Living things are found almost everywhere in the world and that distinct environments support the life of different types of plants and animals. (M)

Plants and animals have features that help them live in different environments. (M)

Evolution and adaptation

Animals and plants are classified into groups and subgroups according to their similarities. Within groups of animals there are families and different species within these families. (H)

Human activity can impose far-reaching effects on the environment. (H)

Some kinds of organisms that once lived on Earth have completely disappeared (e.g., dinosaurs, trilobites, mammoths, horsetail trees). (M)

Phase 3

Year 4, Year 5

Heredity

Plants and animals (including humans) resemble their parents in many features because information is passed from one generation to the next.

Features such as skills and behaviours are not passed in same way and must be learned. (H)

Differences exist among individuals of the same kind of plant or animal. (M)

Form and function of cells and organisms

In the human body, systems carry out the key functions of respiration, digestion, reproduction, elimination of waste and temperature control, working together to meet our basic needs. (H/OT)

The brain gets signals from all parts of the body telling what is going on there. The brain also sends signals to parts of the body to influence what they do. (V)

The behaviour of individual organisms is influenced by internal cues (e.g., hunger) and external cues (e.g., changes in the environment), and that humans and other organisms have sense that help them to detect these cues. (M)

Cycles and systems

Animals are ultimately dependent on plants for their survival. (H)

The relationship among organisms can be represented as food chains and food webs (e.g., green plants make their own food with sunlight, water, and air; some animals eat the plants; some animals eat the animals that eat the plants). (H/M)

Some animals are dependent on plants for food, shelter or in the case of humans, clothing and fuel. (H)

The transfer of energy (e.g., through the consumption of food) is essential to all living organisms. (M)

An organism's patterns of behaviour are related to the nature of that organism's environment (e.g., kinds and numbers of other organisms present, availability of food and resources, physical characteristics of the environment). (M)

Changes in the environment can have different effects on different organisms (e.g., some organisms move in, others move out; some organisms survive and reproduce, others die). (M)

All organisms (including humans) cause changes in their environments, and these changes can be beneficial or detrimental. (M)

Plants also depend on animals in various ways. For example, flowering plants may depend on insects for pollination and on other animals for dispersing their seeds.(H)

Evolution and adaptation

The adaptation of living things 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. (H)

In the competition for materials and energy, those that are better adapted will survive and may pass on their adapted feature to their offspring. (H)

The effect of human activity on the environment has already resulted in changes that are damaging to many organisms. (H)

Patterns of human development are similar to those of other vertebrates. (V)

Phase 4

Year 6

Heredity

Reproduction is a characteristic of all living things and is essential to the continuation of a species. (M)

In sexual reproduction, a sperm from a male unites with an egg from a female. These are specialised cells each of which has one of the two versions. (H)

The characteristics of an organism can be described in terms of a combination of traits; some traits are inherited through the coding of genetic material and others result from environmental factors. (M)

Form and function of cells and organisms

All living things are made of one or more cells. All the basic functions of life are the result of what happens inside cells. (H)

Different body tissues and organs are made up of different kinds of cells. Some cells are specialised e.g. muscle, blood and nerve cells which carry out specific functions within the organism. (V/H)

Cells divide to make more cells in growth, repair and in reproduction and they extract energy from food in order to carry out these and other functions. (H)

Cycles and systems

Interdependent organisms living together in particular environmental conditions form an ecosystem. In a stable ecosystem there are producers of food (plants), consumers (animals) and decomposers, which are bacteria and fungi that feed on waste products

In stable ecosystems there are producers (plants), consumers (animals) and decomposers (bacteria and fungi that feed on waste products and dead organisms). (H)

Decomposers produce materials that help plants to grow, so molecules are constantly re-used. Energy passes through the ecosystem. When organisms use food some is dissipated as heat, but replaced in the ecosystem by energy from the Sun being used to produce plant food. (H) Energy flows; matter cycles.

In any given ecosystem there is competition among species for the energy and materials they need to live. The persistence of an ecosystem depends on the continued availability of these materials in the environment. (H)

Plant species have adaptations to obtain the water, light, minerals and space they need to grow and reproduce in particular locations. If conditions change, the plant populations may change, resulting in change of animal populations. (H)

Evolution and adaptation

Biodiversity includes diversity of individuals, species, and ecosystems. (OT)

Those less suited to a particular environment may die before reproducing, so later generations will contain more of the better adapted individuals. This only occurs if the changes result from mutations (changes) in the reproductive cells. Changes in other cells are not passed on. (H)

Maintaining diversity of species and within species is important. A reduction in the diversity of life can lead to significant ecosystem degradation and loss of ability to respond to changes in the environment. (H)

MATERIALS AND MATTER

The study of the properties, behaviours and uses of materials, both natural and human-made; the origins of human-made materials and how they are manipulated to suit a purpose.
Related concepts:changes of state, chemical and physical changes, conduction and convection, density, gases, liquids, properties and uses of materials, solids, structures, sustainability
All material in the Universe is made up of very small particles.
Atoms are the building blocks of all materials, living and non-living [link to 'Living Things']. The behaviour of the atoms explains the properties of different materials. Chemical reactions involve rearrangement of atoms in substances to form new substances.

Phase 1

K1, K2, Year 1

Materials and matter

Different materials are recognisable by their properties, some of which are used to classify them as solids, liquids or gases. (H)

Observable properties of objects can be described (e.g., colour, shape, size). (M)

Objects can be sorted based on observable properties. (M)

The physical properties of things can change. (M)

Everyday materials can be physically changed in a variety of ways. (A)

Phase 2

Year 2, Year 3

Materials and matter

Different objects are made up of many different types of materials (e.g., cloth, paper, wood, metal) and have many different observable properties (e.g., color, size, shape, weight). (M)

All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called material (matter) because it has mass and takes up space. (H)

Things can be done to materials to change some of their properties (e.g., heating, freezing, mixing, cutting, dissolving, bending), but not all materials respond the same way to what is done to them. (M, V)

Different materials can be combined, including by mixing, for a particular purpose. (A)

Phase 3

Year 4, Year 5

Materials and matter

Substances can be classified by their physical and chemical properties (e.g., magnetism, conductivity, density, solubility, boiling and melting points). (M)

Matter has different states (i.e., solid, liquid, gas) and each state has distinct physical properties; some common materials such as water can be changed from one state to another by heating and cooling. (M)

When some materials are combined they form a new material with different properties than the original materials; other materials simply mix without changing permanently and can be separated again.

The mass of a material remains constant whether it is together, in parts, or in a different state. (M) Matter cannot be created or destroyed.

Natural and processed materials have a range of physical properties; these properties can influence their use. (A)

Phase 4

Year 6

Materials and matter

The differences between solids, liquids and gases can be explained in terms of the movement of particles and the separation and strength of the attraction between neighbouring particles. (H)

The stronger the force of attraction between the particles the more energy is needed to separate them, for example in going from a solid to a liquid form or from a liquid to a gas. This is why materials have different melting and boiling points. (H)

The smallest piece of a material is called an atom. (H)

Chemical change implies the formation of a new substance. (OT)

Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. (A)