Hawker Brownlow EDUCATION

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Innovate! Educate! Inspire!

Anne Tweed

Monday 26 May

Designing High-Quality Secondary Science Units Aligned to the National Curriculum

Session 3

ANNE TWEED

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A message from Hawker Brownlow Education

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Science Curriculum Themes and Big Ideas: Year 7 to 10

Biological Sciences

Units

THEMES	STRUCTURE AND FUNCTION OF LIVING ORGANISMS *The structure and function of living things allows them to respond to changes in their internal and external environments.*	DIVERSITY AND EVOLUTION *The process of evolution and natural selection has resulted in the wide diversity of living things that exist, or have existed, on earth.*	INTERDEPENDENCE OF LIVING ORGANISM AND SYSTEMS *Living things are interdependent and interact with each other and their environment.*
Year 7		**CLASSIFICATION** *All living things are classified and based on structural features and evolutionary relationships.* • Classification systems group organisms into useful categories • Groupings are by similarities and evolutionary relationships	**FOOD WEBS** *The interaction of living organisms, including humans, can be represented using food webs. Humans can effect these interactions.* • Food webs/eating relationships • Energy from sun fuels ecosystems • Humans impact populations in ecosystems
Year 8	**CELLS** *Living things are made of cells that have evolved to perform functions that enable them to survive and reproduce.* • Cell structures • Cell function and specialisation • Cells come from pre-existing cells **ORGAN SYSTEMS** *Multi cellular organisms co-ordinate their function using specialised tissues and organ systems.*		

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Science Curriculum Themes and Big Ideas: Year 7 to 10

	• Specialised tissues and organs
	• Organ systems (complete one or more in detail as time allows)
	  ○ Circulatory--transport
	  ○ Respiratory—gas exchange
	  ○ Digestive—food and waste
	• Connectedness of organ systems		

Year 9	**SYSTEMS COORDINATION** *Multi-cellular organisms rely on internal systems to effectively co-ordinate response to both internal and external environmental changes.* • Homeostasis • Stimulus response • Coordination of systems—nervous and endocrine		**ECOSYSTEMS** *Ecosystems consist of interdependent populations and their abiotic environments resulting in recycling of matter and a flow of energy* • Matter cycling and energy flow • Components of ecosystems and interactions within biomes • Interrelationships • Changes that are natural or human caused • Dynamic equilibrium
Year 10		**REPRODUCTION & INHERITANCE** *Reproduction allows genetic information to be passed on through generations in predictable ways.* • Sexual and asexual methods • Inheritable genes and combinations • Patterns of inheritance including variation • Mutations and gene technologies **THE THEORY OF EVOLUTION & NATURAL SELECTION** *Biological evolution explains the unity and*	

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		diversity of species. • Evolution as change over time • Evidence of evolution • Natural selection	

Chemical Sciences

Units

THEMES	PROPERTIES OF MATTER *The chemical and physical properties of substances are determined by their structure.*	CHANGES OF MATTER *Changes in matter involve the rearranging of atoms and energy transfer.*
Year 7		**CHEMICAL MIXTURES** *All mixtures are comprised of two or more substances that can be separated based on physical properties.* • Pure substances vs. mixtures • Mixtures (solutions, colloids, suspensions, emulsions) and separation techniques
Year 8	**THE PARTICLE NATURE OF MATTER** *The arrangement and motion of particles determine the state and physical properties of matter.* • Kinetic molecular theory of matter • States of matter models relative to thermal energy **ELEMENTS AND COMPOUNDS** *Matter is composed of many different elements that can be combined in a variety of ways to form compounds.* • Elements vs. compounds • Physical properties of compounds • Introduce Periodic Table	**CHEMICAL CHANGE** *When elements are combined chemically the properties of the resulting compound may differ from those of the original elements.* • Differences between chemical and physical change

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Science Curriculum Themes and Big Ideas: Year 7 to 10

Year 9	**ATOMIC STRUCTURE**
	Different elements have different numbers of subatomic particles within their atoms. Some elements become unstable and can decay.
	• Protons, neutrons and electrons
	• Radioactive decay
		CONSERVATION OF MASS
		Chemical reactions involve the rearrangement of atoms to form new substance without the loss of matter.
		• Conservation of matter
		• Word equations—reactants and products
		• Role of energy
		
		CHEMICAL REACTIONS
		Chemical reactions involve energy transfer and play a significant role in living and non-living systems.
		• Energy transfer as exo- or endothermic
		  ○ Living (photosynthesis and respiration)
		  ○ Non-living (combustion and oxidation)

Year 10	**THE PERIODIC TABLE** *The chemical and physical properties of an element are determined by its atomic structure.* • Organization, history and trends in the periodic table • Properties of families of elements	**EXPLORING CHEMICAL REACTIONS** *Production of materials useful to society relies on an understanding of chemistry. (Better living through chemistry.)* • Ionic and covalent bonding • Acid reactions • Chemical equations—balancing and predicting • Rates of reactions • Industrial applications

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Science Curriculum Themes and Big Ideas: Year 7 to 10

Earth Science

Units

THEMES	EARTH IN SPACE AND TIME The planet Earth is a tiny part of a vast universe that has developed over a huge expanse of time. Comprehension of patterns can be used to explain Earth phenomena.	EARTH STRUCTURES AND THE CHANGING EARTH Earth's surface is a complex and dynamic set of interconnected systems that interact over a wide range of temporal and spatial scales.
Year 7	**INTERACTIONS BETWEEN THE EARTH, MOON AND SUN** *The interactions and relative positions of the sun, Earth and moon are responsible for predictable and periodic phenomena.* • Seasons, tides and phases of the moon	**RENEWABLE AND NON-RENEWABLE RESOURCES** *Humans rely on the Earth's natural resources, some of which are renewable or replenishable and some of which are not.* • Water cycle • Renewable and Non-renewable resources
Year 8		**ROCKS AND GEOLOGIC TIMESCALES** *A record of Earth's history is contained in rocks that are continuously broken down and reformed by geological processes which occur over millions of years.* • Rocks and minerals • Formation of rocks and fossils
Year 9		**DYNAMIC EARTH SYSTEMS** *The earth is a dynamic system that is constantly changing due to geological processes that have occurred over billions of years.* • Plate tectonics • Structure of the earth • Natural disasters

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Science Curriculum Themes and Big Ideas: Year 7 to 10

Year 10	**EVOLUTION AND FEATURES OF THE UNIVERSE** *The universe is a continually evolving system.* • Origin of the universe—Big Bang • Stellar evolution • Conditions for life	**CLIMATE CHANGE** *The earth's climate is governed by intricately balanced biogeochemical cycles which are affected by human activity resulting in global climate change.* • Climate change and evidence—disruption and theories • Greenhouse effects • Human impacts

Science Curriculum Themes and Big Ideas: Year 7 to 10

Physical Sciences

Units

THEMES	FORMS OF ENERGY AND ENERGY TRANSFER *Energy can be transformed and transferred from one form to another.*	FORCES AND MOTION *Application of forces affects the behaviour of objects.*
Year 7		**BALANCED & UNBALANCED FORCES** *Balanced and unbalanced forces determine stability or instability of all systems.* • Balanced and unbalanced forces • Simple machines **GRAVITATIONAL FORCES** *Gravity is a force of attraction between two objects that acts in predictable ways.* • Gravity and earth objects • Gravity and celestial interactions
Year 8	**ENERGY TRANSFORMATION** *Energy exists in different forms and can be transformed from one form to another.* • Kinetic energy and potential energy • Forms of energy and transformations • Heat energy is a by-product of energy transfer • Energy conservation	

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Science Curriculum Themes and Big Ideas: Year 7 to 10

Year 9	**ENERGY TRANSFER** *Energy can be transferred in different ways depending upon the materials involved.* • Wave theory—mechanical and electromagnetic • Energy transfer—conduction, convection, radiation	
Year 10	**CONSERVATION OF ENERGY** *In a closed system, the total amount of energy remains constant.* • Energy conservation • Energy efficiencies • Open and closed systems	**LAWS OF MOTION** *Forces acting on objects affect their motion in predictable ways.* • Newton's three laws • Applications of the laws—predictability, calculations

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Unburdening the Curriculum

Time in school for teaching and learning is not limitless. Yet many textbooks and course syllabi seem to assume otherwise. They include a great abundance of topics, many of which are treated in superficial detail and employ technical language that far exceeds most students' understanding.

Cutting Major Topics

The case for reducing the number of different topics taught in science, mathematics, and technology is straightforward. A basic message from research on how children learn science is that (1) many science concepts are inconsistent with children's beliefs about how the natural world works, and (2) for children to understand science concepts often requires that they wrestle with how those concepts are more satisfactory than their own current beliefs. Learning science effectively, therefore, requires direct involvement with phenomena and much discussion of how to interpret observations. Moreover, it requires encountering the intended concepts in a variety of contexts and successively more adequate formulations—activities that obviously take time.

Pruning Subtopics from Major Topics

Similar arguments can be made for a less radical adjustment of traditional curriculum content that will leave time for higher-priority learning goals. Part of the curriculum problem is that, in addition to treating too many major topics, the curriculum treats many subtopics within them with excessive detail (relative to the topic's importance for literacy). In addition to eliminating whole topics, therefore, progress can be made by cutting back on the extent and complexity of the treatment of at least some topics. Whereas dropping whole topics can lead to the elimination of whole chapters or units, pruning may correspond loosely to cutting out paragraphs at the subtopic level. The purpose of such pruning is to focus on what is really important to know about a topic rather than on how to make it easier to learn.

Trimming Technical Vocabulary

A special case of pruning topics involves cutting back on the teaching of technical terms for their own sake. It is not an easy task. Some teachers say that technical vocabulary has been an integral part of their instruction for so long that they can barely conceive of what topics would be without it. And de-emphasizing vocabulary may not produce immediate cheers from students either, particularly the older ones, since many of them have come to believe that memorizing words is the same thing as understanding the concepts—and they have become very good at it. Students' inclination, reinforced over years of schooling, to substitute memorization for understanding is all the more reason for teachers to help students get better at learning content that has greater utility and durability.

Reducing Wasteful Repetition

Overloading the curriculum with topics, overloading topics with detail, and having students learn words and terms they don't need are not the only ways to waste instructional time. Another waste is the unnecessary repetition of topics—the same ideas in the same contexts, often with the same activities and the same questions. But deciding what is necessary and what is not is not always an easy matter. The common student complaint that the same topics appear in successive grades, often in the same way, is matched by the common teacher complaint that the students did not learn what they were supposed to before, and so previous topics have to be "reviewed" or, to be frank about it, taught all over again. This situation leads to frustration on the part of both teachers and students and to the loss of opportunities to take up other topics or the same topic in a new and more advanced context.

Retrieved from http://www.project2061.org/publications/designs/default.htm on 10 July 2013 from AAAS, *Designs for Science Literacy* Chapter 7.

FORMS OF ENERGY AND ENERGY TRANSFORMATIONS
Energy Transformation 8

Big Idea: Energy exists in different forms and can be transformed from one form to another.

Australian National Curriculum Content Description	**Learning Targets** Students should know and understand that:	**Behavioural Objectives** Students should be able to:	**VELS Performance Expectations** Science Knowledge and Understanding
Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems (ACSSU155) **Key Concepts** • Energy can be present in different forms and can be transformed within a system from one form to another. (LT: 1-4, 6) • Thermal energy always flows out of hotter regions or objects and into colder ones. Heat is thermal energy in the process of transfer or conversion across a boundary of one form or state of matter to another (LT: 5) • Whenever energy is transformed from one form to another, some energy is lost to the surrounding environment.	**1.** Energy can exist in different forms. All forms of energy can be described in terms of kinetic energy, thermal and energy that can be released or absorbed due to changes in interacting particles in a system. **2.** Energy is measured in joules. One joule is equivalent to the energy required raise the temperature of one ml of water one degree Celsius. **3.** Kinetic energy is energy an object possesses because it is in motion. **4.** Potential energy is the energy that an object possesses because of its position or condition and is referred to as stored energy. It is evident as: • Gravitational potential energy • Elastic potential energy • Chemical potential energy **5.** Thermal energy is used to describe the energy of motion of particles within a substance. Temperature is a measure of the average thermal motion in a substance. **6.** Energy can be changed (transformed) from one form to another **7.** When energy is transformed, the total amount of energy stays constant (is conserved). This is known as the Law of Conservation of Energy.	**1.1** Identify and name different forms of energy within an environment. **1.2** Investigate different forms of energy including kinetic, potential and heat and their effects on objects. **2.0** Recognize that energy is measured in joules and appropriately use joules in energy investigations. **3.0** Provide an everyday example of kinetic energy. **4.1** Recognize that an object does not have to be moving to possess energy. **4.2** Investigate and measure potential energy and how potential energy can be increased and decreased. **5.1** Relate the thermal energy of a substance to the motion of its particles. **5.2** Design, construct and test an insulation system to measure the transfer of thermal energy. **6.1** Use a diagram or model of a moving object (roller coaster, pendulum, etc.) to describe the conversion of potential energy into kinetic energy and vice versa. **6.2** Discuss different forms of energy and describe how they can be converted from one form to another for use by humans (e.g., thermal, electrical, light, chemical, mechanical).	**4.25** Awareness of how models are used to explain scientific phenomena and processes related to energy. **4.5** Use and limitations of models and laws of science to explain scientific phenomena and processes related to energy. **4.75** Application of models and laws of science to familiar and unfamiliar situations related to energy. **5.25** Awareness of the development over time of a scientific concept related to energy. **5.5** The way energy may be responsible for change **5.5** Presentation of alternative theories about a scientific concept related to for example, particle and wave models of light. **5.75** Quantitative knowledge including understanding of The way energy may be responsible for change. **5.75** The illustration of a scientific concept related to energy, which has developed through scientific collaboration. **5.75** Comparison of knowledge and technology that contributed to

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FORMS OF ENERGY AND ENERGY TRANSFORMATIONS
Energy Transformation 8

Big Idea: Energy exists in different forms and can be transformed from one form to another.

Australian National Curriculum Content Description	**Learning Targets** Students should know and understand that:	**Behavioural Objectives** Students should be able to:	**VELS Performance Expectations** Science Knowledge and Understanding
(LT: 7-8) • Energy efficient systems reduce energy loss. The total amount of energy present before and after the transformation however remains the same. (LT: 7-8)	**8.** Transformation of energy within a system usually results in some energy escaping into its surrounding environment. Some systems transfer less energy to their environment and are therefore more efficient.	**6.3** Trace the energy conversions that occur in a system e.g. the human body. **7.0** Understand through investigation that energy is not created or destroyed but can be transformed from one form to another. **8.0** Evaluate the efficiency of energy transformation e.g. light globes, bicycle	the development of the concept of energy transfer.
	Essential Vocabulary chemical energy, potential energy, energy, conservation, transformation, gravitational potential energy, joules, kinetic energy	**Worthwhile Tasks**	

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List of Assessment Statements for Energy Concepts, Knowledge and Skills

1. Recognizes that things that give off light often also give off heat
2. Explains that energy is needed to do work
3. Identifies uses of energy
4. Understands that sound is a form of energy
5. Relates kinetic energy to the speed of an object
6. Recognizes that heat can move from object to object by conduction
7. Compares ability of materials to conduct heat
8. Makes predictions about the transformation between kinetic and potential energy
9. Describes the transformations of energy that may occur in electrical systems
10. Explains that a turbine in a machine that is used in the transformation of mechanical energy to electrical energy
11. Explains that energy cannot be created or destroyed, only changed from one form to another
12. Defines kinetic energy and gives examples
13. Classifies examples of heat transfer as conduction
14. Understands that heat flows from warmer to cooler objects until both reach equilibrium
15. Gives examples of energy transfer through radiation
16. Explains that when energy in converted from one form to another, heat is often produced as a by-product
17. Recognizes the major forms of energy
18. Defines potential energy and gives examples

Curriculum Mapping Project: Time Audit

Year 7 Science Units

Area	Units	Time
Introduction to Science	A. **Science as a Human Endeavour:** Nature of Science	A. 4 weeks
Biology	A. **Diversity and Evolution:** Classification B. **Interdependence of Living Organisms and Systems:** Food Webs	A. 4 Weeks B. 4 Weeks
Chemistry	A. **Properties of Matter:** Chemical Mixtures	A. 4 Weeks
Earth & Space Science	A. **Earth in Space and Time**: Interactions between the Earth, Moon and Sun B. **Earth Structures and the Changing Earth:** Renewable and Non-renewable Resources	A. 4 Weeks B. 5 Weeks
Physics	A. **Forces and Motion:** Balanced and Unbalanced Forces B. **Forces and Motion:** Gravitational Forces	A. 4 Weeks B. 2 Weeks
	Total: 8 Units	31 Weeks

Year 8 Science Units

Area	Units	Time
Biology	A. **Structure and Function of Living Organisms:** Cells B. **Structure and Function of Living Organisms:** Organ Systems	A. 4 Weeks B. 7 Weeks
Chemistry	A. **Properties of Matter:** The Particle Nature of Matter B. **Properties of Matter:** Elements and Compounds C. **Changes of Matter:** Chemical Change	A. 4 Weeks B. 3 Weeks C. 3 Weeks
Earth & Space	A. **Earth Structure and the Changing Earth:** Rocks and Geologic Timescales	A. 5 weeks
Physics	A. **Forms of Energy and Energy Transformations:** Energy Transformation	A. 5 Weeks
	Total: 7 Units	31 Weeks

Year 9 Science Units

Area	Units	Time
Biology	A. **Structure and Function of Living Organisms:** System Coordination B. **Interdependence of Living Organisms and Systems**: Ecosystems	A. 6 weeks B. 6 weeks
Chemistry	A. **Properties of Matter:** Atomic Structures B. **Changes of Matter:** Conservation of Mass C. **Changes of Matter**: Chemical Reactions	A. 3 weeks B. 3 weeks C. 3 weeks
Earth & Space	A. **Earth Structures and the Changing Earth:** Dynamic Earth Systems	A. 5 weeks
Physics	A. **Forms of Energy and Energy Transformations:** Energy Transfer	A. 5 weeks
	Total: 7 Units	31 Weeks

Year 10 Science Units

Area	Units	Time
Biology	A. **Diversity and Evolution:** Heredity B. **Diversity and Evolution**: Evolution and Natural Selection.	A. 5 weeks B. 5 weeks
Chemistry	A. **Properties of Matter:** Understanding the Periodic Table B. **Changes of Matter:** Exploring Chemical Reactions	A. 4 weeks B. 5 weeks
Earth & Space Science	A. **Earth in Space and Time:** Evolution and Features of the Universe B. **Earth Structures and the Changing Earth** Climate Change	A. 4 weeks B. 5 weeks
Physics	A. **Forms of Energy and Energy Transformations:** Conservation of Energy B. **Force and Motion:** Laws of Motion	A. 3 weeks B. 5 Weeks
	Total: 8 Units	Approximately 36 Weeks

DIVERSITY AND EVOLUTION
Classification 7

Big Idea: All living things are classified based on structural features and evolutionary relationships.

Australian National Curriculum Content Description	**Learning Targets** Students should know and understand that:	**Behavioural Objectives** Students should be able to:	**VELS Performance Expectations** Science Knowledge and Understanding
There are differences within and between groups of organisms: classification helps organise this diversity (ACSSU111) **Key Concepts** • Classification systems allow scientists to group organisms into useful categories and the system of categorization can change over time. (LT: 1,2) • Scientists have developed a system to sort living organisms into groups based on similar features and evolutionary relationships. (LT: 3-5) • In a universal system of classification, organisms of different species are grouped into larger, more general categories based on homologies. (LT: 6-9)	**1.** There are millions of different populations of organisms that inhabit the earth at any one time. Some are very similar to each other structurally and some are very different. **2.** Classifications systems allowed scientists originally to determine which organisms were helpful or harmful. Classifications systems now help scientists study changes over time, how organisms compare and by using a specific naming procedure, make certain that each organism has only one scientific name. **3.** Classification systems have been created by scientists to sort living organisms into groups based on similar characteristics (I.e., structure, function, biochemistry, behaviour, embryonic development, genetics, evolutionary histories and ecological interactions) **4.** Organisms in the same group are more closely related than organisms from different groups. **5.** Many living organisms can be classified as either plants or animals. There are other organisms, many of which are microscopic, that do not belong to either group. **6.** All organisms can be generally classified into one of the five kingdoms. **7.** Organisms that are structurally the same can interbreed and produce fertile offspring are grouped together as a species. **8.** One way of grouping animals is vertebrates and	**1.1** Find similarities and differences between living organisms. **2.1** Understand the need to classify organisms and how classification systems have changed. **3.1** Produce a diagram that compares the classification system to the different levels within a school setting e.g. home group, year level, subschool, school, region, state, country, galaxy, universe, multiverse. **4.1** Understand that the further down the taxonomic groups, the more similar the organisms are. **5.1** Categorise samples of living organisms as belonging to the Plant Kingdom, Animal Kingdom or "other". **6.1** Describe the features of the Monera, Fungi and Protista Kingdoms. **6.2** Reclassify the samples from the "other" category from **5.1** into the correct kingdoms. **7.1** Describe what is meant by species scientifically and cite examples of organisms that don't fit the definition.	**5.0** Explain how the observed characteristics of living things are used to establish a classification system.

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DIVERSITY AND EVOLUTION
Classification 7

Big Idea: All living things are classified based on structural features and evolutionary relationships.

Australian National Curriculum Content Description	Learning Targets Students should know and understand that:	Behavioural Objectives Students should be able to:	VELS Performance Expectations Science Knowledge and Understanding
	invertebrates, according to the presence or absence of a backbone. Vertebrates are further divided into mammals, reptiles, fish, amphibians and birds based on structural characteristics. **9.** The Plant Kingdom is made up of vascular plants and non-vascular (bryophytes).	**8.1** Identify the supporting structures of living things. **8.2** Utilise classification keys to classify a series of specimens from the Animal Kingdom into their correct Classes using the binomial naming system. **9.1** Use characteristics to group plants into related groups.	
	Essential Vocabulary anatomy, class, dichotomous, fungi, genus, invertebrate, kingdoms, order, phylum, species, taxonomy, vascular, vertebrate	**Worthwhile Tasks** **WT** Construct a classification key to sort various non-standard items.	

CHANGES OF MATTER
Conservation of Mass
9

Big Idea: Chemical reactions involve the rearrangement of atoms to form new substances without the loss of any matter.

Australian National Curriculum Content description	**Learning Targets (LT)** Students should know and understand that:	**Behavioural Objectives** Students should be able to:	**VELS Performance Expectations** Science Knowledge and Understanding
Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed (ACSSU178) **Key Concepts** • A chemical reaction involves the rearrangement of atoms without the loss of mass (LT: 1-3) • Energy can play a significant role in determining the types of chemical reactions that will occur. (LT:4)	**1.** In a chemical reaction or equation the original materials are called reactants and the final materials are called products. **2.** In a chemical reaction the number of each type of atom at the start and end of a reaction is the same (conservation of mass). (WT2) **3.** In a chemical reaction, bonds in a molecule or compound are broken, atoms are rearranged, and bonds are reformed to create a new substance. **4.** Chemical reactions may require additional energy from their environment or release energy into their environment.	**1.1** Identify reactants and products in a chemical reaction. **1.2** Describe reactions using word equations. **2.1** Identify numbers of reactants and products in a chemical reaction. **2.2** Describe reactions using word equations that include the number and type of atoms. **2.3** Analyse experimental data to demonstrate that mass is conserved in a chemical reaction. **3.1** Illustrate the rearrangement of atoms to demonstrate a chemical reaction. **4.1** Investigate a series of reactions and explain/illustrate the effect of heat on the overall reaction.	**4.75** Application of models and laws of science to familiar and unfamiliar situations related to matter **5.25** Understanding of symbols used in chemical reactions **5.25** Awareness of the development over time of a scientific concept related to the theory of atomic structure **5.25** Understanding of symbols and equations
	Essential Vocabulary conservation, product, reactant, reaction	**Worthwhile Tasks** **WT1** pHET Simulation: Reactants, Products and Leftovers **WT2** Conduct a series of experiments to demonstrate conservation of mass.	

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EARTH STRUCTURES AND THE CHANGING EARTH:
Climate Change 10

Big Idea: The earth's climate is governed by intricately balanced biogeochemical cycles which are affected by human activity resulting in global climate change.

Australian National Curriculum Content Description	**Learning Targets** Students should know and understand that:	**Behavioural Objectives** Students should be able to:	**VELS Performance Expectations**
Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189) **Key Concepts** • Living and nonliving components of the biosphere are dependent upon the flow and cycling of matter. (LT: 1-3) • The greenhouse effect is both a natural process essential to life on Earth and one influenced by human activity. (LT 4-5) • Human activity has led to an increase in global CO_2 levels, thus disrupting the natural biogeochemical cycle of	**1.** Bio-geochemical cycles are pathways by which chemical elements transition through biotic and abiotic environments. **2.** Weather, as part of the water cycle, has natural variability (location, amount and time intervals). **3.** Carbon is cycled through both slow and fast processes between the atmosphere and living and nonliving things. **4.** The greenhouse effect is a natural and important global phenomenon that keeps the global temperature within the range needed to support living organisms. **5.** The accumulation of excess greenhouse gases (eg. CO_2) contributes to an overall warming of the earth, as an increased amount of infrared energy is reflected towards the earth. **6.** The total global levels of atmospheric carbon dioxide are increasing due to human activity (fossil fuels, etc.). The removal of CO_2 by trees and ocean currents (CO_2 sinks) is decreasing. **7.** Evidence to support climate change comes from a variety of sources (e.g.	**1.1** Define bio-geochemical cycle. **1.2** Research different cycles and display research in a visual format. **2.1** Create a non-linguistic representation of the water cycle. **2.2** Use rainfall and humidity data to compare and contrast different biomes/cities. **2.3** Create a travel guide "what to expect" for the weather in a particular city. **3.1** Analyse second hand data on the amount of carbon that is recycled through living and nonliving things. **3.2** Create a visual representation of the slow carbon cycle. **3.3** Create an audio visual that explains the process of the fast carbon cycles. **4.1** Create a visual representation of the greenhouse effect. **5.1** Explore through simulation how greenhouse gases contribute to global temperatures (Phet Simulation) and summarize your findings. **5.2** Design and construct a model greenhouse to investigate the effects of multiple layers of glass on the temperature within the system. **6.1** Analyse a diagram of the carbon cycle - predict and explain the effects of a decrease in one of the carbon removing processes. **6.2** Construct a feedback diagram showing the effects of increasing or decreasing atmospheric carbon to the natural matter cycle. **7.1** Discuss how the term Climate change is more appropriate	**Science Understanding** **8.5** Identify the theories and models that explain phenomena in biological, chemical, earth and space, and physical science contexts. **9.0** Analyse qualitatively the theories and models that explain phenomena in biological, chemical, earth and space, and physical science contexts. **9.5** Analyse qualitatively and quantitatively the theories and models that explain phenomena in biological, chemical, earth and space, and physical science contexts.

carbon. (LT: 6) • The theory of climate change is supported by evidence that points to global changes of climate. (LT: 7-8) • Climate change can significantly disrupt ecosystems. (LT: 9)	sea level rises, melting of ice sheets). **8.** Extreme weather events are increasing due to global climate changes. **9.** A rise in global temperatures can lead to increased stress in many species and also causes a change in species suitability due to local weather changes.	for the current climate patterns being observed than greenhouse effect or global warming. **7.2** Research and present one piece of evidence that supports climate change including a visual representation of the evidence. **8.1** For your region, research the number of severe weather events that have occurred with the last 10 years and compare and contrast the events to previous times in history. **9.1** Investigate the regions in which certain plants can grow and how the changing temperatures have resulted in the shift of suitable growth areas. (E.g. The emergence of wine regions in areas previously incapable of growing grapes). **9.2** Investigate how an increase in ocean acidification has effected or may affect a particular marine organism (e.g. Great Barrier Reef). **9.3** Investigate the effects of rising temperatures on mosquito populations at high altitude.	**Science as a Human Endeavour** **8.5** Provide examples of how developing technologies have extended the boundaries of scientific knowledge and endeavour. **9.0** Illustrate how emerging areas of science have grown from accumulated knowledge and experiences in science. **9.5** Justify an opinion, based on evidence, models and theories currently available, about how science may develop in the future and where new knowledge may emerge over time to solve science-related issues in society.
	Key Concept Terms acidification, biodiversity, climate change, greenhouse effect	**Worthwhile tasks** **Writing task:** Create a persuasive piece on Human effects on Climate Change. **ICT:** Create an advertisement for the human effects on the climate.	

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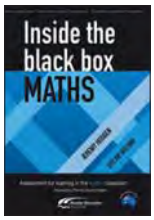

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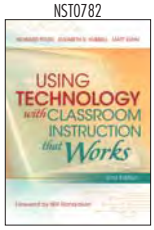

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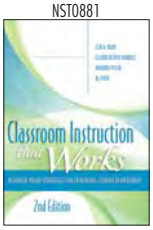

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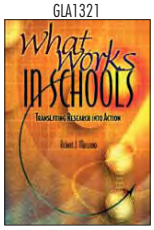

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