Victorian Curriculum – Levels 9 and 10

Introduction:

This document maps Education Perfect lessons to the Victorian Curriculum. A lesson may cover multiple standards, such as fulfilling both science as a human endeavour standards and other science understanding standards. In these cases, the lesson is found in both sections in the document.

Contents:

Science Understanding

Science Inquiry Skills

Key:

- Lessons that address the science understanding standard.
- Lessons that elaborate or extend above and beyond the curriculum.
- Lessons that also fulfil science as a human endeavour standards.
- Lessons that also fulfil science inquiry skills standards.

Science Understanding

Science as a Human Endeavour

Relevant section of the achievement standard:

By the end of Level 10, students analyse how models and theories have developed over time and discuss the factors that prompted their review. They predict how future applications of science and technology may affect people's lives.

Standards:

Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. (VCSSU114)

Predicting Population Changes	How we can use food webs to predict how populations recover after a disaster, such as a bushfire.
Back to the Sea: Cetacean Evolution	Cetaceans and their evolution from terrestrial four-legged mammals.
Feathery Dinosaurs	The discovery of well-preserved feathers of a dinosaur trapped in amber.
Our Evolution	Human evolution as an extension to the evolution topic.
Rewriting Human History	The discovery of human remains in Morocco from 300,000 years ago, far earlier than the current theories suggest.

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.
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 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.
How are Diseases Spread?	How diseases are spread.
Models of the Atom	History of the different models of the atom and the experiments leading to new models.
A Day in the Life of an Industrial Chemist	What industrial chemists do and what it takes to become one.
The Father of Modern Chemistry	Biography on Antoine Lavoisier, explaining who he was and his contribution to chemistry: precise laboratory techniques and the law of conservation of mass.
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.
Evidence of the Earth's Structure	Introduction to techniques used by scientists to probe the inner Earth.
Supercontinents	How the ancient supercontinent of Pangea turned into the seven continents we know today.
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.
The Sixth Sense: Electroreception	How some animals can detect electrical currents.
Steam Engines	The energy transformations used to power steam engines.
Sports Science	How sports science is used to develop new techniques and materials, improving athletes' performances.
Earth's Magnetic Field	Introduction to the Earth's magnetic field and compasses.

Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries. (VCSSU115)

Genomics	The human genome project, and the implications that genomic research has for treating diseases and researching evolution.
Disease Treatment	Ways to treat or control the spread of infectious diseases, including vaccination, antibiotics, and good hygiene practices.
Starfish Nervous System	Comparing the Starfish's unusual nervous system to that of humans.
Effects of Radiation on Humans	The effects of ionising radiation on humans, and the importance of the dose.
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.
Spectroscopy	How spectroscopy was developed, and what some different types of spectroscopy are.
Analytical Chemistry	What an analytical chemist does, including quality assurance and forensics and how to become one.
Volcano Exploration Robots	Exploring how small robots can be used to help explore and study volcanoes.
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.
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.
Observing Space	How we use radio telescopes and satellites to study and measure the stars.
The Secret Lives of Ultra-Cool Dwarf Stars	The discovery of a unique set of exoplanets in the far-off Trappist system that may be able to support life.
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.
Electricity Generation	Electricity and where it comes from in Australia
Levitation at UChicago!	The development of a technique for thermal levitation.
Rockets	Explanation of the forces acting on rockets during launch and of the Space Race.

The values and needs of contemporary society can influence the focus of scientific research. (VCSSU116)

Human Impacts	Introducing biodiversity, and the impacts of European farming, over cropping 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.
Artificial Selection: The Good, The Bad and the Downright Strange	Examples of good, bad, and strange artificial selection.
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.
Fermentation	How fermentation can be used to make bread and other foods, drinks and fuels.
Waste Management	What waste products are and how, as a society, we can manage them. Emphasis on car exhaust and industrial waste.
Chemicals: Friend or Foe?	Introduces dangerous chemicals and explains proper handling and clean up procedures around them.
Extracting Metals	How metals are extracted from their ores.
Fuels and Pharmaceuticals	The chemistry behind fuels and pharmaceuticals.
Polymers	How chemistry can be used to make the useful material we all use every day, plastics!
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.
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.

Save the Great Barrier Reef!	The bleaching of the Great Barrier Reef, and ways that scientists are hoping to save what is left.
Energy in Food	How our body transforms chemical potential energy in food into kinetic and heat energy.
Car Safety Systems	How seatbelts, head rests, crumple zones and airbags use the laws of physics to protect people during car crashes.
How BB-8 Works	Using the Star Wars character 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.
Bushfires	Importance of heat and heat transfer during the Australian bushfires.
Housing Insulation	Explaining how insulation can be used to prevent heat from entering or exiting a house.
Different Views	Comparing different ethical values from around the world.
The Ethics of Genetics	Genetics and the associated ethical issues surrounding genetic research.

Biological Sciences

Relevant section of the achievement standard:

By the end of Level 10 students … analyse how biological systems function and respond to external changes with reference to the interdependencies between individual components, energy transfers and flows of matter. They evaluate the evidence for scientific theories that explain the … diversity of life on Earth. They explain the role of DNA and genes in cell division and genetic inheritance. They apply geological timescales to elaborate their explanations of both natural selection and evolution.

Standards:

Multicellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment. (VCSSU117)

	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 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 Defence	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.
	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.
	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.
	The History of Disease	Ways ancient humans thought diseases were caused, and how these ideas evolved over time.
	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.

An animal's response to a stimulus is coordinated by its central nervous system (brain and spinal cord); neurons transmit electrical impulses and are connected by synapses. (VCSSU118)

	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.
	Components of Neural Pathways	Neural pathways consist of cells that transport nerve impulses from sensory receptors to neurons and on to effectors.
	Passage of Nerve Impulses	The passage of nerve impulses involves transmission of an action potential along a nerve axon and synaptic transmission by neurotransmitters.
	Starfish Nervous System	Comparing the Starfish's unusual nervous system to that of humans.

The transmission of heritable characteristics from one generation to the next involves DNA and genes. (VCSSU119)

	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 probabilities 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.
	Chromosomal Abnormalities	How chromosomal abnormalities can arise from meiosis, and that these abnormalities can result in chromosomal disorders such as Down syndrome.

	Proteins	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.
	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.
	Genomics	The human genome project, and the implications that genomic research has for treating diseases and researching evolution.
	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.
	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.
	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: 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".
	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."
	Attraction: It's all in the Armpits	A passage about the major histocompatibility complex (MHC) and the role it plays in human mate choice.
	Epigenetics: Inheritance is Strange	A passage about epigenetics and the current thinking surrounding inheritance.
	DNA Fingerprinting: Thirsty Thievery	Interpretation of DNA profiles.

	The Blue People of Troublesome Creek	Interpretation of family pedigrees.

The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. (VCSSU120)

	Geological Time	The concept of deep time and the Geological Timescale.
	Overview: Evidence for Evolution	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	The fossil evidence in support of Darwin's theory of evolution, including the fossil record.
	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.
	Biodiversity	The concept of biodiversity and its importance.
	Extinction	What extinction is and how it comes about.
	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	Bacteria and how they evolve antibiotic resistance.
	Coevolution	How two species influence each other's evolution.

	Mimicry	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.
	Feathery Dinosaurs	The discovery of well-preserved feathers of a dinosaur trapped in amber.
	Our Evolution	Human evolution as an extension to the evolution topic.
	Rewriting Human History	The discovery of human remains in Morocco from 300,000 years ago, far earlier than the current theories suggest.
	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.
	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.
	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.
	The Ancestor of All Things	The Last Universal Common Ancestor (LUCA).
	Natural Selection in Action!	The interpretation of column graphs, pie graphs and line graphs.

	The Biodiversity Gradient	Interpretation of scatterplots, pie graphs and line graphs.

Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems. (VCSSU121)

	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.
	Adaptations	The three main types of adaptations, with specific examples relating to ectothermy and endothermy in animals.
	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 Greenhouse Effect	Chemical compounds used by humans that have substantial impacts on ecosystems, including oil, pesticides and greenhouse gas emissions.
	The Nitrogen Cycle	Importance of nitrogen in ecosystems and how it is recycled.
	Human Impacts	Introducing biodiversity, and the impacts of European farming, over cropping 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.
	Predicting Population Changes	How we can use food webs to predict how populations recover after a disaster, such as a bushfire.
	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.
	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.
	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".
	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.
	Adapting for Survival	Some examples of adaptations for survival in the animal kingdom. This lesson can be used to improve reading comprehension in students.
	Predator-Prey Dynamics	Data is presented on predator-prey relationships in order to understand the flow of energy in an ecosystem.

Chemical Sciences

Relevant section of the achievement standard:

By the end of Level 10 students … explain how similarities in the chemical behaviour of elements and their compounds and their atomic structures are represented in the way the periodic table has been constructed. They compare the properties of a range of elements representative of the major groups and periods in the periodic table. They use atomic symbols and balanced chemical equations to summarise chemical reactions, including neutralisation and combustion. They explain natural radioactivity in terms of atoms and energy change. They explain how different factors influence the rate of reactions.

Standards:

All matter is made of atoms which are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms. (VCSSU122)

	Review: Matter	Review of Year 8 concepts of atoms, elements, and compounds for Australian Year 9 students.
	Atomic Structure	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?	Introduction to isotopes (what they are and how to name them) and relative atomic mass.
	The Periodic Table	Introduction to how elements are grouped in the Periodic Table.
	Introduction to 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.
	Introduction to Radioactivity	Introduction to radioactivity and radioisotopes.
	Types of Radiation	Describing alpha, beta and gamma radiation.
	Half-Lives	How to calculate half-lives and how carbon dating works.
	Nuclear Bombs	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	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.
	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	Build a model of an atom and explain 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.

The atomic structure and properties of elements are used to organise them in the periodic table. (VCSSU123)

	History of the Atomic Model	The model of the atom, and the models that came before it.
	Electron Configuration	How electrons are configured in an atom.
	The Periodic Table	Introduction to the periodic table.
	Trends in the Periodic Table	The trends in the periodic table.
	Introduction to Bonding	The concept of chemical bonding.
	Metallic Bonding	Metallic bonding.
	Ionic Bonding	Ionic bonding.
	Covalent Bonding	Covalent bonding.
	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.
	Chemicals: Friend or Foe?	Introduces 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.
	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.
	Helium: More Than a Bit of Squeaky Fun	The global helium shortage and how people are looking into finding more.
	Metallic Hydrogen or: How I Learned to Stop Worrying and Love the Scientific Process	The recent discovery of metallic hydrogen, including the criticisms of how the discovery was carried out.
	Understanding the Periodic Table	Using the periodic table to look up information about specific elements.

Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed. (VCSSU124)

	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.
	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.
	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.
	Make 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.

Different types of chemical reactions are used to produce a range of products and can occur at different rates; chemical reactions may be represented by balanced chemical equations. (VCSSU125)

	Chemical vs. Physical	Learn to identify whether a chemical or physical reaction has taken place.
	Chemical Reactions	Chemical reactions.
	Combination and Decomposition Reactions	Combination and decomposition reactions.
	Acid Reactions	Acid reactions.
	Precipitation Reactions	Precipitation reactions.

	Oxidation and Reduction	Oxidation and reduction 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.
	Collision Theory	Reactions occur when molecules collide with the right orientation and with sufficient energy.
	Collision Theory and Rate of Reaction	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	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.
	Analytical Chemistry	What an analytical chemist does, including quality assurance and forensics and how to become one.
	Extracting Metals	How metals are extracted from their ores.
	Fuels and Pharmaceuticals	The chemistry behind fuels and pharmaceuticals.
	Polymers	How chemistry can be used to make the useful material we all use every day, plastics!
	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.
	Chemical Clocks	How the rate of reaction can be manipulated to produce unusual results, such as a solution that flickers between colourless and purple!
	Graphing Rate of Reaction	Interpreting graphs of reactant concentration over time.

Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer. (VCSSU126)

	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.
	Types of Chemical Reactions	Decomposition, synthesis and single and double displacement reactions.

	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 Metals	Observing how hydrochloric acid can react with magnesium.
	Acids and Bases	Acids and bases and their uses. This lesson can be used to improve reading comprehension.

Earth and Space Sciences

Relevant section of the achievement standard:

By the end of Level 10 students … evaluate the evidence for scientific theories that explain the origin of the Universe ... They explain global features and events in terms of geological processes and timescales, and describe and analyse interactions and cycles within and between Earth's spheres.

Standards:

The theory of plate tectonics explains global patterns of geological activity and continental movement. (VCSSU127)

	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.
	Earth's Magnetic Field	The Earth's magnetic field.
	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.
	Evidence of the Earth's Structure	Introduction to techniques used by scientists to probe the inner Earth.
	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.
	The Hotspot Debate	Researching the debate over geological hotspots, and preparing a debate over this topic.
	Ice Tectonics on Europa	Tectonic processes on the moon Europa.
	Subduction Zones and Ophiolite Belts	Ophiolite: a product of some subduction zones.
	Understanding Megaquakes	Interpreting data on the largest earthquakes in recorded history.

Global systems, including the carbon cycle, rely on interactions involving the atmosphere, biosphere, hydrosphere and lithosphere. (VCSSU128)

	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.
	Ocean Currents	Ocean currents and their effect on the climate.
	El Niño and La Niña	El Niña, La Niña and the Southern Oscillation.
	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 permafrosts.
	Disappearing Polar Ice	The effects of the enhanced greenhouse effect on land and sea ice in polar regions.
	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.
	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.
	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.
	Save the Great Barrier Reef?	The bleaching of the Great Barrier Reef, and ways that scientists are hoping to save what is left.
	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.
	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.
	Examining Past Climate	Presents temperature and greenhouse gas composition data from ice cores for students to interpret.
	Reading a Weather Map	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.

The Universe contains features including galaxies, stars and solar systems; the Big Bang theory can be used to explain the origin of the Universe. (VCSSU129)

	Universe Introduction	Introduction to the main components of the universe, including stars and the planets surrounding our sun.
	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.
	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.
	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.

	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, and how it was disproved by the discovery of cosmic microwave background radiation.
	Red Shift	What the Doppler effect and red shift are, and how red shift provides evidence that the universe is expanding.
	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.
	Observing Space	How we use radio telescopes and satellites to study and measure the stars.
	The Secret Lives of Ultra-Cool Dwarf Stars	The discovery of a unique set of exoplanets in the far-off Trappist system that may be able to support life.
	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.

Physical Sciences

Relevant section of the achievement standard:

By the end of Level 10 students … explain the concept of energy conservation and model energy transfer and transformation within systems. They give both qualitative and quantitative explanations of the relationships between distance, speed, acceleration, mass and force to predict and explain motion. They use the concepts of voltage and current to explain the operation of electric circuits and use a field model to explain interactions between magnets.

Standards:

Electric circuits can be designed for diverse purposes using different components; the operation of circuits can be explained by the concepts of voltage and current. (VCSSU130)

	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.
	Conductors and Insulators	Conductors and insulators, and how they are used in circuits.
	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.
	Calculating Using Ohm's Law	Practice calculating voltage, current and resistance using Ohm's Law.
	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.
	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.
	Development of Light Bulbs	The development of light bulbs as a passage with which improve reading comprehension.

The interaction of magnets can be explained by a field model; magnets are used in the generation of electricity and the operation of motors. (VCSSU131)

	Magnetism	An introduction to magnets and magnetic fields.
	Magnetic Fields	Explanation of magnetic fields and magnetic flux lines, using permanent bar magnets as an example.
	Examples of Magnetic Fields	Explanation of the magnetic fields produced by current carrying wires and solenoids.
	Magnetic Force on a Wire	Explanation of the magnetic forces acting on current carrying wire in magnetic fields and how to use the right-hand slap rule.
	Magnetic Force on a Charged Particle	Explanation of the magnetic forces acting on charged particles in magnetic fields and how to use the right-hand slap rule.

	Electromagnetic Induction	Explanation of how electromagnetic induction causes a current to be generated in wires due to their interaction with magnetic fields.
	Generators	Explanation of how electromagnetic induction is used in generators to produce electricity.
	Motors	Explanation of how magnets are used in DC motors to produce motion.
	Maglev Trains	Explaining how maglev trains use electromagnets to levitate.
	Earth's Magnetic Field	Introduction to the Earth's magnetic field and compasses.
	Mapping Magnetic Fields	Investigation into the shapes of magnetic fields and the nature of magnetic forces.
	Magnetic Navigation	Video comprehension on how animals use magnetic fields to navigate.
	Flipping Poles	Understanding how poles can flip, and how they have done so in the Earth's past.

Energy flow in Earth's atmosphere can be explained by the processes of heat transfer. (VCSSU132)

	Types of Energy	Recap on the most common types of kinetic and potential energy.
	Conservation of Energy	The Law of Conservation of Energy.
	Energy Transfer	Energy transfer, with a focus on the transfer of heat.
	Energy Transformations	Energy transformations.
	Useful and Wasted Energy	Introduction to the concepts of useful energy, wasted energy and efficiency.
	Work and Power	The concepts of work and power, with calculations.
	Energy Efficiency	Energy efficiency, with calculations.
	Energy Calculations	Practice using the energy, work and power formula.

	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.
	Electricity Generation	Electricity and where it comes from in Australia
	Energy in Food	How our body transforms the chemical potential energy in food into kinetic and heat energy.
	Levitation at UChicago!	The development of a technique for thermal levitation.
	Steam Engines	The energy transformations used to power steam engines.
	Bushfires	Importance of heat and heat transfer during the Australian bushfires.
	Housing Insulation	Explaining how insulation can be used to prevent heat from entering or exiting a house.
	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.
	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.

The description and explanation of the motion of objects involves the interaction of forces and the exchange of energy and can be described and predicted using the laws of physics. (VCSSU133)

	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.
	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.
	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.
	Weight and Mass	Introduction to gravity and the difference between weight and mass.

	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 Investigation	Investigation into a car safety system.
	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.
	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.
	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.
	Rockets	Explanation of the forces acting on rockets during launch and of the Space Race.
	Sports Science	How sports science is used to develop new techniques and materials, improving athletes' performances.
	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.
	Crashing Drones	How scientists are studying animals to help make drones safer for everyone.
	History of Rockets	The history of rockets, used to improve reading comprehension.

Graphing and Analysing Motion	Learning how to turn raw data into graphs, and how to read the motion graphs that are created.

Science Inquiry Skills

Relevant section of the achievement standard:

By the end of Level 10 students … develop questions and hypotheses that can be investigated using a range of inquiry skills. They independently design and improve appropriate methods of investigation including the control and accurate measurement of variables and systematic collection of data. They explain how they have considered reliability, precision, safety, fairness and ethics in their methods and identify where digital technologies can be used to enhance the quality of data. They analyse trends in data, explain relationships between variables and identify sources of uncertainty. When selecting evidence and developing and justifying conclusions, they account for inconsistencies in results and identify alternative explanations for findings. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and use appropriate scientific language, representations and balanced chemical equations when communicating their findings and ideas for specific purposes.

Questioning and Predicting

Formulate questions or hypotheses that can be investigated scientifically, including identification of independent, dependent and controlled variables. (VCSIS134)

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.
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.
Building Circuits	Investigation into lightbulbs in series and parallel circuits.
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.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
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.
Variables	Independent variables, dependent variables and control variables.
Control Variables and Control Groups	The importance of control variables and control groups, and the importance of using these for results to be meaningful.
Scientific Method	The scientific method and how to write a scientific report.
Hypothesising and Predicting	How to make a scientific hypothesis and predicting results of experiments.

Planning and Conducting

Independently plan, select and use appropriate investigation types, including fieldwork and laboratory experimentation, to collect reliable data, assess risk and address ethical issues associated with these investigation types. (VCSIS135)

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.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
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.
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.
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.
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.
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.
Make 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.
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.
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.
Acids and Metals	Observing how hydrochloric acid can react with magnesium.
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.
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.
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.
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.
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.
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.
Mapping Magnetic Fields	Investigation into the shapes of magnetic fields and the nature of magnetic forces.
Safety Equipment	The different types of safety equipment and when to use them.
Safety Guidelines	Discussing safety instructions for the lab, including what to wear and what to do when things go wrong.

Accuracy	Accuracy and selecting measuring equipment which will give a more accurate result.
Repeatability and Reliability	An introduction to repeatability and reliability and their importance when carrying out experiments.
Validity	Validity when performing an experiment, and how changing variables can invalidate an experiment.
Fair Tests	Fair tests and how to control variables.
Sample Size	The importance of large sample sizes in collecting accurate results.
Choosing Appropriate Units	Practice choosing appropriate units for volumes, distances, energies and speeds.
Units of Distance	Introduction to the SI units used to measure distance, and how to convert between the units.
Units of Energy	Introduction to the SI units used to measure energy, and how to convert between the units.
Units of Speed	Introduction to the SI units used to measure speed, and how to convert between the units.
Units of Volume	Introduction to the SI units used to measure volume, and how to convert between the units.

Select and use appropriate equipment and technologies to systematically collect and record accurate and reliable data, and use repeat trials to improve accuracy, precision and reliability. (VCSIS136)

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.
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.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.
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.
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.

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.
Polar Ice	Investigation into the effects of land ice and sea ice on sea levels.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
Battery Voltages	Investigation where students measure the voltages on a range of batteries and compare this to the advertised voltages.
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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.
Balloon Rocket	Investigation into Newton's Third Law using a balloon rocket.
Egg Drop	Investigation into Newton's First Law.
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.
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.
Equipment Types	Basic laboratory equipment and its uses.

Bunsen Burner	The design and makeup of the Bunsen burner.
Separating Substances and Other Equipment	Introduction to some important pieces of scientific equipment and their uses with a focus on equipment needed to separate mixtures.
Equipment Quiz	A quiz testing the ability of students to name scientific equipment.
Measuring in Science	How to read different measuring tools. The tools discussed are rulers, measuring cylinders, protractors, thermometers and scales.
Reading the Meniscus	The way to read a measurement from a fluid that has a meniscus.
Observations and Inferences	How to make observations and inferences using qualitative and quantitative methods.
Organising Data into a Data Table from an Experiment	How to format data tables using scientific conventions, and how to create and input data into data tables.
Interpreting Data Tables	How to interpret data tables, and the difference between directly proportional and inversely proportional relationships.
Measuring Electricity	How to measure voltage, current and resistance using ammeters, voltmeters and multimeters.
Magnification	How magnification can be calculated and changed and how this relates to the field of view and resolution.
Parts and Function of a Microscope	How optical microscopes work and what they are.
Types of Microscopes	The different types of microscopes that can be used.
Using a Microscope	How to prepare wet mounts and use a microscope.
Algebra in Science	Introduction to how algebra is used in science with the examples of calculating net force and using Newton's Second Law.
Rearranging Equations	Introduction on how to rearrange simple algebraic equations.
Scientific Notation	How to write large and small numbers in scientific notation.
Significant Figures	How to write numbers to significant figures, and how to identify significant figures.

Recording and Processing

Construct and use a range of representations, including graphs, keys, models and formulas, to record and summarise data from students' own investigations and secondary sources, to represent qualitative and quantitative patterns or relationships, and distinguish between discrete and continuous data. (VCSIS137)

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.
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.
Building an Evolutionary Timeline	Creating and interpreting a timeline with a list of major dates in the evolution of life on Earth.
Eye Dissection	Investigation dissecting a cow eye and identify the key structures.
Kidney Dissection	Dissecting a kidney and identify the key structures.
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.
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.
Ohm's Law	Investigation into Ohm's Law in a simple circuit.
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.
Energy in Skate Parks	Investigation into energy transformations and waste energy using a PhET Skate Park simulation.
Truckapults	Investigation into Newton's Second Law using trucks of varying masses.
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.
Mapping Magnetic Fields	Investigation into the shapes of magnetic fields and the nature of magnetic forces.

Graphs in Science	How graphs are used in science.
Bar Graphs	Bar graphs, and what type of information is best represented in bar graphs.
Line Graphs	How to make and read a line graph.
Matching Tables to Graphs	Whether data should be presented in a table or a graph.
Food Webs	Interpreting food web diagrams to teach interpretation skills.
Interpreting Diagrams	Exercises on interpreting food chains, flow charts, dichotomous keys and force diagrams.
Water Cycle	Introduction to interpreting diagrams using the water cycle as an example.
A Guide for Making Graphs in Excel (Mac Version)	How to make scatter plots, histograms and column graphs in Excel, when using a Mac computer.
A Guide for Making Graphs in Excel (Windows Version)	How to make scatter plots, histograms and column graphs in Excel, when using a Windows computer.
Scatter Graphs	Explanation of scatter graphs and lines of best fit.

Analysing and Evaluating

Analyse patterns and trends in data, including describing relationships between variables, identifying inconsistencies in data and sources of uncertainty, and drawing conclusions that are consistent with evidence. (VCSIS138)

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.
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.
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.
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.
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.
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.
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.
Make 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.
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.
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.
Acids and Metals	Observing how hydrochloric acid can react with magnesium.
Build a Seismometer	Investigation learning what a seismometer is and how to make one from household materials.
The Hotspot Debate	Researching the debate over geological hotspots, and preparing a debate over this topic.
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.
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.
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.
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.
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.
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Mapping Magnetic Fields	Investigation into the shapes of magnetic fields and the nature of magnetic forces.

Use knowledge of scientific concepts to evaluate investigation conclusions, including assessing the approaches used to solve problems, critically analysing the validity of information obtained from primary and secondary sources, suggesting possible alternative explanations and describing specific ways to improve the quality of data. (VCSIS139)

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.
Assessing Biodiversity	Making pitfall traps and identify the invertebrates caught in them.

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.
Extracting DNA	Extracting DNA from plant or animal tissue samples.
Research Project: 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".
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.
Conservation of Mass	Students perform three reactions. In each reaction, they weight the reactants and products to find that mass has been conserved.
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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.
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The Hotspot Debate	Researching the debate over geological hotspots, and preparing a debate over this topic.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Measuring Parallax	Investigation using parallax to measure the distance of far-away objects.
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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.

Mapping Magnetic Fields	Investigation into the shapes of magnetic fields and the nature of magnetic forces.
Evaluating in Science	How to evaluate experimental results.

Communicating

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations. (VCSIS140)

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.
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Research Project: 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".
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.
The Hotspot Debate	Researching the debate over geological hotspots, and preparing a debate over this topic.
Climate Change	A research based investigation on the effects of the enhanced greenhouse effect on the climate.
Static Electricity	Investigation into static electricity and how it can be used to levitate objects.
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