

VCE CHEMISTRY UNIT 2
Environmental Chemistry
SAMPLE COURSE OUTLINE



Week	Area of Study	Key knowledge	Possible activities	Key skills
1	1 Water	Role of water in maintaining life in the environment – unique properties of water: relationship between structure and bonding and properties and uses including solubility and conductivity.	<p>Practical activity: Investigation of some of the properties of water for example specific heat capacity, density, freezing and boiling points. Compare these properties to those of other common liquids.</p> <p>Practical activity: Investigate the solubility of a range of compounds in water.</p> <p>Practical activity: Derive a solubility curve - this could be a student designed activity.</p> <p>Demonstration: Supersaturation of sodium thiosulfate in water.</p> <p>Demonstration: Chemical stalagmite using sodium acetate.</p>	<p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings.</p>

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			<p><i>References</i> Advice to Teachers p41, VCE Chemistry Study design 2007–2011.</p> <p>One (or both) of these practical activities could be used in the summary report with annotations of three practical activities if the summary report was not completed in Unit 1.</p>	
2	1	<p>Role of water in maintaining life in the environment – ways in which substances behave in water: the dissociation of soluble ionic solutes; the ionisation of polar molecules such as acids; the separation of non-ionising polar molecules such as ethanol.</p> <p>Role of water in maintaining life in the environment – maintaining water quality.</p>	<p>View animation showing how ionic solids dissolve in water at www.mhhe.com/physsci/chemistry/essentialchemistry/flash/molvie1.swf</p> <p><i>References</i> Useful website at www.environment.nsw.gov.au/envirom/waterqual.htm</p> <p>Write equations for the three groups of substances dissolving in water.</p> <p>Response to stimulus material regarding control of water quality in Australia, for example newspaper articles, videos or other resources.</p>	<p>Communicate chemical information and understandings.</p> <p>Communicate chemical information and understandings.</p> <p>Apply chemical understandings.</p>

Week	Area of Study	Key knowledge	Possible activities	Key skills
3	1	<p>Calculations including concentration and volume of solutions.</p> <p>Role of water in maintaining life in the environment – maintaining water quality: solubility, precipitation reactions.</p>	<p>Explain how the concentration of a solution can be determined.</p> <p>Calculate the concentration of solutions in a range of units eg mol/L, g/L and g/100mL (for solubility curves).</p> <p>Practical activity: Solubility of ions and formation of precipitates. (This activity could be planned by students.) This activity could be used as part of the summary report including annotations of three practical activities if the summary report was not completed in Unit 1.</p> <p>Write 'full' and ionic equations for the formation of precipitates.</p>	<p>Apply chemical understandings.</p> <p>Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Communicate chemical information and understandings.</p> <p>Apply chemical understandings. Communicate chemical information and understandings.</p>

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4	1	<p>Role of water in maintaining life in the environment – desalination, including the principles of distillation.</p>	<p>Investigation of desalination plans in Australia to combat lack of water during droughts. (This could be completed as a written response to stimulus material provided from the website).</p> <p><i>References</i> Perth has such a plant already. See website www.watercorporation.com.au/water/water_sources_desalination_faq.cfm</p> <p>Practical activity: Distillation of pure water from salt water.</p> <p>Practical activity: Investigate a range of commercially available water purification tablets for example as used by campers. (This could be a student designed extended experimental investigation.)</p>	<p>Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p>

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5	1	Acids and bases: proton transfer; common reactions of acids; strong and weak acids and bases; polyprotic acids; amphiprotic substances.	Practical activity: Investigate the common reactions involving acids and bases and write balanced equations. (Students will need to refer to area of study 2 to complete this task.)	Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.
6			Formulate and write balanced chemical equations to demonstrate hydrolysis of acids and bases.	Communicate chemical information and understandings.
		Role of water in maintaining life in the environment – maintaining water quality: pH.	Use the definition of pH to calculate pH and $[H_3O^+]$ for acidic solutions.	Apply chemical understandings.
7		Calculations including pH of strong acids and of strong bases.	View animation of self-ionisation of water. http://www.johnkyrk.com/H2O.html	
			Calculation of pH of alkaline solutions.	Communicate chemical information and understandings. Apply chemical understandings.
		Acids and bases: proton transfer; common reactions of acids; strong and weak acids and bases; polyprotic acids; amphiprotic substances.	Differentiate between strong and concentrated acids.	Apply chemical understandings.
			Relate the strength and concentration of acids and bases to the safety procedures for their use.	Investigate and inquire scientifically.
			Demonstration: Strong and weak acids.	Apply chemical understandings.
			Demonstration: Amphiprotic substances in water.	Apply chemical understandings.

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8	1	Calculations including mass-mass stoichiometry.	<p>Solve simple problems involving mass/mass, mass/volume and volume/concentration calculations (could start with precipitation reactions).</p> <p>Practical activity: Products of the thermal decomposition of NaHCO_3.</p> <p>The series of practical activity exercises involving acids and bases could form an extended experimental investigation into the properties and reactions of acids and bases if the extended experimental investigation was not completed in Unit 1. (Students will need to refer to area of study 2 to complete this task.)</p> <p>For other activities refer Advice for teachers p41 VCE Chemistry Study Design 2007–2010.</p>	<p>Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p>

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9	1	Redox reactions in aqueous solution including writing balanced equations for oxidation and reduction reactions, for example metal displacement reactions, corrosion of iron.	<p>Practical activity: Displacement reactions of metals and solutions of metal ions. (This could be a student designed extended experimental investigation).</p> <p>Write balanced partial ionic equations for oxidation and reduction of metals and simple ions for example $\text{Mg(s)} \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^-$. (This could also be completed as an analysis of first and/or secondhand data).</p> <p>Write overall equations for redox reactions.</p> <p>Practical activity: Corrosion of iron and factors that affect its corrosion.</p> <p>Practical activity: Electrochemical cells and corrosion.</p> <p>These practical activities could be used as the summary report including annotations of three practical activity activities.</p>	<p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Communicate chemical information and understandings.</p> <p>Apply chemical understandings.</p> <p>Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p>

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10	1	Application of the principles of green chemistry: for example, replacement of halogenated solvents with supercritical carbon dioxide in industrial processes or in plant crop protection.	A group investigation of supercritical carbon dioxide: an example of green chemistry – benign by design. See detailed example p 43 VCE Chemistry Study Design 2007-2011 and CDROM 'Chemistry- a pathway to emerging Sciences in Victoria', Green chemistry section. Information gathered could be included in a written or multimedia presentation related to green chemistry.	Apply chemical understandings. Communicate chemical information and understandings.
11	2 The atmosphere	Role of the atmosphere in maintaining life in the environment – effects of human activities, such as agriculture, industry, transport, energy production on the atmosphere. Role of the atmosphere in maintaining life in the environment – chemical reactions and processes of acid rain.	Brainstorm how the atmosphere is essential in maintaining life and how human activities impact on the composition of the atmosphere. Demonstration: Burn sulfur and dissolve the oxide in water forming an acidic solution. Compare to the acidic solution formed when NO ₂ and CO ₂ are bubbled through separate water samples. Write equations for these reactions. (This could be completed as an analysis of first and/or secondhand data). Investigate the effect of the acid solution on seedlings. (This could be a student design extended experimental investigation.)	Apply chemical understandings. Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings. Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.

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12	2	<p>Role of the atmosphere in maintaining life in the environment – qualitative effects of ozone depletion and photochemical smog.</p> <p>Role of the atmosphere in maintaining life in the environment – role of the carbon and nitrogen cycles in maintaining life on earth.</p>	<p>Students could prepare a report (visual or written) on the environmental effects of ozone depletion or of photochemical smog.</p> <p>Alternately a set of structured questions could be provided for the students to answer using a specific set of websites.</p> <p><i>References</i> Many sites are available with up to date information on ozone depletion. This one gives links to several useful sites. http://au.dir.yahoo.com/Regional/Countries/Australia/Society_and_Culture/Environment_and_Nature/Global_Change/Ozone_Depletion/</p> <p>Annotate diagrammatic representations of the carbon and nitrogen cycles, adding explanations and equations for example respiration, photosynthesis.</p>	<p>Apply chemical understandings. Communicate chemical information and understandings. Apply chemical understandings.</p> <p>Apply chemical understandings. Communicate chemical information and understandings.</p>
13	2	<p>Role of the atmosphere in maintaining life in the environment – the laboratory and industrial preparation of one gas of significance to the quality of the atmosphere.</p> <p>The major contributing gases to the enhanced greenhouse effect and at least one of the associated local, state, national or international protocols.</p>	<p>Practical activity: Preparation and properties of carbon dioxide. (Students will need to refer to area of study 1 to complete this task. This could be a student designed extended experimental investigation.)</p> <p>Prepare a short report on the major contributing gases to the enhanced greenhouse effect and an associated protocol.</p> <p><i>References</i> Refer to VCE Chemistry Study Design 2007-2011p 45 for detailed example of summary report of annotated practical activity work.</p>	<p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p> <p>Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.</p>

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14	2	Kinetic, molecular theory and its use in explaining properties of gases.	Demonstration: Balloon in a flask and expanding marshmallow.	Investigate and inquire scientifically. Apply chemical understandings.
15		Calculations including those involving gas laws, molar volume (V_M) at STP and SLC, the General gas equation, volume-volume and mass-volume stoichiometry.	Discuss the limitations of the Kinetic Molecular Theory. Complete calculations using Boyle's, Charles' and Avogadro's Laws as well as the General gas equation. Practical activity: Molar volume of Hydrogen or Oxygen. Complete calculations involving the law of partial pressures. Solve simple stoichiometry exercises involving the mass and volume of gases. Solve simple problems involving mass/volume of gas, volume/volume (gases at same temperature and pressure). (Students will need to refer to area of study 1 to complete this task.)	Apply chemical understandings. Apply chemical understandings. Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings. Apply chemical understandings. Apply chemical understandings. Apply chemical understandings.
16		Revision for Unit 2.		

Note: for more detailed information about the practical activities included, refer to the Advice for teachers section of the Study design.