NSW SYLLABUS
for the Australian curriculum

BOARD OF STUDIES
NEW SOUTH WALES

SCIENCE K–10
(incorporating Science and Technology K–6)
SYLLABUS

Published by
Board of Studies NSW

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CONTENTS

QUESTIONING AND PREDICTING

OUTCOME

A student:

› develops questions or hypotheses to be investigated scientifically SC5-4WS

Related Life Skills outcome: *SCLS-4WS*

CONTENT

WS4 Students question and predict by:

a. formulating questions or hypotheses that can be investigated scientifically (ACSIS164, ACSIS198)

b. predicting outcomes based on observations and scientific knowledge

PLANNING INVESTIGATIONS

OUTCOME

A student:

› produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively SC5-5WS

Related Life Skills outcome: *SCLS-5WS*

CONTENT

WS5.1 Students identify data to be collected for an investigation by:

a. describing the purpose of an investigation

b. explaining why certain types of information need to be collected in a range of investigation types

c. selecting possible sources of data, including secondary sources, relevant to the investigation

d. justifying why variables need to be kept constant if reliable first-hand data is to be collected in controlled experiments

WS5.2 Students plan first-hand investigations by:

a. planning and selecting appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (ACSIS165, ACSIS199)

b. describing a logical procedure for undertaking a range of investigation types

c. designing controlled experiments to collect valid first-hand data

d. specifying the dependent and independent variables for controlled experiments

e. accounting for the use of an experimental control as appropriate

WS5.3 Students choose equipment or resources for an investigation by:

a. identifying appropriate equipment and materials

b. identifying the appropriate units to be used in collecting data

c. selecting equipment to collect and record reliable data or information, using digital technologies as appropriate, eg data loggers

d. assessing risks and addressing ethical issues associated with these methods (ACSIS165, ACSIS199)

CONDUCTING INVESTIGATIONS

OUTCOME

A student:

› undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively SC5-6WS

Related Life Skills outcome: *SCLS-6WS*

CONTENT

WS6 Students conduct investigations by:

a. individually and collaboratively using appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (ACSIS165, ACSIS199)

b. safely constructing, assembling and manipulating identified equipment

c. selecting and using appropriate equipment, including digital technologies, to systematically and accurately collect and record data (ACSIS166, ACSIS200)

d. using appropriate units for measuring physical quantities

e. reporting data and information, evidence and findings, with accuracy and honesty

f. evaluating the effectiveness of the planned procedure, considering risk factors and ethical issues, and suggesting improvements as appropriate

PROCESSING AND ANALYSING DATA AND INFORMATION

OUTCOME

A student:

› processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions SC5-7WS

Related Life Skills outcome: *SCLS-7WS*

CONTENT

WS7.1 Students process data and information by:

a. selecting and using a variety of methods to organise data and information including diagrams, tables, models, spreadsheets and databases

b. selecting and extracting information from tables, flow diagrams, other texts, audiovisual resources and graphs, including histograms and column, sector or line graphs

c. accessing data and information by using a range of appropriate digital technologies

d. applying numerical procedures and mathematical concepts and using digital technologies, where appropriate

e. identifying data which supports or discounts a question or hypothesis being investigated or a proposed solution to a problem

f. describing specific ways to improve the quality of the data (ACSIS171, ACSIS205)

WS7.2 Students analyse data and information by:

a. analysing patterns and trends, including identifying inconsistencies in data and information (ACSIS169, ACSIS203)

b. describing relationships between variables (ACSIS169, ACSIS203)

c. assessing the validity and reliability of first-hand data

d. using knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170, ACSIS204)

e. synthesising data and information to develop evidence-based arguments

f. evaluating conclusions and evidence, including identifying sources of uncertainty and possible alternative explanations (ACSIS171, ACSIS205)

g. critically analysing the validity of information from secondary sources (ACSIS172, ACSIS206)

PROBLEM SOLVING

OUTCOME

A student:

› applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems SC5-8WS

Related Life Skills outcome: *SCLS-8WS*

CONTENT

WS8 Students solve problems by:

a. describing strategies to develop a range of possible solutions to an identified problem

b. assessing strategies that have been identified as possible solutions to an identified problem

c. applying the processes of Working Scientifically in developing creative solutions to problems

d. using cause-and-effect relationships to explain ideas

e. using models to explain phenomena and make predictions

f. applying critical thinking in considering suggested proposals, solutions and conclusions, including a consideration of risk

g. evaluating different approaches used to solve problems (ACSIS172, ACSIS206)

COMMUNICATING

OUTCOME

A student:

› presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations SC5-9WS

Related Life Skills outcome: *SCLS-9WS*

CONTENT

WS9 Students communicate by:

a. selecting and using in presentations, for different purposes and contexts, appropriate text types including discussions, explanations, expositions, procedures, recounts or reports

b. selecting and constructing an appropriate table, type of diagram, table or graph (histogram or sector, column or line graph) to present information and show relationships clearly and succinctly using digital technologies as appropriate

c. using appropriate units for physical quantities and symbols to express relationships, including mathematical ones

d. proposing ideas that demonstrate coherence and logical progression

e. presenting scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations for specific audiences (ACSIS174, ACSIS208)

PHYSICAL WORLD

OUTCOMES

A student:

- applies models, theories and laws to explain situations involving energy, force and motion SC5-10PW
- explains how scientific understanding about energy conservation, transfers and transformations is applied in systems SC5-11PW

Related Life Skills outcomes: *SCLS-10PW*, *SCLS-11PW*, *SCLS-12PW*

CONTENT

PW1 Energy transfer through different mediums can be explained using wave and particle models. (ACSSU182)

Students:

a. explain, in terms of the particle model, the processes underlying convection and conduction of heat energy

b. identify situations where waves transfer energy

c. describe qualitatively, using the wave model, the features of waves including wavelength, frequency and speed

d. explain, using the particle model, the transmission of sound in different mediums

e. relate the properties of different types of radiation in the electromagnetic spectrum to their uses in everyday life, including communications technology

f. describe the occurrence and some applications of absorption, reflection and refraction in everyday situations

PW2 The motion of objects can be described and predicted using the laws of physics. (ACSSU229)

Students:

a. describe qualitatively the relationship between force, mass and acceleration

b. explain qualitatively the relationship between distance, speed and time

c. relate acceleration qualitatively to a change in speed and/or direction as a result of a net force

d. analyse qualitatively everyday situations involving motion in terms of Newton's laws

PW3 Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity.

Students:

a. describe voltage, current and resistance in terms of energy applied, carried and dissipated

b. describe qualitatively the relationship between voltage, resistance and current

c. compare the characteristics and applications of series and parallel electrical circuits

d. outline recent examples where scientific or technological developments have involved specialist teams from different branches of science, engineering and technology, eg low-emissions electricity generation and reduction in atmospheric pollution

PW4 Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

Students:

a. apply the law of conservation of energy to account for the total energy involved in energy transfers and transformations

b. describe how, in energy transfers and transformations, a variety of processes can occur so that usable energy is reduced and the system is not 100% efficient

c. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230)

d. discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources

Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- investigate quantitatively, features of waves including frequency, wavelength and speed using $v = f\lambda$ and relate this to musical instruments
- relate scattering and dispersion of light to everyday occurrences
- explain the difference between speed and velocity
- describe the relationships between displacement, time, velocity and acceleration, using the equations of motion
- relate quantitatively, force, mass and acceleration, and apply to everyday situations
- apply Newton's laws of motion to space travel
- compare energy changes in interactions in sport activities
- explain the relationship between resistance, voltage and current, using Ohm's Law
- investigate the energy efficiency of appliances and relate this to a household energy account
- research how engineers and architects employ scientific concepts and principles in designing energy-efficient devices and buildings

EARTH AND SPACE

OUTCOMES

A student:

- describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community SC5-12ES
- explains how scientific knowledge about global patterns of geological activity and interactions involving global systems can be used to inform decisions related to contemporary issues SC5-13ES

Related Life Skills outcomes: *SCLS-13ES*, *SCLS-14ES*, *SCLS-15ES*, *SCLS-16ES*

CONTENT

ES1 Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. (ACSHE157, ACSHE191)

Students:

a. outline some of the major features contained in the universe, including galaxies, stars, solar systems and nebulae (ACSSU188)

b. describe, using examples, some technological developments that have advanced scientific understanding about the universe

c. use appropriate scales to describe differences in sizes of and distances between structures making up the universe

d. identify that all objects exert a force of gravity on all other objects in the universe

e. use scientific evidence to outline how the Big Bang theory can be used to explain the origin of the universe and its age (ACSSU188)

f. outline how scientific thinking about the origin of the universe is refined over time through a process of review by the scientific community

ES2 The theory of plate tectonics explains global patterns of geological activity and continental movement. (ACSSU180)

Students:

a. outline how the theory of plate tectonics changed ideas about the structure of the Earth and continental movement over geological time

b. relate movements of the Earth's plates to mantle convection currents and gravitational forces

c. outline how the theory of plate tectonics explains earthquakes, volcanic activity and formation of new landforms

d. describe how some technological developments have increased scientific understanding of global patterns in geological activity, including in the Asia-Pacific region

ES3 People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the atmosphere, biosphere, hydrosphere and lithosphere. (ACSHE160, ACSHE194)

Students:

a. outline how global systems rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere, including the carbon cycle (ACSSU189)

b. describe some impacts of natural events, including cyclones, volcanic eruptions or earthquakes, on the Earth's spheres

c. evaluate scientific evidence of some current issues affecting society that are the result of human activity on global systems, eg the greenhouse effect, ozone layer depletion, effect of climate change on sea levels, long-term effects of waste management and loss of biodiversity

d. discuss the reasons different groups in society may use or weight criteria differently to evaluate claims, explanations or predictions in making decisions about contemporary issues involving interactions of the Earth's spheres

Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- relate colours of stars to their age, size and distance from the Earth
- describe evidence used to support estimates of time in the universe
- describe some recent contributions made by Australian scientists in the exploration and study of the universe
- discuss technological developments that have extended the ability of scientists to collect information about, and monitor events in, the natural world
- research evidence relating global warming to changes in weather patterns, including El Niño and La Niña
- examine the factors that drive deep ocean currents, their role in regulating climate and their effects on marine life
- research how computer modelling has improved knowledge and predictability of phenomena, eg atmospheric pollution, ocean salinity and climate change
- discuss the development and implications of international agreements relating to biodiversity and climate change, eg the original 1987 Montreal Protocol, 1992 United Nations Conference on Environment and Development, 1997 Kyoto Protocol and the 2009 United Nations Climate Change Conference
- outline examples where advances in science and emerging science and technologies significantly affect people's lives, including generating new career opportunities in areas such as astrophysics, geophysics, space science and vulcanology

LIVING WORLD

OUTCOMES

A student:

- analyses interactions between components and processes within biological systems SC5-14LW
- explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society SC5-15LW

Related Life Skills outcomes: *SCLS-17LW*, *SCLS-18LW*, *SCLS-19LW*, *SCLS-20LW*, *SCLS-21LW*

CONTENT

LW1 Multicellular organisms rely on coordinated and interdependent internal systems to respond to changes in their environment. (ACSSU175)

Students:

a. describe some examples of how multicellular organisms respond to changes in their environment

b. describe how the coordinated function of internal systems in multicellular organisms provides cells with requirements for life, including gases, nutrients and water, and removes cell wastes

c. outline some responses of the human body to infectious and non-infectious diseases

d. describe the role of, and interaction between, the coordination systems in maintaining humans as functioning organisms

e. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research, eg the occurrence of diseases affecting animals and plants, an epidemic or pandemic disease in humans or lifestyle related non-infectious diseases in humans

LW2 Conserving and maintaining the quality and sustainability of the environment requires scientific understanding of interactions within, the cycling of matter and the flow of energy through ecosystems.

Students:

a. recall that ecosystems consist of communities of interdependent organisms and abiotic components of the environment (ACSSU176)

b. outline using examples how matter is cycled through ecosystems such as nitrogen (ACSSU176)

c. describe how energy flows through ecosystems, including input and output through food webs (ACSSU176)

d. analyse how changes in some biotic and abiotic components of an ecosystem affect populations and/or communities

e. assess ways that Aboriginal and Torres Strait Islander peoples' cultural practices and knowledge of the environment contribute to the conservation and management of sustainable ecosystems

f. evaluate some examples in ecosystems, of strategies used to balance conserving, protecting and maintaining the quality and sustainability of the environment with human activities and needs

LW3 Advances in scientific understanding often rely on developments in technology, and technological advances are often linked to scientific discoveries. (ACSHE158, ACSHE192)

Students:

a. relate the organs involved in human reproductive systems to their function

b. identify that during reproduction the transmission of heritable characteristics from one generation to the next involves DNA and genes (ACSSU184)

c. identify that genetic information is transferred as genes in the DNA of chromosomes

d. outline how the Watson-Crick model of DNA explains:

- the exact replication of DNA
- changes in genes (mutation)

e. describe, using examples, how developments in technology have advanced biological understanding, eg vaccines, biotechnology, stem-cell research and in-vitro fertilisation

f. discuss some advantages and disadvantages of the use and applications of biotechnology, including social and ethical considerations

LW4 The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. (ACSSU185)

Students:

a. describe scientific evidence that present-day organisms have evolved from organisms in the past

b. relate the fossil record to the age of the Earth and the time over which life has been evolving

c. explain, using examples, how natural selection relates to changes in a population, eg in the development of resistance of bacteria to antibiotics and insects to pesticides

d. outline the roles of genes and environmental factors in the survival of organisms in a population

Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- debate why any investigation relating to biological research and involving or affecting animals, must be humane, justified and ethical
- describe the range of functions carried out by some endocrine (hormonal) glands in humans
- investigate how models can be used to predict the changes in populations due to environmental changes, eg the impact of fire or flooding, introduction of a disease or predator
- discuss the strengths and limitations of using models to make predictions about changes in biological systems

- describe examples of advances in science and/or emerging science and technologies, in areas that involve biological science such as dentistry, environmental science, biomedical engineering, physiology, pharmaceuticals or nanotechnology
- assess the role of the development of fast computers in the analysis of DNA sequences
- research how information technology is applied in bioinformatics

CHEMICAL WORLD

OUTCOMES

A student:

- explains how models, theories and laws about matter have been refined as new scientific evidence becomes available SC5-16CW
- discusses the importance of chemical reactions in the production of a range of substances, and the influence of society on the development of new materials SC5-17CW

Related Life Skills outcomes: *SCLS-22CW*, *SCLS-23CW*, *SCLS-24CW*

CONTENT

CW1 Scientific understanding changes and is refined over time through a process of review by the scientific community.

Students:

a. identify that all matter is made of atoms which are composed of protons, neutrons and electrons (ACSSU177)

b. describe the structure of atoms in terms of the nucleus, protons, neutrons and electrons

c. outline historical developments of the atomic theory to demonstrate how models and theories have been contested and refined over time through a process of review by the scientific community

d. identify that natural radioactivity arises from the decay of nuclei in atoms, releasing particles and energy (ACSSU177)

e. evaluate the benefits and problems associated with medical and industrial uses of nuclear energy

CW2 The atomic structure and properties of elements are used to organise them in the Periodic Table. (ACSSU186)

Students:

a. identify the atom as the smallest unit of an element and that it can be represented by a symbol

b. distinguish between the atoms of some common elements by comparing information about the numbers of protons, neutrons and electrons

c. describe the organisation of elements in the Periodic Table using their atomic number

d. relate the properties of some common elements to their position in the Periodic Table

e. predict, using the Periodic Table, the properties of some common elements

f. outline some examples to show how creativity, logical reasoning and the scientific evidence available at the time, contributed to the development of the modern Periodic Table

CW3 Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed. (ACSSU178)

Students:

a. recall that all matter is composed of atoms and has mass

b. identify a range of compounds using their common names and chemical formulae

c. classify compounds into groups based on common chemical characteristics

d. investigate a range of types of important chemical reactions that occur in non-living systems and involve energy transfer, including:

   - combustion (ACSSU179)
   - the reaction of acids including metals and carbonates (ACSSU179)
   - corrosion
   - precipitation
   - neutralisation
   - decomposition

e. identify some examples of important chemical reactions that occur in living systems and involve energy transfer, including respiration and reactions involving acids such as occur during digestion (ACSSU179)

f. construct word equations from observations and written descriptions of a range of chemical reactions

g. deduce that new substances are formed during chemical reactions by rearranging atoms rather than creating or destroying them

CW4 Different types of chemical reactions are used to produce a range of products and can occur at different rates and involve energy transfer. (ACSSU187)

Students:

a. identify that chemical reactions involve energy transfer and can be exothermic or endothermic

b. compare combustion and respiration as types of chemical reactions that release energy but occur at different rates

c. describe the effects of factors, eg temperature and catalysts, on the rate of some common chemical reactions

d. analyse how social, ethical and environmental considerations can influence decisions about scientific research related to the development and production of new materials

e. describe examples to show where advances in science and/or emerging science and technologies significantly affect people's lives, including generating new career opportunities in areas of chemical science such as biochemistry and industrial chemistry (ACSHE161, ACSHE195)

Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- use models to describe the arrangement of electrons in the energy levels of common elements
- research the development of ideas about the nature of radioactivity
- investigate the order of activity of a range of metals

- balance a range of common chemical equations
- conduct flame tests and explain the colours in terms of subatomic structure
- research ways that are used to restore and prevent corrosion of submerged objects
- investigate the processes involved in the production of new materials from synthetic fibres
- evaluate, using scientific evidence, the claims, explanations or predictions made in the media or advertising in relation to a substance, material or product
- construct simple electrochemical cells using fruit and describe energy transfer
- research the structure of small portable electrochemical cells, eg mercury cells and rechargeable batteries