VCE CHEMISTRY UNIT 1
The Big Ideas of Chemistry
SAMPLE COURSE OUTLINE

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Week	Area of Study	Key knowledge	Possible activities	Key skills
1	**1. The Periodic Table**	Atomic Theory – historical development of the model of atomic theory with contributions from Dalton to Chadwick.	Discuss in an historical context. Create a simple timeline with each student contributing their research on a key player, for example Dalton, Thomson, Bohr etc. Present the information to the rest of the class.	Apply chemical understandings.
		Atomic Theory – limitations of the model of atomic theory. The Periodic Table – historical development from Mendeleev to Seaborg.	Incorporate limitations in the timeline systematically as each model is discussed in the above activity. Note that Groups should be numbered 1 to 18 as per IUPAC nomenclature. Describe how the work of people (for example Mendeleev, Ramsay, Rutherford, Seabora etc.) shaped the modern Periodic Table. *References* VCE Chemistry Study Design 2007–2011: Advice for teachers p36 and Websites p64. Study Design glossary p30. Rutherford's gold leaf experiment at this website http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/ruther14.swf	Apply chemical understandings.

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2	**1**	The Periodic table – trends and patterns of properties within the Periodic table: atomic number, types of compounds formed, metallic/non-metallic character, chemical reactivity of elements.	Practical activity: Examination of elements of Period 3: • Burn Period 3 elements to make oxides • Investigate acid-base properties of oxides • Investigate reactions of elements with water. Written report focuses on similarities and differences of the elements. This activity could be used as the summary report including annotations of three practical activities and could draw on material from area of study 2.	Investigate and inquire scientifically. Communicate chemical information and understandings.
3	**1**	Atomic Theory – mass number, isotopes, calculation of relative atomic mass, electronic configuration including subshells. Interpretation of data from mass spectroscopy.	Introduction to the basic operation of mass spectrometer as background for isotopes/isotopic mass – use analogy of balls of different masses being kicked at right angles to direction of movement. *References* Use internet for animated virtual mass spectrometer. Virtual mass spectrometer at www.colby.edu/chemistry/OChem/DEMOS/MassSpec.html	Apply chemical understandings. Communicate chemical information and understandings.

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4	**1**	Atomic theory. Electronic configuration including subshells.	Link back to atomic theory development to introduce subshell theory of electron structure. Emission spectra and 1st ionization energies can be used as evidence for electron structure. Electronic configurations can be linked to position of element in the periodic table using s-block, p-block. Practical activity: Flame tests or use The Periodic Table and emission spectra website http://jersey.uoregon.edu/vlab/elements/Elements.html *References* A number of websites show animations of orbitals. These may help students visualize the electron clouds. Useful atomic orbitals website www.chemguide.co.uk/atoms/properties/atomorbs.html	Apply chemical understandings. Investigate and inquire scientifically. Apply chemical understandings.

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5	**1**	The mole concept including empirical and molecular formulas, percentage composition, Avogadro's constant.	Mole leads on directly from mass spectroscopy via ^{12}C. (Demonstrate: Mole using jellybeans and smarties.)	Apply chemical understandings. Investigate and inquire scientifically.
6			This leads directly to practice calculations involving mole, number of particles, and Avogadro's constant. Determination of Avogadro's constant using metal cubes (mass, volume and volume of a sphere).	Investigate and inquire scientifically. Apply chemical understandings.
7			Practice calculations involving mole, mass and relative atomic mass (link back to measurements made using mass spectrometer). Restrict to elements only at this stage. Practical activity: Empirical formula determination of copper. Practice calculations involving molecular formulas. Practical activity: Percentage by mass of magnesium in magnesium oxide.	Apply chemical understandings. Communicate chemical information and understandings.
			These two practical activities could be part of the summary report with annotations of three practical activities. Annotations could include observations that show the links from one practical activity to the next and/or links that show how concepts are illustrated/related across the two practical activities.	Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings.

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8	**2 Materials**	Models of bonding to explain observed properties including melting temperature, electrical conductivity, chemical reactivity, shape, polarity of bonds, intermolecular forces – metals. Limitations of the bonding models.	Practical activity: Growing metal crystals by electrolysis or by displacement reactions. Practical activity (Modelling of structure): 3D models of metallic structure can be created using small balls. (Students will need to refer to area of study 1 to complete this task.) An obvious limitation in this model is the inability to represent electrons satisfactorily. This activity could be completed as an extended experimental investigation. (If the summary report with annotations of three practical activity activities is used the annotations could show the relationship between properties, structures and any anomalies).	Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings. Communicate chemical information and understandings.
9	**2**	Models of bonding to explain observed properties including melting temperature, electrical conductivity, chemical reactivity, shape, polarity of bonds, intermolecular forces – ionic compounds. Limitations of the bonding models.	Practical activity: Properties of Sodium Chloride, for example solubility, hardness, crystal structure. Modelling electron transfer: Use smarties or beads to represent electrons (different colours to represent different elements). Students could work in groups creating ionic compounds by electron transfer. Modelling of structure: 3D models of ionic compounds are commercially available for demonstration and also as kits for students to make up. Students should be able to generate discussion of limitations.	Investigate and inquire scientifically. Apply chemical understandings. Investigate and inquire scientifically Investigate and inquire scientifically.

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10	**2**	Models of bonding to explain observed properties including melting temperature, electrical conductivity, chemical reactivity, shape, polarity of bonds, intermolecular forces – molecular substances, network lattices, layer lattices.	Modelling: Building molecular models – commercial kits or coloured blu tack and tooth picks can be used. A wide range of molecules should be selected. Draw Lewis structures of covalent molecules.	Investigate and inquire scientifically. Apply chemical understandings.
11	**2**	Limitations of the bonding models.	Limitations could include the inability of models to explain interactions between molecules. This discussion would lead to Intermolecular bonding. OR Summary tables – one comparing and contrasting the strong types of bonding (covalent, ionic and metallic); and the other comparing the three types of intermolecular bonding (dipole-dipole, hydrogen bonding and dispersion forces). OR Modelling structure: Build or observe models of diamond, graphite and Buckminsterfullerene (‘bucky’ balls). Students working in pairs will decide how they model molecules of their choice. They will report on their investigation using a combination of written and visual formats. Discussion of these structures leads to carbon nanotubes and discussion of nanotechnology.	Communicate chemical information and understandings. Communicate chemical information and understandings. Communicate chemical information and understandings.

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12	**2**	Behaviour of surfaces and the application of surface chemistry in nanotechnology.	Student response to an article on nanotechnology or students research an application of nanotechnology (See powerpoint on the CD-ROM 'Chemistry-a pathway to the Emerging Sciences in Victoria). Also see Advice to Teachers, VCE Chemistry Study Design 2007-2011 p40. Assessment task is an oral or visual presentation explaining the application of nanotechnology in the development of new materials. (Students will need to refer to area of study 1 to complete this task.)	Apply chemical understandings. Communicate chemical understandings. Communicate chemical information and understandings.
13	**2**	Properties and systematic naming of alkanes and alkenes up to C_6. Structural isomers of C_4H_{10}.	Model a range of Hydrocarbon molecules. Practical activity: Investigating the products of combustion of a hydrocarbon. Modelling: Structural isomers of C_4H_{10}. Graph and analyse boiling point data of a number of alkanes; interpret and justify these in terms of intermolecular bonding. (This activity could be completed as an extended experimental investigation if the summary report including annotations of three practical activities has been completed previously.)	Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and 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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14	**2**	Addition polymers – relationship between structure, properties and applications.	Write equations for the formation of a range of addition polymers using structural formulas. Examine and report on the properties and uses of a range of polymers formed by addition polymerisation of ethene and its derivatives. *References* Useful website on addition polymers: www.cem.msu.edu/~reusch/VirtTxtJml/polymers.htm	Apply chemical understandings. Communicate chemical information and understandings. Apply chemical understandings. Communicate chemical information and understandings.
15	**2**	Addition polymers – synthesis, cross-linking. Addition polymers – development of customised polymers.	Practical activity: Making Slime and Silly Putty. Practical activity: Making an elastomer (rubber). Investigate and report on ways in which polymers are modified for specific uses. *References* Polymers is an obvious area where careers in Chemistry can be discussed, but many other careers also use chemistry. Refer p7 VCE Chemistry Study Design 2007–2011.	Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings. Investigate and inquire scientifically. Apply chemical understandings. Communicate chemical information and understandings. Apply chemical understandings. Communicate chemical information and understandings.
16		Revision of Unit 1.		

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