New South Wales Syllabus – Stage 5

Introduction:

This document maps Education Perfect lessons to the New South Wales Syllabus. When a lesson covers both scientific content and science skills, it will be listed in both sections.

Contents:

Key:

- Addresses the core science content.
- Contains additional content, as described on the NSW Syllabus webpage.
- Elaborates and extends beyond the syllabus.
- Also fulfils working scientifically (skills) curriculum standards.

Physical World

Outcomes:

A student applies models, theories and laws to explain situations involving energy, force and motion.

A student explains how scientific understanding about energy conservation, transfers and transformations is applied in systems.

Content:

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

Heat Transfer	Overview of conduction, convection, and radiation. All concepts are explained in detail in the other lessons in this folder.
Conduction	Heat transfer via conduction with a focus on how this relates to the particle model.
Convection	Explanation of convection as a method of heat transfer.
Radiation	Explanation of radiation as a method of heat transfer and how different coloured objects absorb different amounts of radiation.
Conductors and Insulators	Introduction to conductors and insulators with some common examples.
Convection in Liquids	Investigation into convection of water as it is heated.
Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Housing Insulation	Explaining how insulation can be used to prevent heat from entering or exiting a house.
Bushfires	Importance of heat and heat transfer during the Australian bushfires.
Sound	Overview of sound waves including how they are formed, pitch, and loudness.
Sound Formation	Introduction to how sound waves are formed and why they must travel through a medium.

Pitch and Loudness	Explanation of how the pitch and loudness of a sound wave are determined by its frequency and amplitude.
Musical Bottles	Investigation in which students make musical instruments out of glass bottles.
Slinky Waves	Investigation using a slinky to explore the difference between longitudinal and transverse waves.
Speed of Sound	Investigation measuring the speed of sound.
Hearing Sound	Explanation of how our ears enable us to interpret vibrations in the ear as sound.
Australian Aboriginal Music	Explanation of how traditional Aboriginal instruments produce sound.
Bionic Ears	Explanation of how cochlear implants can restore hearing.
Turned Down for What: Workplace Noise	Overview of why it is important to maintain safe noise levels in the workplace, in order to prevent hearing loss.
Ultrasound	Reading comprehension lesson on ultrasound and its uses.
Straw Instruments	Investigation into the importance of resonance frequency in music.
Light as a Wave	Introduction to light as a transverse wave with a frequency and wavelength.
Colour	How different frequencies of light are different colours, white light, and how we see light.
Materials	Introduction to transparent, translucent, and opaque materials.
Reflection	The Law of Reflection and how images form in plane mirrors.
Refraction	Introduction to refraction and refractive indices.
Total Internal Reflection	Introduction to total internal reflection.
Lenses	Comprehensive lesson on lenses, including the nature of images and practice drawing ray diagrams.
Light: Summary	Summary of light. All concepts mentioned here are covered in greater detail in the other Smart Lessons in this folder.
The Electromagnetic Spectrum	In this Smart Lesson, students what the electromagnetic spectrum. They learn how wavelength affects the qualities and visibility of waves on this spectrum, and how forms of electromagnetic radiation have different applications.
Build a Periscope	Investigation into the uses of reflection.
Colourful Candy	Investigation into why we see colour and the interaction of coloured light with coloured objects.
Law of Reflection	Investigation into the Law of Reflection.
Lenses	Investigation into concave and convex lenses.

Refraction	Investigation into how the refraction of light and refractive indices can be used to determine the material that a transparent block is made out of.
Curved Mirrors	Reflection of light by concave and convex mirrors.
Plane Mirrors and Reflection	Reflection of light and plane mirrors.
Snell's Law	Introduction to how to use Snell's Law to calculate the critical angle.
Bionic Eye	How an artificial eye could work, and the research being done into the concept.
Electromagnetic Radiation and Medicine	Explanation of how electromagnetic radiation can be used to detect and treat cancer.
The History of Lenses	The development of lenses and how they are used in telescopes, microscopes and cameras.
You, Me and UV	How UV can result in skin cancer and the importance of practicing good sun protection.
Cell Phones	How microwaves are used to transmit calls made on cell phones.
Internet	How analogue and digital signals are used to transmit information and connect to the internet.
Radio Waves	Radio waves and the difference between AM and FM signals.
X-Rays	How we can use x-rays, how they can harm us and how radiographers protect themselves from x-rays.
Radar	Explanation of how radar works and why it is useful.
History of Radio Communication	The history of radio communication. This lesson is designed to improve reading comprehension.
Energy in Classrooms	Research investigation into how light, heat, sound, wifi and devices impact on the classroom environment.
Optical Fibres	Investigation into how optical fibres are used to communicate.
Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Working in Physics	Introduction into different jobs related to physics and how to become a physicist.

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

Distance and Time	Introduction to two key ideas in physics: distance and time.
Displacement	Explanation of distance and displacement, with calculations involving addition, subtraction and the use of Pythagoras' Theorem.
Speed	Explanation of speed and velocity, with calculation questions.

Acceleration	Explanation of acceleration with calculations.
Introduction to Forces	Recap of the concepts learnt in Year 7 forces, including how objects are affected by forces and the difference between balanced and unbalanced forces.
Types of Forces	Recap of the difference between contact and non-contact forces and some common forces, focussing on gravity, magnetism and friction.
Newton's First Law	Introduction to Newton's First Law of Motion and the concept of inertia.
Newton's Second Law	An explanation of Newton's Second Law and how the F=ma law can be used to find force, acceleration, and mass of an object.
Newton's Third Law	Introduction to Newton's Third Law of Motion.
Car Safety Systems	Smart Lesson on how seatbelts, head rests, crumple zones and airbags use the laws of physics to protect people during car crashes.
Car Safety Systems Investigation	Investigation into a car safety system.
Balloon Rocket	Investigation into Newton's Third Law using a balloon rocket.
Egg Drop	Investigation into Newton's First Law.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Using the Acceleration Formula	Practice rearranging the formula for acceleration to find the formulae for final velocity, initial velocity and time.
Distance-Time and Displacement-Time Graphs	Explanation of distance-time graphs and displacement-time graphs, and how to calculate speed and velocity from them.
Velocity-Time Graphs	Velocity-time graphs including how to use them to find acceleration and distance travelled.
Acceleration-Time Graphs	Acceleration-time graphs and how we can use them to find the change in velocity of an object.
Summary of Motion Graphs	Revision of displacement-time graphs, velocity-time graphs and acceleration-time graphs.
Rockets	Explanation of the forces acting on rockets during launch and of the Space Race.
Reaction Times	Investigation into reaction times and how they change when you're distracted.
Planetary Motion	How gravity causes planets to orbit the Sun.
Tides	Smart Lesson on how the tides are caused by the gravitational forces of the Sun and the Moon.
How BB-8 Works	Smart Lesson which uses BB-8 to explain the difference between weight and mass, and also outlines a theory which explains how BB-8 can roll without anything pushing it.
Sports Science	How sports science is used to develop new techniques and materials, improving athletes' performances.

History of Rockets	Smart Lesson on the history of rockets to improve reading comprehension.
Gravity	Investigation into the effects of gravity and air resistance on falling objects.
Ticker Timers	Investigation that uses ticker timers to gather data on the motion of a toy car.

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

Electricity	Overview of electricity, covering: current, resistance and voltage, as well as series and parallel circuits.
Electric Circuits	Introduction to energy transfer in electric circuits and symbols of common circuit components.
Current	Explanation of electrical current and ammeters.
Resistance	Introduction to resistance in circuit components and wires.
Voltage	Introduction to voltage, voltmeters and voltage drops.
Introduction to Ohm's Law	Introduction to how current, resistance and voltage are related through Ohm's Law.
Batteries	Introduction to batteries with a focus on the difference between wet cell and dry cell batteries.
Circuits in Series	Introduction to series circuits with a focus on current and voltage across circuit components.
Circuits in Parallel	Introduction to parallel circuits with an explanation of how current and voltage act in these circuits.
Circuits Comparison	Comparing series and parallel circuits with a focus on lightbulb brightness and switch usage.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
Building Circuits	Investigation into lightbulbs in series and parallel circuits.
Resistance	Comparing the measured resistance for a number of resistors to the resistance advertised by the resistors' coloured bands.
Calculating Using Ohm's Law	Practice calculating voltage, current and resistance using Ohm's Law.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.
Conductors and Insulators	Conductors and insulators, and how they are used in circuits.
The Sixth Sense: Electroreception	How some animals can detect electrical currents.
War of the Currents	History lesson on how Edison and Tesla competed with each other to dominate the newly emerged electrical market in 19th century America.

Development of Light Bulbs	The development of light bulbs to improve reading comprehension.
Static Electricity	Investigation into static electricity and how it can be used to levitate objects.

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

Types of Energy	Recap on the most common types of kinetic and potential energy.
Conservation of Energy	Smart Lesson on the Law of Conservation of Energy.
Energy Transfer	Smart Lesson on energy transfer, with a focus on the transfer of heat.
Energy Transformations	Smart Lesson on energy transformations.
Useful and Wasted Energy	Introduction to the concepts of useful energy, wasted energy and efficiency.
Energy Efficiency	Smart Lesson on energy efficiency, with calculations.
Electricity Generation	Smart Lesson all about electricity and where it comes from in Australia
Energy Efficiency of Bouncy Balls	Investigation into the energy efficiency of bouncy balls.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Roller Coasters	Investigation into the energy transformations in a roller coaster.
Work and Power	Smart Lesson on the concepts of work and power, with calculations.
Energy Calculations	Practice using the energy, work and power formula.
Energy in Food	Smart Lesson about how our body transforms the chemical potential energy in food into kinetic and heat energy.
Steam Engines	Smart Lesson about the energy transformations used to power steam engines.
Building an Electromagnet	Investigations into electromagnets and how electrical currents can induce magnetic fields.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.

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.

A student 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.

Content:

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

Universe Introduction	Introduction to the main components of the universe, including stars and the planets surrounding our sun.
Gravity	The effect gravity has on the universe, and the cosmological principle.
Light and Light Speed	The speed of light and light years.
Radar Ranging	How we can measure distances in space using radar.
The Life Cycle of Stars	How stars are formed, and the various stages they go through as they die. The lesson also introduces supernovae and black holes.
Distances between Stars, Parallax and Parsecs	How the parallax phenomenon can be used to measure how far stars are from Earth.
The Big Bang Theory	Introduction to what The Big Bang Theory is, and how The Big Bang would have progressed.
Cosmic Background Radiation	The alternate theory of the original of the universe, the Steady State Theory
Red Shift	What the Doppler effect and red shift are, and how red shift provides evidence that the universe is expanding.
Observing Space	How we use radio telescopes and satellites to study and measure the stars.
Scientific Theory	Introduction to what scientific theories are and how, unlike hypotheses, they are heavily supported by evidence.

Scientific Notation	How to perform scientific notation on both very large and very small numbers.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
Properties of Stars	How a star's brightness and colour can be used to determine its distance from Earth, when it is too far to use the parallax method.
Hertzsprung-Russell Diagrams	How Hertzsprung-Russell diagrams can be used to find the absolute magnitude of a star's brightness when its distance from Earth is unknown, and how this can be used to calculate how far away the star is.
Flame Tests	An investigation burning different substances to see what colour flame they produce.
Relativity	Introduction to Einstein's theory of relativity, and some of the mind-boggling conclusions that can be drawn from it.
End of the Universe	Discussing how the expansion of the universe is increasing, not decreasing, and what this means for the future of the universe. It also includes how dark matter may explain this accelerated rate of expansion.
Life	The conditions on early Earth, and the many theories for how life eventually appeared.

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

Igneous Rocks	Recap of igneous rocks and the processes that form them.
Metamorphic Rocks	Recap of metamorphic rocks and the processes that form them.
Sedimentary Rocks	Recap of sedimentary rocks and the processes that form them.
Compositional Layers of the Earth	The Earth's layers.
Wegener's Theory of Continental Drift	The theory proposed by Alfred Wegener.
Seafloor Spreading and Hess' Theory	How Hess and colleagues used magnetic striping to support the theory of seafloor spreading.
Plate Tectonics	Mechanical layers of the Earth and how they interact in plate tectonics.
Divergent Plate Boundaries	Divergent plate boundaries, seafloor spreading and magnetic striping.
Convergent Plate Boundaries	Convergent plate boundaries, subduction zones and mountain building.
Transform Boundaries and Faults	Types of fault lines and the landforms they produce.
Formation of Volcanoes	Types of volcanoes and the tectonic processes that form them.

Types of Lava	Types of lava and their effects on volcanic eruptions.
Volcanic Hazards	Effects of volcanic eruptions on people, the environment and global climate.
Earthquakes	Earthquakes and seismic waves, and how they are formed.
Measuring Earthquakes	How seismographs work; magnitude and intensity of earthquakes.
Seismic Hazards	Recent earthquakes in Japan and New Zealand, with a focus on tsunamis, liquefaction and other associated hazards.
Supercontinents	How the ancient supercontinent of Pangea turned into the seven continents we know today.
Volcano Exploration Robots	Exploring how small robots can be used to help explore and study volcanoes.
Build a Seismometer	Investigation learning what a seismometer is and how to make one from household materials.
Deep Time and Plate Tectonics	In this investigation, students research how the Earth's tectonic plates have moved over time, and from this make a timeline.
Understanding Megaquakes	Interpreting data on the largest earthquakes in recorded history.
Evidence of the Earth's Structure	Introduction to techniques used by scientists to probe the inner Earth.
Earth's Magnetic Field	The Earth's magnetic field.
Geological Time	The concept of deep time and the Geological Timescale.
Development of the Geological Timescale	How humanity came to understand how old the Earth is, and why our modern geological timescale is organised the way it is.
Ice Tectonics in Europa	Tectonic processes on the moon Europa.
Subduction Zones and Ophiolite Belts	Ophiolite: a product of some subduction zones.

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

Spheres	Defining and explaining the four biospheres of earth: biosphere, lithosphere, atmosphere and hydrosphere.
Water Cycle	Explaining the steps of the water cycle, and how human activity has come to affect steps of the water cycle and the consequences of these impacts.

Carbon Cycle	The steps of the carbon cycle, and analyses how human activity has come to affect carbon levels in the atmosphere.
Nitrogen Cycle	The steps of the nitrogen cycle, and analyses how human activity has come to affect nitrogen levels in the four spheres of Earth and the consequences of these changes.
Phosphorus Cycle	The steps of the phosphorus cycle, how human activity has come to affect hydrospheric phosphorus levels and the consequences of this change in hydrospheric phosphorus.
Climate and Weather	The difference between weather and climate. Introducing the concept of climate change.
The Greenhouse Effect	The natural process of the greenhouse effect and how it maintains a comfortable temperature on Earth.
The Enhanced Greenhouse Effect	The enhanced greenhouse effect and how human activity is intensifying the natural warming process.
Human Influences on Climate	Ways humans influence the climate, including deforestation, agriculture, burning fossil fuels and using fertilisers.
Climate Change and Biodiversity	The concept of biodiversity, its importance and how it is affected by climate change.
It's Getting Hot in Here	The effect of the greenhouse effect on global temperatures and permafrost.
Disappearing Polar Ice	The effects of the enhanced greenhouse effect on land and sea ice in polar regions.
Carbon Capture	Introducing carbon capture as a way that humans may be able to reduce climate change. It explains why carbon capture is important and what important carbon sinks are.
Carbon Footprints	What a carbon footprint is and how it can be measured and reduced.
CFCs and the Ozone Layer	How CFCs have led to the hole in the ozone layer resulting in the ban of certain chemicals. Discussion on how scientific research can have a positive and meaningful impact on society.
If Climate Change is Real, How Come...?	Arguments against climate change, and explains why each argument fails to grasp what is occurring under climate change.
Troubled Waters	How climate change is affecting marine habitats, including coral reefs.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Polar Ice	Investigation into the effects of land ice and sea ice on sea levels.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Examining Past Climate	This Smart Lesson presents temperature and greenhouse gas composition data from ice cores for students to interpret.
Ocean Currents	Ocean currents and their effect on the climate.
El Niño and La Niña	El Niña, La Niña and the Southern Oscillation.

Computer Modelling and the Environment	What computer modelling is, and how it can be used to study the weather, ocean conditions, pollution and climate change.
Convection Currents	Creating an observable convection current in the lab to better understand the nature of convection currents in the environment.
Reading a Weather Map	This Smart Lesson teaches students how to identify key features on weather maps, including pressure and temperature.
The Southern Oscillation Index	Interpreting data on La Niña and El Niño conditions using the Southern Oscillation Index.
Pollution	The different types of pollution, including air, land, light, noise and water pollution.
Where Have all the Turtles Gone?	Ways that climate change is threatening sea turtles, including producing a skewed sex ratio and killing eggs.

Living World

Outcomes:

A student analyses interactions between components and processes within biological systems.

A student explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society.

Content:

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

Basics of Homeostasis	Homeostasis and why it is important.
Homeostatic Terms	What the terms variable, set point and reference range mean in the context of homeostasis.
Stimulus-Response Model	How the stimulus-response model helps the body maintain homeostasis.
Negative and Positive Feedback	What negative and positive feedback are.

Control Systems	Introducing the body's two control systems: the nervous system and endocrine system.
The Nervous System	Introducing the central and peripheral nervous systems.
The Neuron	Introducing the different components and types of a neuron.
Nerve Pathways	Introducing voluntary and involuntary movements, reflexes and nerve pathways.
Sensory Receptors and the Eye	How the parts of the eye enable it to function.
The Endocrine System	Introducing the endocrine system, including the main endocrine glands of the human body.
Endocrine System in Action	Introducing the pancreas and how the hormones it secretes control blood glucose levels.
Immune System	Introducing the immune system and the three lines of immune defence.
First & Second Lines of Deffence	Explaining the first and second lines of immune defence, the inflammatory response in particular.
Third Line of Defence & Lymphatic System	Introducing the lymphatic system and the third line of defence.
What are Diseases?	Introducing diseases, different types of disease and the difference between infectious and non-infectious diseases.
What are Pathogens?	Introducing different types of pathogens.
Cancer	Cancer, the effects it has on the body, and methods of prevention and treatment.
Chickenpox	Chickenpox, the effects it has on the body and methods of prevention and treatment.
Malaria	Malaria, the effects it has on the body and methods of prevention and treatment.
Disease Treatment	Ways to treat or control the spread of infectious diseases, including vaccination, antibiotics, and good hygiene practices.
How are Diseases Spread?	How diseases are spread.
Eye Dissection	Investigation dissecting a cow eye and identify the key structures.
Kidney Dissection	Dissecting a kidney and identify the key structures.
Testing Reflexes	Exploring the knee-jerk reflex as an example of a reflex arc.
Body Temperature	Interpreting data on human body temperature changes when exposed to different temperatures.
Regulating Blood Glucose Levels	Interpreting data on how blood glucose and insulin levels change throughout the day.
Degenerative Diseases	How degenerative diseases, such as Multiple Sclerosis and Parkinson's Disease, affect the nervous system.
Endocrine Diseases	What the endocrine system does and what happens when it does not function properly.

Pathogens	Various pathogens, including viruses, fungi, parasites and prions.
Starfish Nervous System	Comparing the Starfish's unusual nervous system to that of humans.
The History of Disease	Ways ancient humans thought diseases were caused, and how these ideas evolved over time.

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.

Introduction to Ecology	**Introducing ecology and ecosystems.**
The Biosphere and Biomes	**Describing the biosphere and its division into biomes.**
Species and Organisms	**Organisms, species and hybrids.**
Parts of an Ecosystem	**Introduction to abiotic and biotic factors.**
Abiotic Factors	**The important abiotic factors that impact on ecosystems.**
Biotic Factors and Competition	**Biotic factors in ecosystems, with a focus on competition between and within species.**
Symbiosis	**Three types of symbiosis: mutualism, commensalism and parasitism.**
Producers	**Producers, and how they use photosynthesis to make energy.**
Consumers and Decomposers	**Consumers, decomposers and detritivores.**
Food Chains and Food Webs	**Food chains and food webs.**
Trophic Levels	**Introducing the concepts of trophic levels and energy pyramids.**
The Carbon Cycle	**The importance of carbon in ecosystems and how it is recycled.**
Biodiversity	**The meaning and significance of biodiversity.**
Bushfires	**The causes and consequences of bushfires in Australia.**
Drought	**The causes and consequences of droughts, and how species have adapted to deal with them.**
Flooding	**The consequences of flooding, both positive and negative.**
The Nitrogen Cycle	**Importance of nitrogen in ecosystems and how it is recycled.**
Human Impacts	**Introducing biodiversity, and the impacts of European farming, overcropping and pest control on it.**
Invasive Species	**Introducing the ideas about what makes an introduced species invasive and the impacts of invasive species on ecosystems including specific Australian examples.**

Oil Spills	How oil spills affect ecosystems.
Pesticides	How pesticides affect ecosystems.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Photosynthesis and Starch	Extracting starch - a product of photosynthesis - from leaves.
Background Information - Different Perspectives on Mining	This lesson explains what mining is and how it influences the Australian economy and ecosystems. It is intended this lesson will be completed before starting the lesson "Research Project - The Carmichael Coal Mine".
Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Sampling a Leaf Litter Ecosystem	Collecting samples of leaf litter at different depths and identify the invertebrates present. Also measuring the abiotic factors temperature and humidity at each depth. Using this information, students propose explanations for why the invertebrate community changes as one moves deeper into the leaf litter.
Predator-Prey Dynamics	Data is presented on predator-prey relationships in order to understand the flow of energy in an ecosystem.
Predicting Population Changes	How we can use food webs to predict how populations recover after a disaster, such as a bushfire.
Adaptations	The three main types of adaptations, with specific examples relating to ectothermy and endothermy in animals.
The Greenhouse Effect	Chemical compounds used by humans that have substantial impacts on ecosystems, including oil, pesticides and greenhouse gas emissions.
Adapting for Survival	Smart Lesson introduces some examples of adaptations for survival in the animal kingdom. This lesson can be used to improve reading comprehension in students.

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

Basics of DNA	Introduction to DNA suitable for complete beginners. It introduces what DNA, genes and chromosomes are and explains where DNA is located.
Structure of DNA	The key concepts about the structure of DNA. Including the double helix, sugar phosphate backbone and nucleotides. It also introduces nitrogenous bases.
Nitrogenous Bases	Expanding upon information from Structure of DNA. It explains the four types of nitrogenous bases and the complementary base pair rule.
Genes and Genetic Information	Explaining, in simple terms, the nucleotide sequence of a gene codes for a protein.
Homologous Chromosomes	Defines and explains the terms homologous chromosome, haploid and diploid.
Sex Chromosomes	Introduces the sex chromosomes and autosomes.
DNA Replication	The steps of DNA replication and key ideas around it. Why cells replicate their DNA before dividing, introducing mutations and defines sister chromatids.
Mitosis	The steps of mitosis.
Gametes and Fertilisation	What gametes are used for and how their genetic content differs from normal cells. It then explains the process of fertilization and why it is important that gametes are haploid.
Meiosis	The steps of meiosis.
Mitosis vs. Meiosis	Highlights key differences between mitosis and meiosis. It is a revision lesson that assumes prior knowledge of the steps of mitosis and meiosis, either from teaching in the classroom or from completing previous smart lessons.
Mendel	Mendel's experiments breeding peas. They learn what Mendel did during his experiments as well as what his key observations and conclusions were.
Alleles	What alleles are and how they are different from genes. It also explains why we have two alleles and the terms genotype, phenotype, heterozygous and homozygous.
Inheriting Alleles and Punnett Squares	How meiosis and fertilization act together to pass alleles from parent to offspring. It then teaches students how to read Punnett squares and calculate propabilities and ratios from them.
Making Punnett Squares	How to find the genotypes of the parents, make a Punnett square and then find probabilities and genotypic and phenotypic ratios.
Allele Interactions	The three types of allele interactions: dominant/recessive, incomplete dominance and codominance.
Pedigrees	How to make and read pedigrees. This lesson assumes a basic understanding of dominant and recessive alleles. It does not cover pedigrees of sex-linked genes.

Sex Linkage	The concept of sex linkage and that males are more likely to have recessive X-linked phenotypes than females.
Sex Linkage, Punnet Squares and Pedigrees	How to make Punnett squares for sex-linked genes, and how to read Punnett squares and pedigrees for sex-linked genes.
Discovering the Double Helix	How the double helix was discovered. It explores the big names involved, including Watson, Crick and Franklin. Special emphasis is put on the ethical concerns around how Franklin's data was obtained and credited by Watson and Crick.
The Ethics of Genetics	Exploring ethical concerns and implications of genetic testing in embryos. It also explores the potential for genetically modifying embryos in the future, and whether this would be morally acceptable.
Extracting DNA	Extracting DNA from plant or animal tissue samples.
Modelling Inheritance of Alleles	In this investigation, students are given cards that represent the alleles of two parents across five genes. By randomly selecting and combining alleles, students can explore the processes of meiosis and fertilisation. From this, they can observe how siblings can end up looking different, even when they have the same parents.
Observing Mitosis	Observing cells from an onion root tip through a microscope and attempting to identify cells in different stages of mitosis.
Background Information - The Consequences of Inbreeding	Students will learn about how dog breeders use inbreeding to maintain purebred dog lineages, and what health consequences this can have for the animals. This provides background information for "Research Project - Researching Inbreeding in Dogs."
Research Project - Researching Inbreeding in Dogs	Students research inbreeding in purebred dogs and write an essay explaining their findings. More information on inbreeding can be found in the Smart Lesson "Background Information - The Consequences of Inbreeding".
DNA Fingerprinting: Thirsty Thievery	This data interpretation lesson guides students through the interpretation of DNA profiles.
The Blue People of Troublesome Creek	This data interpretation lesson guides students through the interpretation of family pedigrees.
Genomics	The human genome project, and the implications that genomic research has for treating diseases and researching evolution.
Asexual and Sexual Reproduction	This lesson teaches about sexual and asexual reproduction, and how they differ from one another. It includes a brief explanation of the advantages and disadvantages of the two types of reproduction.
Chromosomal Abnormalities	How chromosomsal abnormalities can arise from meiosis, and that these abnormalities can result in chromosomsal disorders such as Down syndrome.

Proteins	An introduction to proteins. Students learn that proteins are made of amino acids and coded for by alleles. Students also learn about the roles of different types of proteins, including enzymes, antibodies, structural proteins and transport proteins.
The History of Genetic Thought	How society's understanding of genetics has grown over the past several centuries, and how it has contributed to the theory of evolution.
Attraction: It's all in the Armpits	This science comprehension lesson contains a passage about the major histocompatibility complex (MHC) and the role it plays in human mate choice.
Epigenetics: Inheritance is Strange	This science comprehension lesson contains a passage about epigenetics and the current thinking surrounding inheritance.

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

Geological Time	The concept of deep time and the Geological Timescale.
Theories and Evidence	An overview of all the types of evidence for evolution covered in the upcoming lessons. Included are brief overviews and introductions for the fossil record, comparative techniques in living species and geographical distributions.
Fossils and the Fossil Record	The fossil evidence in support of Darwin's theory of evolution, including the fossil record.
Evidence from Living Species	The similarities among living species which provide evidence for evolution. These similarities can be examined through comparative anatomy, comparative embryology, and chemical comparisons.
Geographical Distribution	This topic examines the geographical distribution of species and how this provides evidence for evolution.
Darwin's Theory of Evolution	Describes how Darwin came to propose his Theory of Evolution.
Mechanisms of Evolution	Describes the mechanisms of evolutionary change. These include mutations, gene flow, genetic drift and natural selection.
Natural Selection	Natural selection, and the processes required for it to occur.
Artificial Selection	What artificial selection is, how it relates to genetic diversity and how it provides a model for evolution.
Bacterial Resistance	Extension lesson looks at bacteria and how they evolve antibiotic resistance.
The Ancestor of All Things	The Last Universal Common Ancestor (LUCA).
Building an Evolutionary Timeline	Creating and interpreting a timeline with a list of major dates in the evolution of life on Earth.

Great Ape Genealogy	Using coloured paperclips to model nucleotide sequences from human, chimp and gorilla DNA. Comparing the nucleotide sequences of the three different species and from this infer how they are related.
Survival of the Mutants	Groups of students compete to collect and store the most candy. Different groups have different traits, such as being blind or having their hands tied together. Through this exercise, students explore how different traits can affect an organism's foraging ability and overall fitness.
Natural Selection in Action!	The interpretation of column graphs, pie graphs and line graphs.
Biodiversity	The concept of biodiversity and its importance.
Extinction	Smart Lesson that teaches you what extinction is and how it comes about.
Coevolution	Extension lesson that examines how two species influence each other's evolution.
Mimicry	Extension lesson describes the different forms of mimicry: Mullerian, Batesian and Aggressive.
Sexual Selection	How and why male competition and female choice can influence the evolution of species.
Artificial Selection: The Good, the Bad and the Downright Strange	Examples of good, bad, and strange artificial selection.
Back to the Sea: Cetacean Evolution	Cetaceans and their evolution from terrestrial four-legged mammals.
Our Evolution	Human evolution as an extension to the evolution topic.
The History of Evolutionary Thought	Overview on the history of evolutionary thought, from Lyell to Lamarck.
The Wallace Line	The faunal boundary line between Asia and Australasia, and why it exists.
Evolution and Extinction	How human actions are causing rapid changes in the environment. These changes are typically too fast for species to adapt to and, as a result, many species are going extinct.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
The Biodiversity Gradient	This data interpretation lesson guides students through the interpretation of scatterplots, pie graphs and line graphs.

Chemical World

Outcomes:

A student explains how models, theories and laws about matter have been refined as new scientific evidence becomes available.

A student 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.

Content:

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

What are Atoms, Elements and Compounds?	A review of Year 8 concepts of atoms, elements, and compounds for Australian Year 9 students.
The Structure of an Atom	Introduction to the structure of atoms and properties of subatomic particles for Year 9 Australian students.
Atomic Symbols	How to determine the number of each subatomic particle in an atom by using atomic and mass numbers.
What are Isotopes?	An introduction to isotopes (what they are and how to name them) and relative atomic mass.
What is Radioactivity?	An introduction to radioactivity and radioisotopes.
Effects of Radiation on Humans	The effects of ionising radiation on humans, and the importance of the dose.
Models of the Atom	History of the different models of the atom and the experiments leading to new models.
Radioactivity in Industry	The uses of radioactivity in industry, including smoke alarms, detecting the thickness of materials, irradiation and detecting leaks in underground pipes.
Radioactivity in Medicine	The uses of radioactivity in medicine, including nuclear imaging and radiotherapy.
Build an Atom	Investigation where students building a model of an atom and explaining how the relative sizes and charges of the subatomic particles are represented.
The Periodic Table	Introduction to how elements are grouped in the Periodic Table.
What are Ions?	Introduction to ions including what they are, how they form, and how to name them.

Ionic Compounds	Ionic bonds and the structure and properties of ionic compounds.
Ions in Solution	How ions behave in solution, including solubility, recrystallisation and electrical conductivity.
Naming Ionic Compounds	How to name ionic compounds and write ionic formulae.
Half-lives	How to calculate half-lives and how carbon dating works.
Nuclear Bombs	An explanation of nuclear bombs with a focus on Hiroshima.
Nuclear Fission	Nuclear fission and the difference between controlled and uncontrolled chain reactions.
Nuclear Power	Introduction to nuclear power plants with a focus on the Chernobyl disaster.
Types of Radiation 1	Describing alpha, beta and gamma radiation.
Types of Radiation 2	Extension Smart Lesson looking at the properties of each of the three types of radiation, specifically their penetrating abilities and ionising abilities.
Writing Nuclear Equations	How to write nuclear equations for alpha and beta decay reactions.
Skittle Half Lives	Investigation where students shake a bag of skittles, dump it out and remove the skittles that land face up. This is repeated in order to model a half-life.

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

What are Atoms, Elements and Compounds?	A review lesson, covering concepts of atoms, elements, and compounds.
The Structure of an Atom	A review lesson, covering content on the structure of atoms and properties of subatomic particles.
Atomic Symbols	A review lesson, describing how to determine the number of each subatomic particle in an atom by using atomic and mass numbers.
The Periodic Table	Introduction to the periodic table.
Trends in the Periodic Table	The trends in the periodic table.
Quiz- First 20 Elements (Name to Symbol)	Students identify the correct symbol for the first 20 elements in the Periodic Table.
Quiz- First 20 Elements (Symbol to Name)	Students identify what element a symbol represents, for the first 20 elements in the Periodic Table.
Groups 1 and 2	The properties of group 1 and 2 metals in the periodic table.

Group 14	The properties of group 14 elements in the periodic table.
Group 17	The properties of group 17 elements in the periodic table.
Group 18	The properties of group 18 elements in the periodic table.
Other Groups	The groups 15, 16 and the transition metals, and introduces the lanthanides and actinides.
Designing the Periodic Table	A history of how Mendeleev designed the periodic table.
Electron Configuration	How electrons are configured in an atom.
Flame Test	Observing the different coloured flames produced by different elements.
History of the Atomic Model	The model of the atom, and the models that came before it.
Introduction to Bonding	The concept of chemical bonding.
Metals in the Periodic Table	This lesson describes the properties of group 1 and 2 metals in the periodic table.
Metallic Bonding	Metallic bonding.
What are Ions?	Introduction to ions including what they are, how they form, and how to name them.
Ionic Compounds	Smart Lesson introducing ionic bonds and the structure and properties of ionic compounds.
Ions in Solution	Smart Lesson on how ions behave in solution, including solubility, recrystallisation and electrical conductivity.
Naming Ionic Compounds	Smart Lesson on how to name ionic compounds and write ionic formulae.
Ionic Bonding	Ionic bonding.
Covalent Bonding	Covalent bonding.
Chemicals: Friend or Foe?	Dangerous chemicals and explains proper handling and clean up procedures around them.
Spectroscopy	How spectroscopy was developed, and what some different types of spectroscopy are.
Metallic Hydrogen or: How I Learnt to Stop Worrying and Love the Scientific Process	This Science Comprehension lesson discusses the recent discovery of metallic hydrogen, including the criticisms of how the discovery was carried out.
Ionic Bonding Card Game	In this investigation, students have cards that represent different cations and anions. They must match the cards in their hand in order to make balanced ionic compounds. The more cards in a compound, the more points.
Modelling Bonding using Tennis Balls	Tennis balls are used to represent electrons, while students represent atoms. To model metallic, ionic and covalent bonding, students must obtain or get rid of tennis balls in various ways.

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

Introduction to Chemical Reactions	What chemical reactions are. Including how to identify chemical reactions and what happens during a chemical reaction.
Reactants and Products	The differences between reactants and products using everyday examples. Investigation using baking soda and vinegar.
Writing Chemical Equations 1	Introduction on how to write chemical equations, focusing on how to write word equations. Includes exercise of writing equations from videos of exciting chemical reactions.
Writing Chemical Equations 2	How to write formula equations: recap chemical symbols learn how to write chemical formula and formula equations. Some extension information on structural formula.
Conservation of Mass	The concept of the Conservation of Mass.
Acids	Concept of acids, and how they dissolve, plus their strength.
Bases	Concept of bases, and how they dissolve, plus their strength.
Indicators	The pH scale, indicators, and how they are used to identify whether a substance is acidic or basic.
Acid-Metal Reactions	Reactions between acid and metals. Also introduces concept of salts.
Neutralisation Reactions	Neutralisation reactions and how to name the salts produced in this reaction
Endothermic and Exothermic Reactions	The difference between endothermic and exothermic reactions, and which types of reaction respiration and photosynthesis are.
Combustion Reactions	How combustion works. Including an explanation of incomplete combustion.
Oxidation Reactions	What oxidation reactions are.
Acid Rain: Reactions Around Us	The causes of acid rain and the effects it has on the environment.
Combustion and the Environment	The Greenhouse Effect and how human activities have contributed to it.
Photosynthesis: Reactions Around Us	Photosynthesis.
Respiration: Reactions Around Us	Respiration.
Acids and Bases	Acids and bases and their uses. This lesson can be used to improve reading comprehension.
Conservation of Mass	Students perform three reactions. In each reaction, they weight the reactants and products to find that mass has been conserved.
Identifying Chemical Reactions	Students carry out a number of physical and chemical changes. Among these, they must identify which are chemical reactions.

Marshmolecules	Students build models of molecules using marshmallows, then modify these molecules to represent chemical reactions. This helps students visualise how the same atoms are present in the reactants as in the products.
Acids and Metals	Observing how hydrochloric acid can react with magnesium.
Balancing Equations	Practice balancing equations.
A Day in the Life of an Industrial Chemist	What industrial chemists do and what it takes to become one.
Fermentation	How fermentation can be used to make bread and other foods, drinks and fuels.
The Father of Modern Chemistry	A biography on Antoine Lavoisier, explaining who he was and his contribution to chemistry: precise laboratory techniques and the law of conservation of mass.
Waste Management	What waste products are and how, as a society, we can manage them. Emphasis on car exhaust and industrial waste.
Types of Chemical Reactions	Decomposition, synthesis and single and double displacement reactions.
Making Your Own Forge	Students use a Bunsen burner to anneal and temper paperclips. They then compare their durability to unmodified paperclips.

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

Chemical vs. Physical	Learn to identify whether a chemical or physical reaction has taken place.
Chemical Reactions	Chemical reactions.
Rate of Reaction	The different ways to control the rate of a reaction.
Agitation, Concentration and Surface Area	How agitation, concentration and surface area can affect the rate of a reaction.
Activation Energy, Temperature and Catalysts	How temperature and catalysts relate to activation energy, and how this affects the rate of a reaction.
Extracting Metals	How metals are extracted from their ores.
Fuels and Pharmaceuticals	The chemistry behind fuels and pharmaceuticals.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.

Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.
Graphing Rate of Reaction	Interpreting graphs of reactant concentration over time.
Analytical Chemistry	What an analytical chemist does, including quality assurance and forensics and how to become one.
Polymers	How chemistry can be used to make the useful material we all use everyday, plastics!
Milk Plastic	Making plastic out of milk.
Combination and Decomposition Reactions	Combination and decomposition reactions.
Acid Reactions	Acid reactions.
Precipitation Reactions	Precipitation reactions.
Oxidation and Reduction	Oxidation and reduction reactions.
Collision Theory	This lesson explains that reactions occur when molecules collide with the right orientation and with sufficient energy.
Collision Theory and Rate of Reaction	This lesson explains that, according to collision theory, the rate of reaction will be proportional with the number of effective collisions.
Rate of Reaction Equations	Calculating the rate of reactions using the concentrations of its reactants and products.
Factors Affecting Reaction Rates	Exploring factors that affect the rate of reaction, including surface area, concentration, temperature and the presence of catalysts.
Reaction Equations	Writing chemical equations. Including the phase (solid, aqueous or gaseous) of the different reactants and products.
The Mole	This lesson explains what a mole is. Students perform various calculations, including finding a molar mass, number of atoms or number of moles.
Empirical and Molecular Formulae	The difference between empirical and molecular formulae, and how to convert from one to the other using molecular mass.
Moles and Equations	How to find moles and masses of products and reactants based on their relative abundance in chemical equations.
Chemical Clocks	This Science Comprehension lesson discusses how the rate of reaction can be manipulated to produce unusual results, such as a solution that flickers between colourless and purple!

Working Scientifically

Questioning and Predicting

Outcomes:

A student develops questions or hypotheses to be investigated scientifically.

Content:

WS4 Students question and predict.

Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Building Circuits	Investigation into lightbulbs in series and parallel circuits.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Examining Past Climate	This Smart Lesson presents temperature and greenhouse gas composition data from ice cores for students to interpret.
The Southern Oscillation Index	Interpreting data on La Niña and El Niño conditions using the Southern Oscillation Index.
Regulating Blood Glucose Levels	Interpreting data on how blood glucose and insulin levels change throughout the day.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Background Information - Different Perspectives on Mining	This lesson explains what mining is and how it influences the Australian economy and ecosystems. It is intended this lesson will be completed before starting the lesson "Research Project - The Carmichael Coal Mine".

Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Research Project - Researching Inbreeding in Dogs	Students research inbreeding in purebred dogs and write an essay explaining their findings. More information on inbreeding can be found in the Smart Lesson "Background Information - The Consequences of Inbreeding".
Survival of the Mutants	Groups of students compete to collect and store the most candy. Different groups have different traits, such as being blind or having their hands tied together. Through this exercise, students explore how different traits can affect an organism's foraging ability and overall fitness.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.
Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.

Planning Investigations

Outcomes:

A student produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively.

Content:

WS5.1 Students identify data to be collected in an investigation.

Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Build a Periscope	Investigation into the uses of reflection.
Colourful Candy	Investigation into why we see colour and the interaction of coloured light with coloured objects.
Law of Reflection	Investigation into the Law of Reflection.

Refraction	Investigation into how the refraction of light and refractive indices can be used to determine the material that a transparent block is made out of.
Energy in Classrooms	Research investigation into how light, heat, sound, wifi and devices impact on the classroom environment.
Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Car Safety Systems Investigation	Investigation into a car safety system.
Gravity	Investigation into the effects of gravity and air resistance on falling objects.
Reaction Times	Investigation into reaction times and how they change when you're distracted.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Deep Time and Plate Tectonics	In this investigation, students research how the Earth's tectonic plates have moved over time, and from this make a timeline.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Convection Currents	Creating an observable convection current in the lab to better understand the nature of convection currents in the environment.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Background Information - Different Perspectives on Mining	This lesson explains what mining is and how it influences the Australian economy and ecosystems. It is intended this lesson will be completed before starting the lesson "Research Project - The Carmichael Coal Mine".
Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Research Project - Researching Inbreeding in Dogs	Students research inbreeding in purebred dogs and write an essay explaining their findings. More information on inbreeding can be found in the Smart Lesson "Background Information - The Consequences of Inbreeding".

Flame Test	Observing the different coloured flames produced by different elements.
Modelling Bonding using Tennis Balls	Tennis balls are used to represent electrons, while students represent atoms. To model metallic, ionic and covalent bonding, students must obtain or get rid of tennis balls in various ways.
Conservation of Mass	Students perform three reactions. In each reaction, they weight the reactants and products to find that mass has been conserved.

Identifying Chemical Reactions	Students carry out a number of physical and chemical changes. Among these, they must identify which are chemical reactions.
Making Your Own Forge	Students use a Bunsen burner to anneal and temper paperclips. They then compare their durability to unmodified paperclips.
Marshmolecules	Students build models of molecules using marshmallows, then modify these molecules to represent chemical reactions. This helps students visualise how the same atoms are present in the reactants as in the products.
Milk Plastic	Making plastic out of milk.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.
Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.

WS5.2 Students plan first-hand investigations.

Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.
Energy Efficiency of Bouncy Balls	Investigation into the energy efficiency of bouncy balls.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Roller Coasters	Investigation into the energy transformations in a roller coaster.
Body Temperature	Interpreting data on human body temperature changes when exposed to different temperatures.
Regulating Blood Glucose Levels	Interpreting data on how blood glucose and insulin levels change throughout the day.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.

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

Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.

Conducting Investigations

Outcomes:

A student undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively.

Content:

WS6 Students conduct investigations.

Convection in Liquids	Investigation into convection of water as it is heated.
Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Musical Bottles	Investigation in which students make musical instruments out of glass bottles.
Slinky Waves	Investigation using a slinky to explore the difference between longitudinal and transverse waves.
Speed of Sound	Investigation measuring the speed of sound.
Straw Instruments	Investigation into the importance of resonance frequency in music.
Build a Periscope	Investigation into the uses of reflection.
Colourful Candy	Investigation into why we see colour and the interaction of coloured light with coloured objects.
Law of Reflection	Investigation into the Law of Reflection.
Lenses	Investigation into concave and convex lenses.
Refraction	Investigation into how the refraction of light and refractive indices can be used to determine the material that a transparent block is made out of.
Energy in Classrooms	Research investigation into how light, heat, sound, wifi and devices impact on the classroom environment.

Optical Fibres	Investigation into how optical fibres are used to communicate.
Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Balloon Rocket	Investigation into Newton's Third Law using a balloon rocket.
Egg Drop	Investigation into Newton's First Law.
Gravity	Investigation into the effects of gravity and air resistance on falling objects.
Reaction Times	Investigation into reaction times and how they change when you're distracted.
Ticker Timers	Investigation that uses ticker timers to gather data on the motion of a toy car.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
Building Circuits	Investigation into lightbulbs in series and parallel circuits.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.
Resistance	Comparing the measured resistance for a number of resistors to the resistance advertised by the resistors' coloured bands.
Static Electricity	Investigation into static electricity and how it can be used to levitate objects.
Building an Electromagnet	Investigations into electromagnets and how electrical currents can induce magnetic fields.
Energy Efficiency of Bouncy Balls	Investigation into the energy efficiency of bouncy balls.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Roller Coasters	Investigation into the energy transformations in a roller coaster.
Flame Tests	An investigation burning different substances to see what colour flame they produce.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
Build a Seismometer	Investigation learning what a seismometer is and how to make one from household materials.
Deep Time and Plate Tectonics	In this investigation, students research how the Earth's tectonic plates have moved over time, and from this make a timeline.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Convection Currents	Creating an observable convection current in the lab to better understand the nature of convection currents in the environment.
Polar Ice	Investigation into the effects of land ice and sea ice on sea levels.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Eye Dissection	Investigation dissecting a cow eye and identify the key structures.
Kidney Dissection	Dissecting a kidney and identify the key structures.
Testing Reflexes	Exploring the knee-jerk reflex as an example of a reflex arc.

Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Photosynthesis and Starch	Extracting starch - a product of photosynthesis - from leaves.
Sampling a Leaf Litter Ecosystem	Collecting samples of leaf litter at different depths and identify the invertebrates present. Also measuring the abiotic factors temperature and humidity at each depth. Using this information, students propose explanations for why the invertebrate community changes as one moves deeper into the leaf litter.
Extracting DNA	Extracting DNA from plant or animal tissue samples.
Modelling Inheritance of Alleles	In this investigation, students are given cards that represent the alleles of two parents across five genes. By randomly selecting and combining alleles, students can explore the processes of meiosis and fertilisation. From this, they can observe how siblings can end up looking different, even when they have the same parents.
Observing Mitosis	Observing cells from an onion root tip through a microscope and attempting to identify cells in different stages of mitosis.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
Building an Evolutionary Timeline	Creating and interpreting a timeline with a list of major dates in the evolution of life on Earth.
Great Ape Genealogy	Using coloured paperclips to model nucleotide sequences from human, chimp and gorilla DNA. Comparing the nucleotide sequences of the three different species and from this infer how they are related.
Survival of the Mutants	Groups of students compete to collect and store the most candy. Different groups have different traits, such as being blind or having their hands tied together. Through this exercise, students explore how different traits can affect an organism's foraging ability and overall fitness.
Build an Atom	Investigation where students building a model of an atom and explaining how the relative sizes and charges of the subatomic particles are represented.
Skittle Half Lives	Investigation where students shake a bag of skittles, dump it out and remove the skittles that land face up. This is repeated in order to model a half-life.
Flame Test	Observing the different coloured flames produced by different elements.
Ionic Bonding Card Game	In this investigation, students have cards that represent different cations and anions. They must match the cards in their hand in order to make balanced ionic compounds. The more cards in a compound, the more points.
Modelling Bonding using Tennis Balls	Tennis balls are used to represent electrons, while students represent atoms. To model metallic, ionic and covalent bonding, students must obtain or get rid of tennis balls in various ways.
Conservation of Mass	Students perform three reactions. In each reaction, they weight the reactants and products to find that mass has been conserved.
Identifying Chemical Reactions	Students carry out a number of physical and chemical changes. Among these, they must identify which are chemical reactions.

Making Your Own Forge	Students use a Bunsen burner to anneal and temper paperclips. They then compare their durability to unmodified paperclips.
Marshmolecules	Students build models of molecules using marshmallows, then modify these molecules to represent chemical reactions. This helps students visualise how the same atoms are present in the reactants as in the products.
Acids and Metals	Observing how hydrochloric acid can react with magnesium.
Milk Plastic	Making plastic out of milk.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.
Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.

Processing and Analysing Data and Information

Outcomes:

A student processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions.

Content:

WS7.1 Students process data and information.

Convection in Liquids	Investigation into convection of water as it is heated.
Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Speed of Sound	Investigation measuring the speed of sound.

Colourful Candy	Investigation into why we see colour and the interaction of coloured light with coloured objects.
Law of Reflection	Investigation into the Law of Reflection.
Lenses	Investigation into concave and convex lenses.
Refraction	Investigation into how the refraction of light and refractive indices can be used to determine the material that a transparent block is made out of.
Balloon Rocket	Investigation into Newton's Third Law using a balloon rocket.
Egg Drop	Investigation into Newton's First Law.
Gravity	Investigation into the effects of gravity and air resistance on falling objects.
Reaction Times	Investigation into reaction times and how they change when you're distracted.
Ticker Timers	Investigation that uses ticker timers to gather data on the motion of a toy car.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.
Resistance	Comparing the measured resistance for a number of resistors to the resistance advertised by the resistors' coloured bands.
Energy Efficiency of Bouncy Balls	Investigation into the energy efficiency of bouncy balls.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Scientific Notation	How to perform scientific notation on both very large and very small numbers.
Understanding Megaquakes	Interpreting data on the largest earthquakes in recorded history.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Examining Past Climate	This Smart Lesson presents temperature and greenhouse gas composition data from ice cores for students to interpret.
Reading a Weather Map	This Smart Lesson teaches students how to identify key features on weather maps, including pressure and temperature.
The Southern Oscillation Index	Interpreting data on La Niña and El Niño conditions using the Southern Oscillation Index.
Eye Dissection	Investigation dissecting a cow eye and identify the key structures.
Kidney Dissection	Dissecting a kidney and identify the key structures.
Body Temperature	Interpreting data on human body temperature changes when exposed to different temperatures.
Regulating Blood Glucose Levels	Interpreting data on how blood glucose and insulin levels change throughout the day.

Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Sampling a Leaf Litter Ecosystem	Collecting samples of leaf litter at different depths and identify the invertebrates present. Also measuring the abiotic factors temperature and humidity at each depth. Using this information, students propose explanations for why the invertebrate community changes as one moves deeper into the leaf litter.
Predator-Prey Dynamics	Data is presented on predator-prey relationships in order to understand the flow of energy in an ecosystem.
DNA Fingerprinting: Thirsty Thievery	This data interpretation lesson guides students through the interpretation of DNA profiles.
The Blue People of Troublesome Creek	This data interpretation lesson guides students through the interpretation of family pedigrees.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
Building an Evolutionary Timeline	Creating and interpreting a timeline with a list of major dates in the evolution of life on Earth.
Great Ape Genealogy	Using coloured paperclips to model nucleotide sequences from human, chimp and gorilla DNA. Comparing the nucleotide sequences of the three different species and from this infer how they are related.
Survival of the Mutants	Groups of students compete to collect and store the most candy. Different groups have different traits, such as being blind or having their hands tied together. Through this exercise, students explore how different traits can affect an organism's foraging ability and overall fitness.
Natural Selection in Action!	The interpretation of column graphs, pie graphs and line graphs.
The Biodiversity Gradient	This data interpretation lesson guides students through the interpretation of scatterplots, pie graphs and line graphs.
Skittle Half Lives	Investigation where students shake a bag of skittles, dump it out and remove the skittles that land face up. This is repeated in order to model a half-life.
Making Your Own Forge	Students use a Bunsen burner to anneal and temper paperclips. They then compare their durability to unmodified paperclips.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.
Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.

Graphing Rate of Reaction	Interpreting graphs of reactant concentration over time.

WS7.2 Students analyse data and information.

Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Musical Bottles	Investigation in which students make musical instruments out of glass bottles.
Slinky Waves	Investigation using a slinky to explore the difference between longitudinal and transverse waves.
Speed of Sound	Investigation measuring the speed of sound.
Straw Instruments	Investigation into the importance of resonance frequency in music.
Build a Periscope	Investigation into the uses of reflection.
Colourful Candy	Investigation into why we see colour and the interaction of coloured light with coloured objects.
Law of Reflection	Investigation into the Law of Reflection.
Lenses	Investigation into concave and convex lenses.
Refraction	Investigation into how the refraction of light and refractive indices can be used to determine the material that a transparent block is made out of.
Energy in Classrooms	Research investigation into how light, heat, sound, wifi and devices impact on the classroom environment.
Optical Fibres	Investigation into how optical fibres are used to communicate.
Radio Wave Blockers	Investigation into whether radio waves can be blocked by various materials.
Car Safety Systems Investigation	Investigation into a car safety system.
Balloon Rocket	Investigation into Newton's Third Law using a balloon rocket.
Egg Drop	Investigation into Newton's First Law.
Gravity	Investigation into the effects of gravity and air resistance on falling objects.
Reaction Times	Investigation into reaction times and how they change when you're distracted.
Ticker Timers	Investigation that uses ticker timers to gather data on the motion of a toy car.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
Building Circuits	Investigation into lightbulbs in series and parallel circuits.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.

Resistance	Comparing the measured resistance for a number of resistors to the resistance advertised by the resistors' coloured bands.
Static Electricity	Investigation into static electricity and how it can be used to levitate objects.
Building an Electromagnet	Investigations into electromagnets and how electrical currents can induce magnetic fields.
Energy Efficiency of Bouncy Balls	Investigation into the energy efficiency of bouncy balls.
Energy in Food	Investigation into the amount of chemical potential energy stored in food.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Scientific Theory	Introduction to what scientific theories are and how, unlike hypotheses, they are heavily supported by evidence.
Flame Tests	An investigation burning different substances to see what colour flame they produce.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
Build a Seismometer	Investigation learning what a seismometer is and how to make one from household materials.
Deep Time and Plate Tectonics	In this investigation, students research how the Earth's tectonic plates have moved over time, and from this make a timeline.
Understanding Megaquakes	Interpreting data on the largest earthquakes in recorded history.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Convection Currents	Creating an observable convection current in the lab to better understand the nature of convection currents in the environment.
Polar Ice	Investigation into the effects of land ice and sea ice on sea levels.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Examining Past Climate	This Smart Lesson presents temperature and greenhouse gas composition data from ice cores for students to interpret.
Reading a Weather Map	This Smart Lesson teaches students how to identify key features on weather maps, including pressure and temperature.
The Southern Oscillation Index	Interpreting data on La Niña and El Niño conditions using the Southern Oscillation Index.
Eye Dissection	Investigation dissecting a cow eye and identify the key structures.
Kidney Dissection	Dissecting a kidney and identify the key structures.
Testing Reflexes	Exploring the knee-jerk reflex as an example of a reflex arc.
Body Temperature	Interpreting data on human body temperature changes when exposed to different temperatures.
Regulating Blood Glucose Levels	Interpreting data on how blood glucose and insulin levels change throughout the day.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Photosynthesis and Starch	Extracting starch - a product of photosynthesis - from leaves.

Background Information - Different Perspectives on Mining	This lesson explains what mining is and how it influences the Australian economy and ecosystems. It is intended this lesson will be completed before starting the lesson "Research Project - The Carmichael Coal Mine".
Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Sampling a Leaf Litter Ecosystem	Collecting samples of leaf litter at different depths and identify the invertebrates present. Also measuring the abiotic factors temperature and humidity at each depth. Using this information, students propose explanations for why the invertebrate community changes as one moves deeper into the leaf litter.
Predator-Prey Dynamics	Data is presented on predator-prey relationships in order to understand the flow of energy in an ecosystem.
Extracting DNA	Extracting DNA from plant or animal tissue samples.
Modelling Inheritance of Alleles	In this investigation, students are given cards that represent the alleles of two parents across five genes. By randomly selecting and combining alleles, students can explore the processes of meiosis and fertilisation. From this, they can observe how siblings can end up looking different, even when they have the same parents.
Observing Mitosis	Observing cells from an onion root tip through a microscope and attempting to identify cells in different stages of mitosis.
Research Project - Researching Inbreeding in Dogs	Students research inbreeding in purebred dogs and write an essay explaining their findings. More information on inbreeding can be found in the Smart Lesson "Background Information - The Consequences of Inbreeding".
DNA Fingerprinting: Thirsty Thievery	This data interpretation lesson guides students through the interpretation of DNA profiles.
The Blue People of Troublesome Creek	This data interpretation lesson guides students through the interpretation of family pedigrees.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
Building an Evolutionary Timeline	Creating and interpreting a timeline with a list of major dates in the evolution of life on Earth.
Great Ape Genealogy	Using coloured paperclips to model nucleotide sequences from human, chimp and gorilla DNA. Comparing the nucleotide sequences of the three different species and from this infer how they are related.
Survival of the Mutants	Groups of students compete to collect and store the most candy. Different groups have different traits, such as being blind or having their hands tied together. Through this exercise, students explore how different traits can affect an organism's foraging ability and overall fitness.
Natural Selection in Action!	The interpretation of column graphs, pie graphs and line graphs.
The Biodiversity Gradient	This data interpretation lesson guides students through the interpretation of scatterplots, pie graphs and line graphs.
Skittle Half Lives	Investigation where students shake a bag of skittles, dump it out and remove the skittles that land face up. This is repeated in order to model a half-life.

Flame Test	Observing the different coloured flames produced by different elements.
Ionic Bonding Card Game	In this investigation, students have cards that represent different cations and anions. They must match the cards in their hand in order to make balanced ionic compounds. The more cards in a compound, the more points.
Modelling Bonding using Tennis Balls	Tennis balls are used to represent electrons, while students represent atoms. To model metallic, ionic and covalent bonding, students must obtain or get rid of tennis balls in various ways.
Conservation of Mass	Students perform three reactions. In each reaction, they weight the reactants and products to find that mass has been conserved.
Identifying Chemical Reactions	Students carry out a number of physical and chemical changes. Among these, they must identify which are chemical reactions.
Making Your Own Forge	Students use a Bunsen burner to anneal and temper paperclips. They then compare their durability to unmodified paperclips.
Marshmolecules	Students build models of molecules using marshmallows, then modify these molecules to represent chemical reactions. This helps students visualise how the same atoms are present in the reactants as in the products.
Acids and Metals	Observing how hydrochloric acid can react with magnesium.
Milk Plastic	Making plastic out of milk.
Modelling Rate of Reaction: Concentration	Using a tennis racket, students bat different numbers of tennis balls at a target. This simulates molecules colliding and reacting. They then measure the number of collisions made per minute, and from this infer how changing the number of tennis balls would change the rate of reaction.
Modelling Rate of Reaction: Temperature	Students throw tennis balls at a target to simulate molecules colliding and reacting. They repeat the experiment, throwing the tennis balls more and less often in order to simulate higher and lower temperatures. During this, they measure the number of collisions per minute.
Graphing Rate of Reaction	Interpreting graphs of reactant concentration over time.

Problem Solving

Outcomes:

A student applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems.

Content:

WS8 Students solve problems.

Energy in Classrooms	Research investigation into how light, heat, sound, wifi and devices impact on the classroom environment.
Car Safety Systems Investigation	Investigation into a car safety system.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
Roller Coasters	Investigation into the energy transformations in a roller coaster.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
The Greenhouse Effect	The factors that contribute to the greenhouse effect in different model environments.
Designing Experiments on Pollution	Planning an experiment to study the effects of pollution on plants. After this lesson, students should move on to the lesson Writing a Scientific Report.
Writing a Scientific Report	This lesson follows on from the lesson Designing Experiments on Pollution. In this lesson, students will carry out their previously planned experiment and write a scientific report on it.
Research Project - The Carmichael Coal Mine	In this lesson, students research the controversial Carmichael coal mine and write a report supporting or condemning it. The smart lesson "Different Perspectives on Mining" can be assigned to give students an introduction to mining in Australia.
Research Project - Researching Inbreeding in Dogs	Students research inbreeding in purebred dogs and write an essay explaining their findings. More information on inbreeding can be found in the Smart Lesson "Background Information - The Consequences of Inbreeding".
Milk Plastic	Making plastic out of milk.

Communicating

Outcomes:

A student presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations.

Content:

WS9 Students communicate.

Convection in Liquids	Investigation into convection of water as it is heated.
Heat Conduction	Investigation into heat conduction that also illustrates that different materials conduct heat at different rates.
Insulators	Investigation into the insulating properties of different materials and an everyday use of insulators.
Radiation	Investigation into heat transfer via radiation, and how the colour of objects impact the amount of heat that they radiate.
Slinky Waves	Investigation using a slinky to explore the difference between longitudinal and transverse waves.
Speed of Sound	Investigation measuring the speed of sound.
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