Stage 05

Physical World

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

Content Descriptor	Lesson Names
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, 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	*Properties of Light* • Light as a Wave • Colour • Materials • The Electromagnetic Spectrum • Electromagnetic Radiation and Medicine • You, Me and UV *Reflection and Refraction* • Reflection • Refraction • Refractive Index • Total Internal Reflection • Lenses • Drawing Ray Diagrams • Bionic Eyes • Curved Mirrors • Plane Mirrors and Reflection • Snell's Law • The History of Lenses • Light: Summary *Sound* • Sound Waves • Sound Formation • Pitch and Loudness • Australian Aboriginal Music • Ultrasound *Hearing* • Hearing Sound • Bionic Ears • Turned Down for What: Workplace Noise • The Tiny Toadlet's Conundrum

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

Content Descriptor	Lesson Names
a. describe the relationship between force, mass and acceleration b. explain the relationship between distance, speed and time c. relate acceleration to a change in speed and/or direction as a result of a net force d. analyse everyday situations involving motion in terms of Newton's laws	*Introduction to Motion* • Distance and Time • Displacement and Compass Directions • Calculating Displacement • Speed • Acceleration • Using the Acceleration Formula to Calculate Final Velocity • Using the Acceleration Formula to Calculate Initial Velocity • Using the Acceleration Formula to Calculate Time • Crashing Drones *Graphing Motion* • Distance-Time Graphs • Displacement-Time Graphs • Velocity-Time Graphs • Acceleration-Time Graphs • Summary of Motion Graphs • Graphing and Analysing Motion • Motion *Introduction to Forces* • Introduction to Forces • Types of Forces: Gravity • STEM: The Mass of an Email • Types of Forces: Magnetism and Friction • Weight and Mass • Extension: Earth's Magnetic Field • Focus on Data: Space Travel: The Weight Loss Sensation! • Friction • Pressure • Tides *Newton's Laws of Motion* • Newton's First Law • Comprehension: How Planes Stay Up • Newton's Second Law • Newton's Third Law • Rockets • Car Safety Systems

	• Car Safety Systems Investigation • History of Rockets • How BB-8 Works • Planetary Motion • Sports Science

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

Content Descriptor	Lesson Names
describe voltage, current and resistance in terms of energy applied, carried and dissipated b. describe 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	*Simple Circuits* • Electricity • Circuits • Resistance • Current • Voltage • Introduction to Ohm's Law • Batteries • Calculating Using Ohm's Law *Circuit Properties* • Circuits in Parallel • Comparing Circuits • War of the Currents • Conductors and Insulators • Circuits in Series • Development of Light Bulbs • The Sixth Sense: Electroreception

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

Content Descriptor	Lesson Names
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	*Heat Transfer* • Heat Transfer • Conduction • Convection • Focus on Data: The Speed of Heat Transfer • Radiation • Bushfires • Heat Transfer in the Atmosphere and the Oceans • The Cosmic Microwave Background

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	*Conductors and Insulators* • Conductors and Insulators • Housing Insulation *Energy Transfer and Transformation* • Energy Transformations • Introduction to Heat Transfer • Conductors and Insulators • Displaying Energy Transformations • Energy Transformation and Food • Cars of the Future • Law of Conservation of Energy • Types of Energy *Energy Efficiency* • Cogeneration and Engines • Energy Efficiency • Energy Efficient Houses • The Development of Flight • The Power Grid and You • Useful and Wasted Energy

Additional Content

Content Descriptor	Lesson Names
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	*Further development planned*

Earth and Space

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)

Content Descriptor	Lesson Names
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	*Introduction to the Universe* • The Solar System and Beyond • Models of the Solar System • Scientific Notation • Scientific Theory *Measuring the Universe* • Gravity • Light Speed • Light Years • Seconds and Years • Converting Light Years • Radar Ranging • Observing Space • Observing the Universe • Relativity *Galaxies and Stars* • The Life Cycle of Stars • Parallax and Distances Between Stars • Distances to Stars and Parsecs • Properties of Stars • Reading Hertzsprung-Russell Diagrams • Calculating Distance to Stars • The Secret Lives of Ultra-Cool Dwarf Stars • The James Webb Space Telescope • Black Holes • Life *Evidence for the Big Bang* • The Big Bang Theory • Cosmic Background Radiation • Red Shift • End of the Universe • Red Shift and the Expanding Universe • The Cosmic Microwave Background

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

Content Descriptor	Lesson Names
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	*Structure of the Earth* • Earth's Structure • Mechanical Layers of the Earth *Plate Tectonics* • Wegener's Theory of Continental Drift • Plate Tectonics • Faults • Extension: Earth's Magnetic Field • Ice Tectonics on Europa • Plate Boundaries • Plate Tectonics • Seafloor Spreading & Magnetic Striping • Subduction Zones and Ophiolite Belts *Tectonic Events* • Volcano Formation • Types of Lava • Volcanic Hazards • Earthquakes • Measuring Earthquakes • Seismic Hazards • Understanding Megaquakes • Volcano Exploration Robots • Volcanoes and Earthquakes *Geological History* • The Geological Timescale • Developing the Geological Timescale • Supercontinents • The Time Traveller's Holiday Guide!

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

Content Descriptor	Lesson Names
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	*Spheres and Global Cycles* • Spheres • Water Cycle • Carbon Cycle

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	• Nitrogen Cycle • Phosphorus Cycle • Carbon Capture • Global Cycles *A Changing Climate* • Climate and Weather • Ocean Currents • The Enhanced Greenhouse Effect • El Nino and La Nina • The Greenhouse Effect • Human Influences on Climate • Arguing For or Against Climate Change • CFCs and the Ozone Layer • Climate Change • Examining Past Climate • If Climate Change is Real, How Come...? • The Southern Oscillation Index *Effects of Climate Change* • It's Getting Hot in Here • Disappearing Polar Ice • Apocalypse Now: Natural Disasters • Effects of Climate Change on Biodiversity • Carbon Footprints • Pollution • Save the Great Barrier Reef! • Troubled Waters • Where Have all the Turtles Gone? *Climate Technology* • Cleaning Up Our Litter • Computer Modelling and the Environment • Cool Robots • Reclaiming our Climate

Additional Content

Content Descriptor	**Lesson Names**
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	*Further development planned*

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

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

Content Descriptor	Lesson Names
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	*Further development planned*

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.

Content Descriptor	Lesson Names
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	*Introduction to Ecosystems* • Introduction to Ecology • The Biosphere and Biomes • Species and Organisms *Components of Ecosystems* • Parts of an Ecosystem • Comprehension: Adapting for Survival • Biotic Factors and Competition • Abiotic Factors • Taking a Lichen to Moss • Predator-Prey Dynamics • Adaptations • Interactions Between Organisms • Symbiosis *Energy in Ecosystems* • Producers • Trophic Levels • The Carbon Cycle • Consumers and Decomposers • Food Chains and Food Webs • Producers, Consumers and Decomposers • The Nitrogen Cycle *Changes in Ecosystems* • STEM - Kangaroo Counter • Apocalypse Now: Natural Disasters of September, 2017 • Australian Bushfires • Bee Kind • Biodiversity • Drought • Flooding

	• History of Conservation • Human Impacts • Invasive Species • Life on Mars • Oil Spills • Pesticides • Predicting Population Changes • Saving Australia's Wildlife • The Greenhouse Effect • Will I Stay or Will I Go?

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

Content Descriptor	Lesson Names
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	*DNA the Molecule* • Basics of DNA • The History of Genetic Thought • Discovering the Double Helix • Structure of DNA • Nitrogenous Bases • The Knotty New DNA Structure! • DNA Fingerprinting: Thirsty Thievery • Proteins *Genes and Chromosomes* • Genes and Genetic Information • Homologous Chromosomes • Genomics • Sex Chromosomes • Attraction: It's all in the Armpits • Chromosomal Abnormalities • The Ethics of Genetics *Cell Division* • DNA Replication • Mitosis • Gametes and Fertilisation • Meiosis • Mitosis vs. Meiosis • Asexual and Sexual Reproduction *Inheritance* • Mendel • Sex Linkage, Punnett Squares and Pedigrees • Alleles

	• Inheriting Alleles and Punnett Squares • Making Punnett Squares • Dominant/Recessive Interactions • Incomplete Dominance • Codominance • Pedigrees • Sex Linkage • Epigenetics: Inheritance is Strange • The Blue People of Troublesome Creek

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

Content Descriptor	Lesson Names
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	*The Theory of Evolution* • Darwin's Theory of Evolution • Theories and Evidence • Geological Time • The History of Evolutionary Thought *Evidence of Evolution* • Evidence from Living Species • Fossils and the Fossil Record • Geographical Distribution • The Evidence for Evolution • The Wallace Line *Mechanisms of Evolution* • Biodiversity • Mechanisms of Evolution • Natural Selection • Artificial Selection • Focus on Data: Natural Selection in Action! • Artificial Selection: The Good, the Bad and the Downright Strange • Coevolution • Sexual Selection • The Biodiversity Gradient • The Mechanisms of Evolution *Explaining Evolution* • Extinction • The Science of Puppy Dog Eyes • Back to the Sea: Cetacean Evolution • Bacterial Resistance • Evolution and Extinction

	• Feathery Dinosaurs • Mimicry • Our Evolution • Rewriting Human History • The Ancestor of All Things

Additional Content

Content Descriptor	Lesson Names
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	*Further development planned*

Chemical World

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

Content Descriptor	Lesson Names
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	*Atomic Structure* • What are Atoms, Elements and Compounds? • The Structure of an Atom • Atomic Symbols • Models of the Atom

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	• Watching Paint Dry • The Periodic Table • Atoms & The Periodic Table • The Periodic Table *Ions and Isotopes* • What are Ions? • Ionic Compounds • Ions in Solution • Naming Ionic Compounds • The Cave of the Crystals • What are Isotopes? *Radioactivity* • What is Radioactivity? • Topic Test: Atoms & The Periodic Table with Radioactivity • Radioactivity in Industry • Radioactivity in Medicine • Effects of Radiation on Humans • Half-Lives • Marie Curie and Radioactivity • Name That Radiation! • Nuclear Bombs • Nuclear Fission • Nuclear Power • Properties of Radiation • Types of Radiation • Writing Nuclear Equations

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

Content Descriptor	Lesson Names
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	*Structure of Atoms* • What are Atoms, Elements and Compounds? • The Structure of an Atom • Atomic Symbols • History of the Atomic Model • Electron Configuration • Chemicals: Friend or Foe? *The Periodic Table* • Trends in the Periodic Table • Groups 1 and 2 • Group 14

reasoning and the scientific evidence available at the time, contributed to the development of the modern Periodic Table	• Group 17 • Group 18 • Other Groups • The Periodic Table • Quiz- First 20 Elements (Name to Symbol) • Quiz- First 20 Elements (Symbol to Name) • Designing the Periodic Table • Helium: More Than a Bit of Squeaky Fun • Metallic Hydrogen or: How I Learned to Stop Worrying and Love the Scientific Process • Understanding the Periodic Table *Ions and Ionic Bonding* • Introduction to Ions • Electron Arrangement of Ions • Ionic Compounds • Ions in Solution • Naming Ionic Compounds • Ionic Bonding • Polyatomic Ions and Compounds *Metallic Bonding* • Metals in the Periodic Table • Metallic Bonding *Covalent Bonding* • Covalent Bonding

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

Content Descriptor	Lesson Names
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	*Chemical Reactions* • Introduction to Chemical Reactions • Reactants and Products • Reaction Equations • Chemical Reactions Basics • Chemistry: Glorified Baking? • Writing Chemical Equations *Chemical Equations* • Reaction in Action: Baking Soda and Vinegar • Writing Word Equations • Writing Chemical and Molecular Equations • Writing Chemical Equations

– 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	*Types of Chemical Reactions* • Chemical vs. Physical • Chemical Reactions • Combination and Decomposition Reactions • Acid Reactions • Precipitation Reactions • Oxidation and Reduction • Types of Chemical Reaction *Acids and Bases* • Acids • Bases • pH and Indicators • Acid-Metal Reactions • Neutralisation Reactions • ds and Bases *Types of Reactions* • Physical Properties of Metals • Alloys and Their Uses • Chemical Properties of Metals • Metal Reactions with Oxygen • Metal Reactions with Water • Metal Reactions with Acid • Metal Displacement Reactions *Reactions Around Us* • Acid Rain: Reactions Around Us • Combustion and the Environment • Photosynthesis • Respiration

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)

Content Descriptor	**Lesson Names**
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	*Rates of Reaction* • Collision Theory • Rate of Reaction • Agitation, Concentration and Surface Area • Activation Energy, Temperature and Catalysts • Rate of Reaction Equations • Factors Affecting Reaction Rates • Extension: Collision Theory and Rate of Reaction

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)	• Chemical Clocks • Graphing Rate of Reaction *Combustion* • Endothermic and Exothermic Reactions • Combustion Reactions • Oxidation Reactions • Identifying Chemical Reactions • Types of Chemical Reactions

Additional Content

Content Descriptor	Lesson Names
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	*The Law of Conservation* • Breaking the Law (of Conservation of Mass)? *Balancing Equations* • Chemical Reactions and Equations • Conservation of Mass • Writing Chemical Equations 1 • Writing Chemical Equations 2 • Balancing Chemical Equations • Balancing Equations *Creating with Chemistry* • Analytical Chemistry • Fuels and Pharmaceuticals • Polymers • STEM: Alternate Fuels