VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

# VCE CHEMISTRY 2008–2011: UNIT 4 SAMPLE COURSE OUTLINE

This sample course outline represents one possible teaching and learning sequence for Unit 4.

| Week | Area of Study | Key knowledge | Key Skills | Possible activities and assessment tasks |
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| 1–3 | **1. Industrial chemistry** | • collision theory and factors that affect the rate of a reaction including activation energy | • investigate and inquire scientifically<br>• communicate chemical information and understandings | • Experimental activities related to factors affecting rates of reaction. For example reaction between HCl and marble chips (50min). This could be included as one of the three practical activities required for ***a summary report including annotations of three practical activities.*** (Logbooks should be collected with results after this activity).<br>• Experimental activities related to the use of catalysts. For example investigation of the decomposition of $H_2O_2$ catalysed by catalyse (from liver, potato etc) and comparison to $MnO_2$**.** This could be presented as ***a written report of a practical activity*** if a summary report including annotations of three practical activities is completed in area of study 2.<br>• Alternatively, if a summary report including annotations of three practical activities is completed in area of study 2 experimental data from similar rate of reaction experiments including catalysts could be included in ***an analysis of first (or second-hand) data using structured questions.*** |

| Week | Area of Study | Key knowledge | Key Skills | Possible activities and assessment tasks |
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| | | • energy profile diagrams and the use of ΔH notation<br><br>• reversible reactions: homogeneous equilibria and the equilibrium law, Le Chatelier's Principle and factors which affect the position of equilibrium | • apply chemical understandings<br><br>• investigate and inquire scientifically | • Illustrate the concept of activation energy using energy profile diagrams for endothermic and exothermic reactions.<br><br>• Experimental activities related to equilibria of exothermic and endothermic reactions. For example an investigation of effects of changing temperature on the cobalt chloride equilibrium system (50 mins) and an investigation of the effects of changing concentrations and temperature on the $Fe(SCN)^{2+}$ system (50 minutes). These two experiments could be included with an experiment related to rates of reactions and presented as ***a summary report including annotations of three practical activities.*** (Logbooks should be collected with results after each session).<br><br>• Alternately results from either of these experiments could be included as part of the analysis of ***first hand data using structured questions*** if a summary report including annotations of three practical activities is completed in area of study 2. |

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| 4–5 | **1. Industrial chemistry** | • pH as a measure of strength of acids and bases; $K_w$, $K_a$ for weak acids | • investigate and inquire scientifically<br>• communicate chemical information and understandings<br>• apply chemical understandings | • ***A summary report including annotations of three practical activities drawn from area of study 1.*** Students use the results from the three experiments (rates of reactions, exothermic and endothermic equilibria) above to complete a summary including annotations report using a template and/or questions provided by the teacher. One lesson is provided and logbooks returned to students for reference.<br>• Revision of pH calculations from Unit 2<br>Using $K_w$ for $[OH^-]$ calculations<br>Demonstration of pH of weak acids compared to strong acids<br>$K_a$ calculations. |
| 6–7 | **1. Industrial chemistry** | • principles of waste management used in the chemical industry<br>• the industrial production of the selected chemical<br>– factors affecting the production including rate and equilibrium position, catalysts, temperature, pressure<br>– waste management including generation, treatment and reduction<br>– health and safety<br>– uses of the selected chemical. | • apply chemical understandings<br>• investigate and inquire scientifically<br>• communicate chemical information and understandings | • Revision of the principles of green chemistry from Unit 2.<br>• Research labeling hazardous materials.<br>• In groups research the safety and waste management practices common to the production of chemicals.<br>• Experimental activities to match selected chemical For example if $H_2SO_4$ is chosen, then investigate chemical properties of $H_2SO_4$.<br>• Annotated flow chart or a PowerPoint animation could be developed by students to summarise the industrial production of the selected chemical. This could be presented as *a* ***report on chemistry at work*** if a summary report including annotations of three practical activities is completed in area of study 2. |

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| | | | | • ***References (area of study 1)***<br>VCE Study Design 2007–2011: Advice for teachers p53–56; p62; useful websites p64–65.<br>VCAA CDROM 'Chemistry - a pathway to the emerging sciences in Victoria'. |
| 8–9 | **2. Supplying and Using Energy** | • comparison of energy sources: types, uses and sustainability of sources including brown coal, natural gas, nuclear fission and biochemical fuels | • apply chemical understandings | • Define exothermic and endothermic and identify *useful* exothermic and endothermic reactions. |
| | | • application of calorimetry to measure energy changes in chemical reactions in solution calorimetry and bomb calorimetry | • investigate and inquire scientifically<br>• communicate chemical information and understandings | • Calibrate a calorimeter and use that calorimeter to perform heat of reaction experiments.<br>These two experiments could be included as two of the three practical activities required for ***a summary report including annotations of three practical activities,*** if this assessment task is completed for area of study 2. |
| 10–12 | **2. Supplying and Using Energy** | • the construction and operation of simple galvanic primary and secondary cells<br>• use of the electrochemical series in predicting the products of redox reactions and writing half equations | • investigate and inquire scientifically | • Experimental activities involving electrochemical cells. For example developing an electrochemical series using a number of different half cells. This could be presented as ***a written report of a practical activity*** if a summary report including annotations of three practical activities has been completed for area of study 1. |
| | | • limitations of predictions made using the electrochemical series | • apply chemical understandings | • Revision of redox half equations and stoichiometry involved in redox reactions. |

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| | | • the construction and operation of fuel cells: advantages and disadvantages of fuel cells compared to conventional energy sources | | • Observation and/or manipulation of simulations or animations of fuel cells, or simple galvanic or electrolytic cells using computer software. Some fuel cell animations are available at http://www.h2fc.com/reframe.php?top=/global/tech.shtml&bot=/technology/fuelcells/general.shtml |
| | | | • communicate chemical information and understandings | • Alternatively ***a report on chemistry at work*** could be completed for fuel cells - their construction and operation, advantages and disadvantages compared to conventional energy sources if a summary report including annotations of three practical activities has been completed in area of study 1. |
| 13–14 | **2. Supplying and Using Energy** | • the construction and operation of simple electrolytic cells: comparison of electrolytic cells | • apply chemical understandings | • Alternatively second hand experimental data involving products made in a range of electrolytic cells could be presented as analysis ***of second hand data using structured questions*** if a summary report including annotations of three practical activities has been completed in area of study 1. |
| | | • application of Faraday's laws in electrochemistry | • apply chemical understandings<br>• communicate chemical information and understandings | • Use annotated diagrams and computer simulations to aid understanding of electrolysis. Acid electrolysis simulation at http://www.cambridgeassessment.org.uk/research/innovationassessmentlearning/enigma/simulations/electrolysis/electrolysis.html |
| | | | • investigate and inquire scientifically | • Experimental activities involving electrolysis of aqueous solutions. This experiment could be included as the third practical activity for ***a summary report including annotations of three practical activities*** if this assessment task is being completed for area of study 2. |

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| | | | • communicate chemical information and understandings | • ***A Summary report including annotations of three practical activities***<br>Students would have results from the three experiments (calibration and use of a calorimeter and electrolytic cells) above to complete a summary including annotations report using a template and/or questions provided by the teacher. One lesson is provided and logbooks returned to students for reference.<br><br>• ***References (area of study 2)***<br>VCE Study Design 2007–2011: Advice for teachers p57–59; p62; useful websites p64–65.<br>VCAA CD-ROM 'Chemistry - pathway to the emerging sciences in Victoria'. |
| 15–16 | | • Catch up time<br>Revision of Unit 4 in preparation for examination 1 | | • VCAA sample exam paper under timed conditions<br>http://www.vcaa.vic.edu.au/vce/studies/chemistry/chemindex.html |