Government of **Western Australia**
School Curriculum and Standards Authority

SAMPLE COURSE OUTLINE

CHEMISTRY
ATAR YEAR 11

Sample course outline

Chemistry – ATAR Year 11

Unit 1 – Chemical fundamentals: structure, properties and reactions

Science Inquiry Skills

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences.

Unit 1 Science Inquiry Skills

- identify, research and refine questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations and consider research ethics
- conduct investigations safely, competently and methodically
- represent data in meaningful and useful ways; identify trends, patterns and relationships; identify sources of random and systematic error and estimate their effect on measurement results; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- communicate to specific audiences and for specific purposes

Week	Key teaching points
1–3	Structure of the syllabus • course outline • assessment outline Properties and structure of atoms • symbols of elements • atomic structure – nucleus, electron energy levels and electron configurations • findings from a range of scientific experiments contributed to the understanding of the atom, enabling scientists to develop models of atomic structure and make reliable predictions about the mass, charge and location of the sub-atomic particles (SHE) • bond formation and its relationship to electron arrangement • the periodic table and trends in the periodic table • flame tests • conduct investigations using flame tests (SIS) • isotopes • relative atomic mass • mass spectrometry **Task 1:** Practical – Flame tests and emission spectra
4–6	Properties and structure of materials • pure substances and mixtures • conduct investigations on separation techniques (SIS) • elements and compounds • nanomaterials • matter at the nanoscale can be manipulated to create new materials, composites and devices; the different characteristics of nanomaterials can be used to provide commercially available products. As products are designed on the basis of properties which are different from the bulk material, their use can be associated with potential risks to health, safety and the environment and this has led to regulations being developed to address new and existing nanoform materials (SHE) • type of bonding within ionic, metallic and covalent substances, and their physical properties due to the types of attractions between the particles

Week	Key teaching points
	• molecular formulae • percentage composition **Task 2:** Test
7–10	Chemical reactions: reactants, products and energy change • representation of chemical reactions with chemical equations • enthalpy changes in chemical reactions and phase changes • exothermic and endothermic reactions • conduct investigations on heats of reactions (SIS) • the mole concept – mass, moles, molar mass, calculating masses of substances in a reaction **Task 3:** Investigation – Enthalpy changes in dissolving of ionic compounds **Task 4:** Test
11–14	Properties and structure of materials • hydrocarbons, including alkanes, alkenes and benzene, have different chemical properties that are determined by the nature of the bonding within the molecules • molecular structural formulae (condensed or showing bonds) can be used to show the arrangement of atoms and bonding in covalent molecular substances • IUPAC nomenclature is used to name straight and simple branched alkanes and alkenes from C_1–C_8 • alkanes, alkenes and benzene undergo characteristic reactions such as combustion, addition reactions for alkenes and substitution reactions for alkanes and benzene • comparing energy output for combustion of fossil fuels and biofuels • there are differences in the energy output and carbon emissions of fossil fuels and biofuels. These differences, together with social, economic, cultural and political values, determine how widely these fuels are used (SHE) **Task 5:** Science Inquiry Data analysis – Analysis of melting points of hydrocarbons **Task 6:** Extended response – Energy and CO_2 output for combustion of fossil fuels and biofuels **Task 7:** Test
15	Exam revision
16	**Task 8:** Examination

Sample course outline

Chemistry – ATAR Year 11

Unit 2 – Molecular interactions and reactions

Science Inquiry Skills

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences.

Unit 2 Science Inquiry Skills

- identify, research and refine questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations and consider research ethics
- conduct investigations safely, competently and methodically
- represent data in meaningful and useful ways; identify trends, patterns and relationships; identify sources of random and systematic error; identify anomalous data; estimate the effect of error on measured results; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- communicate to specific audiences and for specific purposes

Week	Key teaching points
1–3	Intermolecular forces and gases • physical properties of covalent molecular substances and their relationship to intermolecular forces • the valence shell electron pair repulsion (VSEPR) theory, Lewis structure diagrams and the shapes of molecules • polarity of molecules as explained by shape, symmetry and bond polarity • polarity of molecules and nature and strength of intermolecular forces • data from chromatography techniques to determine the composition and purity of substances • conduct investigations on chromatography (SIS) • chromatographic techniques are used to determine the components of a wide range of mixtures in various settings. The decision to use a particular chromatographic technique depends on a number of factors. Chromatographic techniques have a wide range of analytical and forensic applications (SHE)
4–5	Intermolecular forces and gases • the behaviour of an ideal gas as explained by the Kinetic Theory • the mole concept to calculate the mass of substances and volume of gases (at STP) involved in a chemical reaction
6–7	Aqueous solutions and acidity • the unique physical properties of water as explained by its molecular shape and hydrogen bonding between molecules • saturated, unsaturated or supersaturated solutions and the concentration of a solution • identification of specific ions in solution – flame tests and various types of chemical reactions • the solubility of substances in water • conduct investigations to determine solubilities of ionic compounds to recognise patterns in solubility (SIS) • the supply of potable drinking water is an extremely important issue for both Australia and countries in the Asian region. Water sourced from groundwater and seawater undergoes a number of purification and treatment processes before it is delivered into the supply system. Chemists monitor drinking water quality to ensure that it meets the regulations for safe levels

Week	Key teaching points
	of solutes. Heavy metal contamination in ground water is monitored to ensure that concentrations are at acceptable levels (SHE)
8–11	Aqueous solutions and acidity • the Arrhenius model to explain the behaviour of strong and weak acids and bases in aqueous solutions • indicator colour and the pH scale • conduct investigations to measure pH (SIS) • patterns of the reactions of acids and bases • conduct investigations to identify the products of reactions (SIS) • the mole concept to calculate the mass of solute, and solution concentrations and volumes involved in a chemical reaction **Task 9:** Practical test – Identification of unknown white powders **Task 10:** Extended response – Sources of acid rain and its effects on natural and built environments **Task 11:** Test
12–14	Rates of chemical reactions • varying the conditions under which chemical reactions occur can affect the rate of the reaction • the rate of chemical reactions can be quantified by measuring the rate of formation of products or the depletion of reactants • conduct investigations to observe effects of factors on rate of reaction (SIS) • collision theory • the activation energy and its influence on the rate of a chemical reaction • energy profile diagrams • the role of a catalyst and its effect on reaction rate • catalysts are used in many industrial processes in order to increase the rates of reactions that would otherwise be uneconomically slow. Catalysts are also used to reduce the emission of pollutants produced by car engines (SHE) **Task 12:** Practical investigation – Rates of reaction of acids with metal carbonates **Task 13:** Test
15	Exam revision
16	**Task 14:** Examination