

# 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 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**

## 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 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.**

## 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 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**

## 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 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.**

## 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 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)**

## 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 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.**

## 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 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.**

**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 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.**



## 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 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 stars 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, worms and bacteria. (H) [Living things]

## 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 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)

## 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 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)

## 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 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)