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 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 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 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 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 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 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 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 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 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 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 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 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)