Suggested teaching program

**Chapter 4: Chemical elements**

Time allocation: 4 weeks

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| **Context and overview** |
| In year 8, students explore changes in matter at a particle level, and distinguish between chemical and physical change. Students use experimentation to isolate relationships between components in systems and explain these relationships through increasingly complex representations. They make predictions and propose explanations, drawing on evidence to support their views |
| **Syllabus outcomes addressed** |
| • Properties of the different states of [matter](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/matter) can be explained in terms of the motion and arrangement of particles ACSSU151  • Differences between elements, compounds and mixtures can be described at a particle level ACSSU152  • Scientific knowledge has changed peoples’ understanding of the world and is refined as new [evidence](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/evidence) becomes available ACSHE134  • Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures ACSHE226  • People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity ACSHE136  • Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge ACSIS139  • Collaboratively and individually plan and conduct a range of [investigation](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/investigation) types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed ACSIS140  • Measure and control variables, select equipment appropriate to the task and collect [data](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/data) with accuracy ACSIS141  • Construct and use a range of representations, including graphs, keys and models to represent and [analyse](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/analyse) patterns or relationships in [data](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/data) using [digital technologies](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/digital-technologies) as appropriate ACSIS144  • Summarise [data](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/data), from students’ own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on [evidence](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/evidence) ACSIS145  • Reflect on scientific investigations including evaluating the quality of the [data](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/data) collected, and identifying improvements ACSIS146  • Use scientific knowledge and findings from investigations to [evaluate](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/evaluate) claims based on [evidence](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/evidence) ACSIS234  • Communicate ideas, findings and [evidence](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/evidence) based solutions to problems using [scientific language](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/scientific-language), and representations, using [digital technologies](http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/science-v9/overview/glossary/digital-technologies) as appropriate ACSIS148 |
| **Achievement standards** |
| Students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.  Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types. |

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| **Student book section** | **WA Syllabus links** | **Suggested indicators of learning and understanding** | **Suggested teaching and learning activities** | **Resources** |
| **4.1 The properties of matter can be described**  **(pages 62–63)** | *Science Understanding*  ACSSU151  ACSSU152  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS141  ACSIS144  ACSIS145  ACSIS148 | By the end of this unit, students should be able to:  • define matter, mass, volume, physical properties and chemical properties  • describe the three states of matter  • provide examples of substances in the three states of matter  • explain the importance of understanding the properties of a substance. | **What if?**  Students investigate the rate of diffusion of M&M dye in water.  **Experiment 4.1**  *Comparing states of matter*  Students investigate the key characteristics that distinguish between solids, liquids and gases.  **Physical vs. chemical properties**  Students can extend their understanding of physical and chemical properties by watching the Study.com video tutorial and completing the quiz. | **Oxford Science 8 Western Australian Curriculum resources**  • What if? Page 61  • Check your learning, page 63  • Experiment 4.1, page 178 |
| **Additional resources**  Study.com website has a video tutorial and quiz about chemical and physical properties of matter:  <http://study.com/academy/lesson/matter-physical-and-chemical-properties.html#lesson> |
| **4.2 Scientists’ understanding of matter has developed over thousands of years**  **(pages 64–65)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE134  ACSHE226 | By the end of this unit, students should be able to:  • define theory, atom and chemistry  • describe how our understating of matter has changed over time  • explain how scientific experimentation and technological developments are involved in refining theories  • relate the properties of the states of matter to the particles. | **Atomic theory timeline**  Students can develop a timeline of the development of the atomic theory. They may use information from the Soft Schools website and present the timeline around the room using an appropriate scale. Encourage students to indicate significant technological developments in the timeline. | **Oxford Science 8 Western Australian Curriculum resources**  • Extend your understanding, page 65 |
| **Additional resources**  Soft Schools interactive timeline of the development of the atomic theory:  <http://www.softschools.com/timelines/atomic_theory_timeline/95/> |

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| **4.3 The particle model explains matter**  **(pages 66–67)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE136  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS141  ACSIS144  ACSIS145  ACSIS146  ACSIS234  ACSIS148 | By the end of this unit, students should be able to:  • define the particle theory of matter and diffusion  • explain how kinetic and thermal energy affect the rate of diffusion  • relate kinetic energy to the particle theory of matter. | **Challenge 4.3A**  *Modelling matter*  Students create models of the states of matter demonstrating their understanding of the particle theory of matter.  **Challenge 4.3B**  *Making a cuppa*  Students observe diffusion of tea and investigate the effect of temperature on the rate of diffusion.  **Investigating how particles differ between solids, liquids and gases**  Students can work through the Bitesize overview of the particle model. | **Oxford Science 8 Western Australian Curriculum resources**  • Check your learning, page 67  • Challenge 4.3A, page 179  • Challenge 4.3B, page 179 |
| **Additional resources**  BBC Bitesize on the particle model:  <http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/particle_model/activity/> |
| **4.4 The particle model can explain the properties of matter**  **(pages 68–69)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE136  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS144  ACSIS145  ACSIS148 | By the end of this unit, students should be able to:  • define tensile strength, hardness, viscosity, compressibility, incompressible and density  • describe how to calculate the density of a liquid, a regularly shaped and irregularly shaped solid  • provide examples of substances of high and low tensile strength, high and low hardness, high and low viscosity and high and low density  • explain strength, hardness, viscosity, compressibility and density in terms of the particles involved. | **Experiment 4.4**  *The density den*  Students calculate the density of water, regular and irregular shaped objects based on experimental data.  **Investigating density**  Students can investigate density in the PHeT simulation. Encourage students to explain the changes in volume and mass in terms of their effect on density and why that might affect an object’s buoyancy. | **Oxford Science 8 Western Australian Curriculum resources**  • Check your learning, page 69  • Experiment 4.4, page 180 |
| **Additional resources**  PHeT simulation:  <http://phet.colorado.edu/sims/density-and-buoyancy/density_en.html> |

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| **4.5 Increasing kinetic energy in matter causes it to expand**  **(pages 70–71)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE136  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS141  ACSIS144  ACSIS145  ACSIS234  ACSIS148 | By the end of this unit, students should be able to:  • define melting point and boiling point  • describe the differences between expansion and contraction of a substance  • explain why heat causes expansion of substances  • relate the motion of particles to their thermal and kinetic energy. | **Experiment 4.5A**  *Effect of heat*  Students investigate the effect of heat on solids, liquids and gases.  **Experiment 4.5B**  *From ice to steam*  Students determine the melting and boiling points of water experimentally.  **Extra activities**  Students can complete some of the other activities listed on the Inquiry In Action website to extend their understanding of how heat affects matter. | **Oxford Science 8 Western Australian Curriculum resources**  • Check your learning, page 71  • Experiment 4.5A, page 182  • Experiment 4.5B, page 184 |
| **Additional resources**  Inquiry in Action website has a number of activities involving how temperature affects matter:  <http://www.inquiryinaction.org/classroomactivities/topic.php?topic=Temperature%20Affects%20Matter> |

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| **4.6 Atoms and elements make up matter**  **(pages 72–73)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE134  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS141  ACSIS144  ACSIS145  ACSIS148 | By the end of this unit, students should be able to:  • define element, monatomic, diatomic and periodic table  • describe the key features of the periodic table, including periods and groups  • list the first 20 elements of the periodic table  • relate the atomic number and mass number of an element to the number of subatomic particles. | **Challenge 4.6A**  *Classifying elements*  Students investigate the nomenclature of the periodic table and some of the methods of classifying the elements.  **Challenge 4.6B**  *Identifying the elements*  Students investigate an element, its position in the periodic table and its main physical and chemical properties.  **Experiment 4.6**  *Properties of the elements*  Students investigate some of the physical and chemical properties of metals.  **Build your own atoms**  Students can experiment with sub-atomic particles and build their own atoms, examining charge, atomic number, mass number and atomic stability using the PHET atom builder. | **Oxford Science 8 Western Australian Curriculum resources**  • Check your learning, page 73  • Challenge 4.6A, page 185  • Challenge 4.6B, page 186  • Experiment 4.6, page 187 |
| **Additional resources**  PHET atom builder website:  <https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html> |

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| **4.7 Atoms bond together to make molecules and compounds**  **(pages 74–75)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE134  *Science Inquiry Skills*  ACSIS139  ACSIS140  ACSIS141  ACSIS144  ACSIS145  ACSIS148 | By the end of this unit, students should be able to:  • define molecule, compound, bonded, molecular element, molecular compounds and polymers  • provide examples of elements, molecules, compounds, mixtures  • explain the difference between an element, molecule, compound and mixture. | **Experiment 4.7**  *Decomposing copper carbonate*  Students investigate a compound and determine that a compound is made up of elements.  **Revising compounds and mixtures**  Students can complete the Bitesize tutorial including the activity and quiz to test their understanding of compounds and mixtures. | **Oxford Science 8 Western Australian Curriculum resources**  • Check your learning, page 75  • Experiment 4.7, page 188 |
| **Additional resources**  BBC Bitesize compounds and mixture revision:  <http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/compounds_mixtures/revision/1/> |
| **4 Review**  **(pages 76–78)** | *Science Understanding*  ACSSU151  ACSSU152  *Science as a Human Endeavour*  ACSHE134  *Science Inquiry Skills*  ACSIS148 | By the end of this unit, students should be able to:  • define all Key Words listed on page 78  • explain the properties of the states of matter in terms of the motion and arrangement of particles  • explain the difference between elements, compounds and mixtures at a particle level  • identify areas of personal strengths and weaknesses in their knowledge and understanding of the topic. | **Revision activities**  • Students could play celebrity heads with the Key Words list  • Students can make dominoes with Key Words on one end and definitions/diagrams/examples on the other end  • Students can create mind maps, Venn diagrams or other graphic organisers to summarise the key concepts of this chapter  • Peer teaching: students can work in groups to reteach the content of the unit to the class for the purpose of revision. Each group could be allocated a double-page to summarise | **Oxford Science 8 Western Australian Curriculum resources**  • Review questions, pages 76–77  • Research topics, page 77  • Key Words list, page 78 |