

# Chemistry

## Yr 7/8 JSO exam syllabus (Chemistry)

<p><b>Australian Curriculum Content Descriptor (V9)</b></p> <p>use particle theory to describe the arrangement of particles in a substance, including the motion of and attraction between particles, and relate this to the properties of the substance (AC9S7U05)</p>	<p>Elaboration of core concepts:</p> <p>Students:</p> <ol style="list-style-type: none"> <li>i. Identify and name states of matter and changes of state.</li> <li>ii. Describe matter as made of particles.</li> <li>iii. Distinguish between <b>materials</b> (substances and mixtures) and <b>particles</b>.</li> <li>iv. Define kinetic energy and relate this to the speed of movement.</li> <li>v. Describe the motion and kinetic energy of, and distance between, particles of the same substance in different states.</li> <li>vi. Describe how adding heat to a substance increases the kinetic energy of the particles.</li> <li>vii. Explain how a sufficient increase in the kinetic energy of particles will overcome the forces of attraction between them, causing a change in state.</li> <li>viii. Explain the properties of solids, liquids and gases in terms of the particle model.</li> </ol>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 2: Matter</a></p> <p>Lesson 1: Matter and its Classification.</p> <ul style="list-style-type: none"> <li>• Part a: Solids, Liquids and Gases.</li> </ul> <p>Lesson 2: Properties of Matter</p> <ul style="list-style-type: none"> <li>• Part a: Physical and Chemical Properties</li> <li>• Part b: Physical and Chemical Changes (physical changes only).</li> </ul> <p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p> <p><i>Note: the content in these lessons overlaps somewhat with AC9S8U06 and AC9S8U07 below.</i></p>
<p>use a particle model to describe differences</p>	<p>Elaboration of core concepts:</p> <p>Students:</p>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p>

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<p>between pure substances and mixtures and apply understanding of properties of substances to separate mixtures (AC9S7U06)</p>	<ol style="list-style-type: none"> <li>i. Identify examples of pure substances, heterogenous mixtures and homogenous mixtures.</li> <li>ii. Identify and analyse examples of solutions, colloids and suspensions.</li> <li>iii. Distinguish pure substances and mixtures in terms of the particles that make them up.</li> <li>iv. Analyse macroscopic properties of mixtures, including transparency, particle size, density, melting point.</li> <li>v. Describe concentration qualitatively (dilute and concentrated) and quantitatively (calculations, using different units).</li> <li>vi. Identify appropriate methods, based on physical properties, for separating mixtures (evaporation; crystallisation; chromatography; distillation; gravity separation and decantation; sieving and filtration; magnetic separation; centrifuging.</li> </ol>	<p><a href="#">Chemistry Tutorial Chapter 2: Matter</a></p> <p>Lesson 1: Matter and its Classification.</p> <ul style="list-style-type: none"> <li>• Part b: Pure substances vs mixtures.</li> </ul> <p><b>Consolidation of content:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p>
<p>classify matter as elements, compounds or mixtures and compare different representations of these, including 2-</p>	<p>Elaboration of core concepts:</p> <p>Students:</p> <ol style="list-style-type: none"> <li>i. Define an atom as the fundamental repeating particle of matter.</li> <li>ii. Define a molecule as a particle made up of two or more atoms strongly bonded together.</li> </ol>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 2: Matter</a></p> <p>Lesson 1: Matter and its Classification.</p> <ul style="list-style-type: none"> <li>• Part b: Pure substances vs mixtures.</li> </ul> <p>Lesson 3: Elements and Compounds</p>

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<p>dimensional and 3-dimensional models, symbols for elements and formulas for molecules and compounds (AC9S8U06)</p>	<ul style="list-style-type: none"> <li>iii. Define a lattice as a regular 3-dimensional arrangement of particles.</li> <li>iv. Distinguish between <b>substances</b> (elements, compounds, mixtures) and <b>particles</b> (atoms, molecules).</li> <li>v. Define elements as substances that are made up of one kind of atom.</li> <li>vi. Define compounds as substances that are made up of two or more kinds of atom strongly bonded together (either as molecules or lattices).</li> <li>vii. Identify groups and periods, metals and nonmetals on the Periodic Table.</li> <li>viii. Identify the normal state of elements from their position on the Periodic Table.</li> <li>ix. Recall the names and formulae of the seven elements that exist as diatomic molecules (<math>H_2</math>, <math>N_2</math>, <math>O_2</math>, <math>F_2</math>, <math>Cl_2</math>, <math>Br_2</math>, <math>I_2</math>).</li> <li>x. Identify elements that exist as individual atoms (e.g. noble gases) and lattices (e.g. carbon, silicon, metals).</li> <li>xi. Interpret chemical formulae for elements and compounds.</li> </ul>	<ul style="list-style-type: none"> <li>• Part a: The Periodic Table of Elements</li> <li>• Part b: Words, Symbols and Particle Diagrams</li> </ul> <p>Video: Kathryn White</p> <ul style="list-style-type: none"> <li>• <a href="#">Introduction to Chemistry: Video 1.1.1</a> (Atoms and Molecules)</li> </ul> <p><b>Consolidation of content:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p>
<p>compare physical and chemical changes and identify indicators of</p>	<p>Elaboration of core concepts:</p> <p>Students:</p>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 2: Matter</a></p>

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<p>energy change in chemical reactions (AC9S8U07)</p>	<ul style="list-style-type: none"><li>i. Describe common macroscopic properties of materials (lustre, density, malleability, ductility, magnetism, boiling point, melting point, flammability).</li><li>ii. State common properties of metal and nonmetal elements.</li><li>iii. Describe physical changes as changes in the properties of substances that are often reversible (e.g. changes of state and dissolving).</li><li>iv. Describe chemical changes as those changes in which a new substance is formed by the rearrangement of atoms.</li><li>v. Identify and describe possible indicators for chemical change, including temperature change, light given off, colour change, bubbles (gas is formed), precipitate formed, odour produced.</li><li>vi. Write word equations to represent simple reactions (no balancing).</li></ul>	<p>Lesson 2: Properties of Matter</p> <ul style="list-style-type: none"><li>• Part b: Physical and Chemical Changes</li></ul> <p><a href="#">Chemistry Tutorial Chapter 8: Chemical Reactions</a></p> <p>Lesson 1: Describing Chemical Reactions</p> <ul style="list-style-type: none"><li>• Part a: What is a Chemical Reaction?</li></ul> <p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p> <p><i>Note: the content in these lessons overlaps somewhat with AC9S9U07 below.</i></p>
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## Yr 9/10 JSO exam syllabus (Chemistry)

The yr 7 & 8 syllabus is assumed knowledge.

<p>explain how the model of the atom changed following the discovery of electrons, protons and neutrons and describe how natural radioactive decay results in stable atoms (AC9S9U06)</p>	<p>Elaboration of core concepts:</p> <p>Students:</p> <ol style="list-style-type: none"><li>Compare the mass, charge and location in an atom of protons, electrons and neutrons.</li><li>Define atomic number and mass number.</li><li>Interpret and create representations of electron configurations for the first 20 elements (<i>use the 2,8,8,2 rule, but note that in larger atoms, 3<sup>rd</sup> electron level can hold up to 18 electrons.</i>)</li><li>Define an ion and identify cations and anions.</li><li>Define an isotope and identify examples of isotopes.</li><li>Given relevant information, deduce mass number, atomic number, charge and/or numbers of subatomic particles in an atom or ion.</li><li>Use and interpret isotope notation (e.g. <math>{}^{16}_8\text{O}^{2-}</math> )</li></ol>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 3: Elements, Atoms and Ions</a></p> <p>Lesson 1: In Search of the Atom</p> <ul style="list-style-type: none"><li>Part a: Democritus to Dalton</li><li>Part b: The Inside Story of the Atom</li><li>Part c: Subatomic Particles</li></ul> <p>Lesson 2: The Periodic Table Revisited</p> <ul style="list-style-type: none"><li>Part c: Isotopes and Isotope Symbols</li></ul> <p>Lesson 3: Ions</p> <ul style="list-style-type: none"><li>Part a: Metals, Nonmetals and Ions</li></ul> <p><b>Extension</b></p> <p><a href="#">Chemistry Tutorial Chapter 7: The Mole and its Applications</a></p> <p>Lesson 1: Atomic Mass and Atom Counting</p> <ul style="list-style-type: none"><li>Part a: Atomic Mass</li></ul>
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	<p>Extension:</p> <p>viii. Define relative atomic mass and calculate it from isotopic mass and abundance.</p> <p>ix. Define radioisotopes (radioactive isotopes) as atoms that have unstable nuclei.</p> <p>x. Describe natural radioactivity as atoms giving out energy to become more stable.</p> <p>xi. Compare and describe the general properties of alpha, beta and gamma radiation.</p> <p>xii. Deduce the products of alpha and beta decay reactions.</p> <p>xiii. State that mass and energy are connected and can be interconverted in nuclear reactions.</p> <p>xiv. Define half-life.</p>	<p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p>
<p>model the rearrangement of atoms in chemical reactions using a range of representations, including word and simple balanced chemical equations, and</p>	<p>Elaboration of core concepts:</p> <p>Students:</p> <p>i. Describe chemical reactions in terms of reactants and products and use examples to show that the properties of the products are not determined by the properties of the reactants.</p>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 8: Chemical Reactions</a></p> <p>Lesson 1: Describing Chemical Reactions</p> <ul style="list-style-type: none"><li>• Part a: What is a Chemical Reaction?</li><li>• Part b: Chemical Equations</li></ul>

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<p>use these to demonstrate the law of conservation of mass (AC9S9U07)</p>	<p>ii. Construct and interpret simple word and chemical equations.</p> <p>iii. State the law of conservation of mass and describe how it relates to the balancing of chemical equations.</p> <p>iv. Analyse experimental data to make inferences related to the states of reactants and products and the law of conservation of mass.</p> <p>Extension:</p> <p>v. Write, balance and interpret more complex chemical equations.</p>	<ul style="list-style-type: none"> <li>Part c: Writing Balanced Chemical Equations (this includes extension-level material)</li> </ul> <p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p>
<p>explain how the structure and properties of atoms relate to the organisation of the elements in the periodic table (AC9S10U06)</p>	<p>Elaboration of core concepts: students:</p> <p>i. Identify elements as metals, metalloids and nonmetals and locate them on a periodic table.</p> <p>ii. Recall the key properties of elements in Groups 1, 2, 17 and 18.</p> <p>iii. Use a Bohr model to identify the valence shell and number of valence electrons of an element and relate this to its position in the Periodic Table.</p>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 3: Elements, Atoms and Ions</a></p> <p>Lesson 2: The Periodic Table Revisited</p> <ul style="list-style-type: none"> <li>Part a: Mendeleev and the Periodic Law</li> <li>Part b: Today's Periodic Table</li> </ul> <p><a href="#">Chemistry Tutorial Chapter 3: Elements, Atoms and Ions</a></p> <p>Lesson 3: Ions</p> <ul style="list-style-type: none"> <li>Part a: Metals, Nonmetals and Ions</li> </ul>

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	<p>iv. Apply the idea that elements in the same group have similar properties to solve problems.</p> <p>v. Explain the basis of emission spectroscopy in terms of electrons jumping levels.</p> <p>vi. Determine the charge on a monatomic ion from its element's position in the periodic table.</p> <p>vii. Describe how atoms gain or lose electrons to obtain a <b>noble gas configuration</b> (not a full outer shell).</p> <p>viii. Write electron configurations for ions.</p> <p>ix. Outline how ionic bonds form and describe the properties of ionic compounds.</p> <p>x. Write formulae for ionic compounds from their names and vice versa.</p> <p>Extension:</p> <p>xi. Write formulas for ionic compounds including polyatomic ions and transition metal ions.</p> <p>xii. Outline how covalent bonds form and describe the properties of covalent (molecular) compounds.</p>	<p><a href="#">Chemistry Tutorial Chapter 4: Compounds, Names and Formulas</a></p> <p>Lesson 1: Ionic Compounds</p> <ul style="list-style-type: none"><li>• Part a: Properties of Ionic Compounds</li><li>• Part b: Combining Ions to Form Ionic Compounds</li><li>• Part c: Binary Ionic Compounds</li></ul> <p>Videos: Kathryn White</p> <ul style="list-style-type: none"><li>• <a href="#">Introduction to Chemistry: Video 1.1.5</a> (Atomic Structure)</li><li>• <a href="#">Introduction to Chemistry: Video 1.1.6</a> (Valence and Ion Names)</li><li>• <a href="#">Introduction to Chemistry: Video 1.1.7</a> (Naming Ionic Compounds)</li></ul> <p><b>Extension:</b></p> <p><a href="#">Chemistry Tutorial Chapter 3: Elements, Atoms and Ions</a></p> <p>Lesson 3: Ions</p> <ul style="list-style-type: none"><li>• Part b: Transition Metal ions</li><li>• Part c: Polyatomic Ions</li></ul> <p><a href="#">Chemistry Tutorial Chapter 4: Compounds, Names and Formulas</a></p>
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	<p>xiii. Write and interpret names and formulae of covalent compounds and acids.</p>	<p>Lesson 1: Ionic Compounds</p> <ul style="list-style-type: none"> <li>Part d: Compounds Containing Polyatomic Ions</li> </ul> <p>Lesson 2: Molecular Compounds</p> <ul style="list-style-type: none"> <li>Part a: Properties of Molecular Compounds</li> <li>Part b: Names and Formulas</li> </ul> <p>Lesson 3: Acids</p> <ul style="list-style-type: none"> <li>Part a: Naming Acids (no O atoms)</li> <li>Part b: Naming Acids Containing Oxyanions</li> </ul> <p>Videos: Kathryn White</p> <ul style="list-style-type: none"> <li><a href="#">Introduction to Chemistry: Video 1.1.7b</a> (Naming Salts of Transition Metals)</li> <li><a href="#">Introduction to Chemistry: Video 1.1.8</a> (Common Covalent Compounds and Acids)</li> </ul> <p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each lesson above.</p>
<p>identify patterns in synthesis, decomposition and displacement reactions</p>	<p>Elaboration of core concepts:</p> <p>Students:</p> <p>i. Identify and describe common types of chemical reaction: synthesis/combination,</p>	<p><b>Content presentation:</b></p> <p>Physics Classroom</p> <p><a href="#">Chemistry Tutorial Chapter 8: Chemical Reactions</a></p>

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<p>and investigate the factors that affect reaction rates (AC9S10U07)</p>	<p>decomposition, single replacement/displacement, double replacement, combustion.</p> <p>ii. Predict products for replacement and combustion reactions.</p> <p>iii. Construct and balance chemical equations from word descriptions of the reaction.</p> <p>iv. Outline collision theory.</p> <p>v. Define activation energy.</p> <p>vi. Describe energy changes in chemical reactions in terms of bonds being made and broken.</p> <p>vii. Identify the factors that cause reaction rate to change and explain them in terms of collision theory.</p> <p>viii. Identify and describe appropriate methods for measuring the rate of a reaction.</p> <p>ix. Analyse experimental data and graphs representing the rate of a reaction.</p> <p>Extension:</p> <p>x. Identify, predict products and write equations for reactions of acids: acid + base, acid + carbonate, acid + metal.</p>	<p>Lesson 2: Classifying Chemical Reactions</p> <ul style="list-style-type: none"><li>• Part a: Decomposition and Synthesis Reactions</li><li>• Part b: Combustion Reactions</li><li>• Part c: Single Replacement Reactions</li><li>• Part d: Double Replacement Reactions</li><li>• Part e: Predicting Products</li></ul> <p>Videos: Kathryn White</p> <ul style="list-style-type: none"><li>• <a href="#">Introduction to Chemistry: Video 1.1.9</a> (Types of Chemical Reactions)</li><li>• <a href="#">Introduction to Chemistry: Video 1.1.10</a> (Balancing Equations)</li><li>• <a href="#">Rates of Reaction: Video 2.4.1</a> (Factors that Affect Rate)</li><li>• <a href="#">Rates of Reaction: Video 2.4.2</a> (Measuring Rate of Reaction)</li></ul> <p><i>Note: videos 2.4.1 and 2.4.2 were produced for a Year 11 audience but are within the reach of a motivated Year 10 student.</i></p> <p><b>Extension:</b></p> <p>Videos: Kathryn White</p> <ul style="list-style-type: none"><li>• <a href="#">Aqueous Solutions and Acids playlist.</a></li></ul> <p><i>(The 4<sup>th</sup> and last video in this playlist contain material on</i></p>
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	<p>xi. Analyse reaction energy diagrams to determine values for activation energy and reaction enthalpy.</p> <p>xii. Apply ratios to deduce mass quantities from balanced chemical equations given relative masses of reactants and products (no moles).</p>	<p><i>acid reactions. The other videos contain content beyond that required for the JSOE but may be interesting for advanced students.)</i></p> <ul style="list-style-type: none"><li>• <a href="#">Introduction to Chemistry: Video</a> (Energy changes in chemical reactions)</li><li>• <a href="#">Introduction to Chemistry: Video</a> (Reaction Energy Diagrams)</li></ul> <p><b>Check your understanding:</b></p> <p>Complete the questions and the Concept Builder exercises listed at the end of each Physics Classroom lesson above.</p>
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