Year 9 unit overview — Australian Curriculum: Science

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum v3.0: Science for Foundation–10* <www.australiancurriculum.edu.au/Science/Curriculum/F-10>.

| School name | Unit title | Duration of unit |
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| Our School | Waves and particles | One term |

| Unit outline |
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| Students explore the atomic and wave models, developing understanding through targeted activities. The atomic and wave models build on students’ understanding of the particle model explored in Year 8, demonstrating how models are developed over time through the process of scientific inquiry.This unit has three overarching aims — that students understand:* phenomena that can only be observed indirectly can be described and explained by scientific models and theories
* models and theories are refined over time through observation, hypothesis and experimentation
* advances in technology can lead to modifications in the modelling used to describe phenomena.

Questions that shape the inquiry:* How does energy get transferred by waves?
* Can a model used to explain mechanical waves work for electromagnetic waves?
* How does sound and light energy get transferred by waves and in what ways are they similar and how are they different?
* How do technologies (e.g. mobile phones and medical devices) make use of electromagnetic radiation and radioactive decay?
* Are claims in the media that mobile phones are not safe to use justified?
* What fundamental principles explain how Aboriginal and Torres Strait Islander traditional hunting tools and musical instruments work?
* How do scientists determine the structure of something they cannot see?
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| Identify curriculum |
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| Content descriptions to be taught | General capabilities and cross‑curriculum priorities |
| Science Understanding | Science as a Human Endeavour | Science Inquiry Skills |
| Chemical sciences* All matter is made of atoms which are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms [(ACSSU177)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSSU177)

Physical sciences* Energy transfer through different mediums can be explained using wave and particle models [(ACSSU182)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSSU182)
 | Nature and development of science* Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community [(ACSHE157)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSHE157)
* Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries [(ACSHE158)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSHE158)

Use and influence of science* People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions [(ACSHE160)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSHE160)
* Advances in science and emerging sciences and technologies can significantly affect people’s lives, including generating new career opportunities [(ACSHE161)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSHE161)
 | Questioning and predicting* Formulate questions or hypotheses that can be investigated scientifically [(ACSIS164)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS164)

Planning and conducting* Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods [(ACSIS165)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS165)
* Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data [(ACSIS166)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS166)

Processing and analysing data and information* Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies [(ACSIS169)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS169)
* Use knowledge of scientific concepts to draw conclusions that are consistent with evidence [(ACSIS170)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS170)

Evaluating* Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data [(ACSIS171)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS171)
* Critically analyse the validity of information in secondary sources and evaluate the approaches used to solve problems [(ACSIS172)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS172)

Communicating* Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations [(ACSIS174)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS174)
 | Description: gc_literacy Literacy* Use scientific language and vocabulary supported by graphic representations to explain concepts and models.
* Use procedural and explanatory genres in writing a report.

Description: gc_numeracy Numeracy* Create tables to display and analyse observations, data and information.
* Calculate wave properties.

Description: gc_ict ICT capability* Develop Excel spreadsheets to record data.
* Create simulations and animations to investigate models.
* Use WebQuest to explore historical development.

Description: gc_critical Critical and creative thinking* Develop the creative and critical thinking skills of solving problems through investigation, making evidence-based decisions to analyse and evaluate own and others’ work and summarise information.

Description: gc_ethical Ethical behaviour* To be considered in the possible extension activities.

Description: gc_personal_social **Personal and social capability*** Work together to plan and conduct investigations and to complete learning experiences.

 Aboriginal and Torres Strait Islander histories and cultures* Engage with the idea that Aboriginal and Torres Strait Islander people have learnt about their world through observation, using the senses and through testing purposeful design to produce artefacts.
* This task should involve communication with the local Indigenous education worker, to ensure that the stories are open enough to allow resharing.
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| Achievement standard |
| By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe [models](http://www.australiancurriculum.edu.au/Glossary?a=S&t=models) of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They [analyse](http://www.australiancurriculum.edu.au/Glossary?a=S&t=analyse) how biological [systems](http://www.australiancurriculum.edu.au/Glossary?a=S&t=systems) function and respond to external changes with reference to interdependencies, energy transfers and flows of [matter](http://www.australiancurriculum.edu.au/Glossary?a=S&t=matter). They describe social and technological factors that have influenced scientific developments and predict how future applications of science and [technology](http://www.australiancurriculum.edu.au/Glossary?a=S&t=technology) may affect people’s lives.Students [design](http://www.australiancurriculum.edu.au/Glossary?a=S&t=design) questions that can be investigated using a range of inquiry skills. They [design](http://www.australiancurriculum.edu.au/Glossary?a=S&t=design) methods that include the control and accurate measurement of [variables](http://www.australiancurriculum.edu.au/Glossary?a=S&t=variables) and systematic collection of [data](http://www.australiancurriculum.edu.au/Glossary?a=S&t=data) and describe how they considered ethics and safety. They [analyse](http://www.australiancurriculum.edu.au/Glossary?a=S&t=analyse) [trends](http://www.australiancurriculum.edu.au/Glossary?a=S&t=trends) in [data](http://www.australiancurriculum.edu.au/Glossary?a=S&t=data), identify [relationships](http://www.australiancurriculum.edu.au/Glossary?a=S&t=relationships) between [variables](http://www.australiancurriculum.edu.au/Glossary?a=S&t=variables) and reveal inconsistencies in results. They [analyse](http://www.australiancurriculum.edu.au/Glossary?a=S&t=analyse) their methods and the quality of their [data](http://www.australiancurriculum.edu.au/Glossary?a=S&t=data), and explain specific actions to improve the quality of their [evidence](http://www.australiancurriculum.edu.au/Glossary?a=S&t=evidence). They [evaluate](http://www.australiancurriculum.edu.au/Glossary?a=S&t=evaluate) others’ methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences. |

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| Relevant prior curriculum | Curriculum working towards |
| In the Australian Curriculum: Science at Year 8:Science UnderstandingChemical sciences* The properties of different states of matter can be explained in terms of the motion and arrangement of particles
* Differences between elements, compounds and mixtures can be described at a particle level

Science as a Human EndeavourNature and development of science* Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people’s understanding of the world
* Science knowledge can develop through collaboration and connecting ideas across the disciplines of science

Use and influence of science* Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations
* People use understanding and skills from across the disciplines of science in their occupations

Science Inquiry SkillsQuestioning and predicting* Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge

Planning and conducting* Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed
* In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task

Processing and analysing data and information* Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate
* Summarise data, from students’ own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions

Evaluating* Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method
* Use scientific knowledge and findings from investigations to evaluate claims

Communicating* Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate
 | In the Australian Curriculum: Science at Year 10:Science UnderstandingChemical sciences* The periodic table organises elements on the basis of their properties and atomic structure.

Physical sciences* Dynamic interactions involving force, motion and energy can be explained by applying the laws of physics.

Science as a Human Endeavour* The content descriptions for Science as a Human Endeavour are the same for Year 9 and Year 10.

Science Inquiry Skills* The content descriptions for Science Inquiry Skills are the same for Year 9 and Year 10.
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| Bridging content |
| The **Year 9 Essential Learnings: Natural and processed materials** address the properties of the different states of matter, and how the differences between elements, compounds and mixtures can be explained in terms of the motion and arrangement of particles. |
| Links to other learning areas |
| **In the Australian Curriculum: Mathematics at Year 9**Compare data displays**In the Australian Curriculum: English at Year 9**Understand how punctuation is used along with layout and font variations in constructing texts for different audiences and purposes |

| Assessment | Make judgments |
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| Describe the assessment | Assessment date | Teachers gather evidence to make judgments about the following characteristics of student work:**Understanding*** description and identification of scientific information and concepts
* use of science knowledge to generate solutions and explanations
* description of technological factors that influence the development of scientific knowledge, and the effect of science on people’s lives

**Skills*** description of methods designed to control and measure variables, collect data, considering safety, reliability and ethical actions
* analysis of trends in data to identify relationships between variables and to develop conclusions
* analysis of methods; identification of sources of uncertainty and proposals of modifications to improve the quality of evidence
* use of appropriate scientific language and representations to communicate findings and ideas.

For further advice and guidelines on constructing guides to making judgments refer to the Learning area standard descriptors: [www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) |
| Students are given opportunities to demonstrate their knowledge, skills and understanding through both formative and summative assessment. The assessment is collated in student folios and allows for ongoing feedback to students on their learning.Year 9 teachers make decisions about the length of time required to complete the tasks and the conditions under which the assessment is to be conducted.The teaching and learning experiences throughout the term provide opportunities for students to develop the understanding and skills required to complete these assessments. As students engage with these learning experiences, the teacher can provide feedback on specific skills.**Experimental investigation: Design (Multimodal)**Prior to undertaking this task teachers will need to investigate the grounding of particular objects in the local area. There may be different messages within Aboriginal and Torres Strait Islander knowledge systems which will be held within these communities. The use of the didgeridoo and other artefacts used in cultural celebration is culturally sensitive in many areas.Task description:Aboriginal and Torres Strait Islander peoples have developed hunting and musical instruments for specific purposes by drawing on knowledge of the properties and shapes of their component materials. * Examine these objects through a scientific lens to gain an understanding of each object’s components and features.
* Design and construct your own musical instrument. Investigate changing one variable of the instrument to change the pitch of sound produced.
* Produce a scientific report demonstrating use of:
* passive voice
* procedural and explanatory genre
* scientific language supported by graphic representations.

Suggested conditions:* 500–700 words
* open.
 | Weeks 2–5 |
| **Supervised assessment: Short and extended responses (Written)**Suggested conditions:* 60 minutes
* supervised.
 | Week 9 |

| Teaching and learning | Supportive learning environment |
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| Teaching strategies and learning experiences | Adjustments for needs of learners | Resources |
| **Investigate the nature of mechanical waves*** Describe wave properties: period, frequency, wavelength, amplitude, and speed (speed = frequency x wavelength).
* Observe the nature of mechanical waves through investigations:
* in water using a ripple tank
* using a slinky spring to compare transverse and longitudinal waves.
* Design and conduct experiments on the properties of waves, such as whether tension affects the speed of the wave.

**Apply an understanding of the wave model to investigate sound*** Investigate the transfer of sound waves through different mediums.
* Conduct practical investigations demonstrating how the pitch and loudness of sound can be changed by changing variables, such as tension and wavelength; explain with reference to wave properties and the wave model.
* Investigate how the human body receives sound waves.

**Experimental investigation — practical design challenge*** Prepare and conduct the investigation (see Assessment).

**Apply an understanding of the wave model to investigate light*** Investigate the composition of white light using prisms, lenses and light boxes.
* Investigate the reflection and refraction of light using prisms, lenses and light boxes.
* Compare the reflection and refraction of light to the reflection and refraction of water using light boxes and a ripple tank.
* Investigate how the human body receives light waves.
* Form expert groups and research other wavelengths in the electromagnetic spectrum including applications to society — radio waves, microwaves, infrared radiation, ultraviolet radiation, x-rays, gamma rays.
* Investigate the use of radiation in medical science.
* Evaluate an article in the media claiming that the radiation from mobile phones is unsafe.

**Investigate how scientific models are developed in the context of the model of the atom*** Mystery boxes activity:
* investigate how indirect evidence can be used to determine structure
* create a model to explain an unseen object in the mystery box
* discuss questions such as: What evidence was accumulated? What were inferences based on?
* Undertake a “webquest” to trace the evidence leading to the formation of the various atomic models:
* solid sphere — Dalton
* plum pudding — Thomson
* nucleus/planetary — Rutherford
* electron orbit — Bohr
* electron cloud — Schrödinger (optional).
* Conduct an investigation to simulate the Rutherford scattering experiment. For example:
* Roll marbles (alpha particles) past a plasticine hill and record the deflections.
* Investigate how the size and location of the hill affects the deflections of the alpha particles and report findings.
* Use data to compare the Rutherford and Thomson models of the atom.
* Construct a model of one of the first ten elements of the periodic table. Explain the parts of the model, making reference to the relative size and electrical charges of electrons, protons and neutrons.
* Compare the isotopes carbon-12, carbon-13, and carbon-14.
* Undertake a WebQuest and use an atomic model to explain radioactivity in terms of alpha, beta and gamma decay.
* Reflect how unseen scientific phenomena can be “seen” through the use of a model.
 | Section 6 of the *Disability Standards for Education* (The Standards for Curriculum Development, Accreditation and Delivery) state that education providers, including class teachers, must take reasonable steps to ensure a course/program is designed to allow any student to participate and experience success in learning. The *Disability Standards for Education 2005* (Cwlth) is available from: <www.ag.gov.au> select Human rights and anti-discrimination > Disability standards for education. | **Web-based*** computers with internet access
* web sites for factsheets
* YouTube clips

**Print-based*** textbooks
* worksheets

**Equipment*** ripple tank
* slinkies
* stringed instrument/s
* prisms, lenses and light boxes

**Safety equipment*** student-completed risk assessment for assessment
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| Use feedback |
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| Ways to monitor learning and assessment | Teachers meet to collaboratively plan the teaching, learning and assessment to meet the needs of all learners in each unit.Teachers create opportunities for discussion about levels of achievement to develop shared understandings; co-mark or cross mark at key points to ensure consistency of judgments; and participate in moderating samples of student work at school or cluster level to reach consensus and consistency. |
| Feedback to students | Teachers plan opportunities through the teaching strategies and learning experiences of the unit. Teachers provide ongoing feedback and encouragement to students on their strengths and areas for improvement. Through particular learning experiences students can reflect on and discuss with their teachers and peers what they are able to do well and what they need to do to improve. |
| Reflection on the unit plan | Identify what worked well during and at the end of the unit, including:* activities that worked well and why
* activities that could be improved and how
* assessment that worked well and why
* assessment that could be improved and how
* common student misconceptions that need, or needed, to be clarified.
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