**Possible UNIT 3 TIMETABLE**

Prepared by Penny Commons for CEA VCE Implementation workshops, October 2023

This timetable is based on the VCAA Study Design and the Pearson Heinemann Chemistry 2, 6th Edition.

The [VCAA has provided *Sample teaching plans* for each area of study](https://vcaa.vic.edu.au/curriculum/vce/vce-study-designs/chemistry/Pages/Teaching-and-Learning.aspx#SampleTeachPlans). These are well worth examining, especially their *Learning Activities column.* This could also be helpful when designing SACs for the year.

**Section review** questions at the end of each section in the Heinemann text book are most helpful as checkpoint questions or homework or weekend study.

Please complete your own minimum list of **Chapter review** questions (in column 4 below) will enable students to determine what they need to carefully revise in that particular area of study.

All **Unit Review** questions should be done as revision of the entire Area of Study.

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| **Week** | **Concepts** | **Heinemann Chemistry 2 Text Chapter** | **You need to list a minimum set of *End of Chapter Review* questions.**  **(Use section questions as class and homework)** | **VCAA minimum of 10 hours of prac across Areas of Study 1 and 2**  **VCAA minimum of 10 hours across Unit 4 Area of Study 3 (can be done anytime on Unit 3 or 4 material)**  **Practical activities (PA) and Worksheets (WS) found in Heinemann *Skills and Assessment book* (SAB)**  **Demonstrations are from the ‘old’ *Demonstrations in Chemistry* Chris Commons et al. You may find some of them on You tube.** | **SAC Dates and details**  **You will need to discuss with your colleagues and school program and decide what content and which style of SACs will be held when.** |
| **Semester 1: Unit 3: How can design and innovation help to optimise chemical processes?**  **Area of Study 1: What are the current and future options for supplying energy?** | | | | | |
| 1 | Carbon based fuels   * Exothermic and endothermic reactions   + Energy profile diagrams * Activation energy * Δ*H*   + Thermochemical equations * Fuels   + Non-renewable fuels   + Renewable fuels   + Fuels for the body   + Energy from combustion * Complete * incomplete | 2 |  | SAB WS 1 Knowledge review—mole, stoichiometry and redox  Demonstrations:   * Endothermic reaction between two solids * Chemical oven   SAB WS 2 Combustion of fuels—energy profile diagrams and calculations  SAB WS 3 Motor fuels—today and tomorrow | **Outcome 1 statement:**  Compare fuels quantitatively with reference to combustion products and energy outputs, apply knowledge of the electrochemical series to design, construct and test primary cells and fuel cells, and evaluate the sustainability of electrochemical cells in producing energy for society.  **Contribution to SAC grade**   * contributes 10%   **For each outcome, one task selected from:**  • comparison and evaluation of chemical concepts, methodologies and methods, and findings from at least two practical activities  • analysis and evaluation of primary and/or secondary data, including identified assumptions or data limitations, and conclusions  • problem-solving, including calculations, using chemistryconcepts and skills applied to real-world contexts  • analysis and evaluation of a chemical innovation, research study, case study, socio-scientific issue, or media communication.  **(More information in VCAA Study Design pages 41-42)** |
| 2 | * Measuring changes in chemical reactions * Stoichiometry involving reactions of fuels   + Limiting reactant   + Mass-mass stoichiometry   + Mass-volume stoichiometry | 3 |  | SAB WS 4 Energy changes and stoichiometry—limiting reactants |
| 3 | * Gases   + The universal gas equation   + Volume-volume stoichiometry * Specific heat capacity * Calculations involving energy changes | 3 |  | SAB PA 1 Synthesis and energy content of biodiesel  SAB PA 2 Energy content of different alcohols |
| 4 | * Calorimetry   + Solution and bomb calorimeters   + Calibration of calorimeters   + Analysis of temperature-time graphs from solution calorimetry | 3 |  | SAB PA 4 Fermentation  SAB PA 5 Calibration of a calorimeter |
| 5 | * Energy from fuels and food   + Comparing energy content   + Energy transformations and efficiencies   + Energy available to the body | 3 |  | SAB PA 3 Energy content of a snack food  SAB WS 5 Calorimetry—energy from a pizza  Demonstrations:   * Balloon in a flask * The expanding marshmallow |
| 6 | * Revision Redox reactions Year 11 * Reduction and oxidation * Reducing and oxidising agents * Primary galvanic cells and fuel cells as sources of energy * Oxidation numbers * Balancing half-equations * In acid * In base * More complex equations | 4 |  | SAB WS 6 Redox reactions and oxidation numbers |
| 7 | * Galvanic cells   + Principles of galvanic cells * Polarity of electrodes * Electron flow * Cathode and reduction * Anode and oxidation   + Electrochemical series * Use to predict electrode reactions * Calculating Eocell * Limitations | 5 |  | SAB WS 7 Investigating galvanic cells -developing an electrochemical series  SAB WS 8 The electrochemical series- predicting reactions  SAB PA 6 Half-cells and the electrochemical series |
| 8 | * Fuel cells * General design features * Innovation to overcome design challenges * Application of green chemistry principles * Storage of hydrogen * Faraday’s laws (can leave till after electrolysis. VCAA does it in both places starting here.) | 5 |  | SAB WS 9 Fuel cells—applications and efficiency  SAB PA 7 Fuel cells  SAB WS 10 Literacy review—electrochemistry and thermochemistry |
| **Area of Study 1 REVIEW Questions** SAB WS 11 and SAB selected Past VCAA Exam questions | | | | | |
| **Semester 1: Unit 3: How can design and innovation help to optimise chemical processes?**  **Area of Study 2: How can the rate and yield of chemical reactions be optimised?** | | | | | |
| 9 | * Rates of chemical reactions * Factors affecting rates of reaction * Collision theory * Catalysts | 6 |  | SAB WS 12 Knowledge review—ionisation reactions and Faraday’s laws  Demonstrations:   * Foam column * Volcanoes using different ground KMnO4 and glycerol   SAB PA 8 Factors affecting the rate of reaction  SAB WS 13 Reaction routes—rate of reaction |  |
| **Term 1 holidays – adjust timetable as needed** | | | | | |
| 10 | * Dynamic equilibrium * Reversible and irreversible reactions * Open and closed systems * Energy profile diagrams * The equilibrium law *K* and *Q*, * Extent of reaction * Factors affecting *K* | 7 |  |  | **Outcome 2 statement:**  Experimentally analyse chemical systems to predict how the rate and extent of chemical reactions can be optimised, explain how electrolysis is involved in the production of chemicals, and evaluate the sustainability of electrolytic processes in producing useful materials for society.  **Contribution to SAC grade**   * contributes 10%   **For each outcome, one task selected from:**  • comparison and evaluation of chemical concepts, methodologies and methods, and findings from at least two practical activities  • analysis and evaluation of primary and/or secondary data, including identified assumptions or data limitations, and conclusions  • problem-solving, including calculations, using chemistry concepts and skills applied to real-world contexts  • analysis and evaluation of a chemical innovation, research study, case study, socio-scientific issue, or media communication.  **(More information in VCAA Study Design pages 41-42)** |
| 10 | * Calculations involving stoichiometry and equilibrium * Dependency of *K* on equation * Meaning of *K* * Calculations involving *K* and concentrations | 7 |  | SAB WS 14 Calculations—equilibrium constants and concentrations  SAB PA 9 Effect of concentration changes on equilibrium yields  SAB PA 10 Effect of volume changes on equilibrium yields (teacher demonstration only) |
| 11 | * Le Châtelier’s Principle * Factors favouring yield * Effect of temperature * Concentration-time graphs | 7 |  | SAB WS 15 Equilibrium reactions  SAB WS 16 Equilibrium—Le Châtelier’s principle and the equilibrium law  SAB PA 11 Effect of temperature on equilibrium yields |
| 12 | * Electrolysis   + Electrolytic cells * Molten ionic compounds * Aqueous solutions   + Electrochemical series * predicting electrode reactions * Comparing electrolytic and galvanic cells * Commercial electrolytic cells   + general operating principles     - molten electrolytes     - aqueous electrolytes     - reactive electrodes     - features to reduce cost | 8 |  | Demonstration:   * Tin crystals by electrolysis   SAB PA 12 Electrolysis of aqueous solutions  SAB WS 17 Electrolytic cells—predicting reactions and comparing electrolytes |
| 13 | * Faraday’s Laws * 1st and 2nd laws of electrolysis * Calculations using Faraday’s laws and stoichiometry * Calculation of current, time, amount of products at electrodes. | 8 |  | SAB PA 13 Determination of Faraday’s constant and Avogadro’s constant  SAB WS 20 Commercial cells and Faraday’s laws |
| 14 | * Secondary cells * Principles * Recharging * Designing for energy efficiency and sustainability * Optimising industrial yield * Producing ‘green’ hydrogen gas * Polymer electrolyte membrane electrolyser * Artificial photosynthesis | 9 |  | SAB WS 19 Secondary cells—storing and producing energy  SAB WS 18 Industrial applications—finding a compromise  SAB WS 21 Literacy review—equilibrium and electrolysis |
| **Area of Study 2 REVIEW Questions** SAB WS 22 and SAB selected Past VCAA Exam questions | | | | | |

**Possible UNIT 4 TIMETABLE**

This timetable is based on the VCAA Study Design and the Pearson Heinemann Chemistry 2, 6th Edition.

The VCAA has provided *Sample teaching plans* for each area of study. These are well worth examining, especially their *Learning Activities column.* This could also be helpful when designing SACs for the year.

**Section review** questions at the end of each section in the Heinemann text book are most helpful as checkpoint questions or homework or weekend study.

Please complete your own minimum list of **Chapter review** questions (in column 4 below), which will enable students to determine what they need to carefully revise in that particular area of study.

All **Unit Review** questions should be done as revision of the entire Area of Study.

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| **Week** | **Concepts** | **Heinemann Chemistry 1 Text Chapter** | **You need to list a minimum set of *End of Chapter Review* questions.**  **(Use section questions as class and homework)** | **VCAA minimum of 10 hours of prac across Areas of Study 1 and 2**  **VCAA minimum of 10 hours across Unit 4 Area of Study 3 (can be done anytime on Unit 3 or 4 material)**  **Practical activities (PA) and Worksheets (WS) found in Skills and Assessment book (SAB)**  **Demonstrations are from the ‘old’ *Demonstrations in Chemistry* out of print. You may even find some of them on You tube.** | **SAC Dates and details**  **You will need to discuss with your colleagues and school program and decide what content and which style of SACs will be held when.** | |
| **Semester 2: Unit 4: How are carbon-based compounds designed for purpose?**  **Area of Study 1: How are organic compounds categorised and synthesised?** | | | | | | |
| 1 | * Structure, nomenclature and properties of organic (some is Year 11 revision) * Carbon characteristics * Unique nature of carbon * Valence electron number * Bond strength and bond energy * Saturated hydrocarbons * Alkanes * Homologous series * Alkyl groups * Unsaturated hydrocarbons * Alkenes * Degree of unsaturation * Cyclic hydrocarbons * Cyclohexane * Benzene | 10 |  | SAB WS 23 Knowledge review—bonding and  organic chemistry | **Outcome 1 statement:**  Analyse the general structures and reactions of the major organic families of compounds, design reaction pathways for organic synthesis, and evaluate the sustainability of the manufacture of organic compounds used in society.  **Contribution to SAC grade**   * contributes 10%   **For each outcome, one task is selected from the same list as for Unit 3.**  **(More information in VCAA Study Design pages 48-49)** | |
| 2 | * Formulas and structures * Structural, semi-structural and skeletal formulas * Structural isomers * Functional groups * Haloalkanes, amines and alcohols * Aldehydes and ketones * Carboxylic acids and amides an esters | 10 |  | SAB WS 24 The complexity of carbon—organic compounds |
| **Term 2 holidays – adjust timetable as needed** | | | | | | |
| 3 | * Naming organic compounds * Hydrocarbons * Haloalkanes, amines and alcohols * Types of alcohols * Molecules containing the carbonyl group * IUPAC priority * Properties of hydrocarbons, haloalkanes * Trends in physical properties * Dispersion forces * Boiling and melting point * Viscosity * Properties of alcohols, amines, carboxylic acids and amides * Properties of aldehydes, ketones and esters | 10 |  | SAB PA 14 Preparing artificial fragrances and flavours  SAB PA 15 Reactions and properties of some organic compounds |  | |
| 4 | * Reactions of organic compounds * Reactions of alkanes and haloalkanes * Reactions of alkenes * Reactions of alcohols, carboxylic acids and esters | 11 |  | SAB WS 25 Focus on functional groups— properties and chemical reactions  SAB PA 16 Modelling functional groups and organic reactions |  | |
| 5 | * Reactions of biological molecules * Synthesis of proteins * Synthesis of starch, glycogen and lipids * Hydrolysis of biomolecules | 12 |  | SAB WS 26 Focus on biological molecules—functional group chemistry  SAB PA 17 Performing a condensation polymerisation reaction (teacher demonstration only)  SAB PA 18 Modelling proteins, fats and carbohydrates |
| 6 | * Organic pathways and atom economy * Synthesis of primary haloalkanes, primary alcohols, primary amines, carboxylic acids and esters * Calculations of atom economy and percentage yield of single-step or overall pathway reactions * Sustainable production of chemicals * Green chemistry principles * Circular economy * Linear economy | 11 |  | SAB WS 27 Green chemistry—approaches to sustainability  SAB WS 28 Literacy review—organic chemistry |
| **Area of Study 1 REVIEW Questions** SAB WS 29 and SAB selected Past VCAA Exam questions | | | | | |
| **Semester 2: Unit 4: How are carbon-based compounds designed for purpose?**  **Area of Study 2: How are organic compounds analysed and used?** | | | | | | |
| 7 | * Laboratory analysis of organic compounds * Analysis techniques * Distillation * Purity * Melting point determination * Qualitative tests for functional groups * C=C double bonds * Hydroxyl * Carbonyl | 13 |  | SAB WS 30 Revision Knowledge review— chromatography, catalysts and stoichiometry  Revise SAB PA 15 Reactions and properties of some organic compounds | **Outcome 2 statement:**  Apply qualitative and quantitative tests to analyse organic compounds and their structural characteristics, deduce structures of organic compounds using instrumental analysis data, explain how some medicines function, and experimentally analyse how some natural medicines can be extracted and purified.  **Contribution to SAC grade**   * contributes 10%   **For each outcome, one task is selected from the same list as for Unit 3.**  **(More information in VCAA Study Design pages 48-49)** | |
| 8 | * Degree of unsaturation –iodine number * Volumetric analysis * Terminology * Redox reaction * Excess and limiting reactants | 13 |  | SAB PA 19 Determining the iodine number of an oil—a secondary data exercise  SAB PA 20 Analysis of ascorbic acid in vitamin C tablets  SAB WS 31 Calculations—stoichiometry involving limiting reactants and redox titrations  SAB WS 32 Analysis—identification of organic compounds and functional groups |
| 9 | * Instrumental analysis of organic compounds * Spectroscopic techniques * IR spectroscopy * Polar bonds in molecules interact with IR light. * The frequency absorbed depends on the nature of the bond | 14 |  | Use CEA Chemical Detectives app for extra practice and fun!  You tube: IR (RSC)  <https://www.youtube.com/watch?v=DDTIJgIh86E> |
| 10 | * NMR spectroscopy * TMS and chemical shift * 1H * number of signals indicates the number of different H chemical environments * splitting patterns * 13C * number of signals indicates the number of different C chemical environments | 14 |  | Use CEA Chemical Detectives app for extra practice and fun! See Apple or Android App stores  SAB WS 33 Spectroscopy—nuclear magnetic resonance  H-NMR (RSC)  <https://www.youtube.com/watch?v=uNM801B9Y84> |
| 11 | * Mass spectrometry * The interaction of a gaseous sample with a high-energy electron beam forms positive ions. * These cations are accelerated by an electric field and then deflected by a magnetic field. * Fragmentation * Base peak * Molecular ion peak | 14 |  | Use CEA Chemical Detectives app for extra practice and fun!  SAB WS 34 Using spectroscopy to determine structure  You tube: MS (RSC)  <https://www.youtube.com/watch?v=J-wao0O0_qM> |
| 12 | * Chromatography (all revision Y11) * Principles of HPLC * Qualitative analysis * Quantitative analysis using HPLC * Structure determination by spectroscopy * Compound identification by using laboratory and instrumental analysis | 14 |  | SAB PA 21 Chromatography of a vegetable extract—extraction of natural plant compounds  SAB WS 35 Chromatography and medicines  You tube: HPLC (RSC)  <https://www.youtube.com/watch?v=kz_egMtdnL4>  SAB WS 37 Literacy review—laboratory and instrumental analysis |
| 13 | * Medicinal chemistry * Some examples of some drugs and uses * Some medicines and tradition uses * Extraction and purification * Identification of functional groups and molecular structure * Stereoisomers * Chiral centres * Enantiomers | 15 |  |  |  | |
| 14 | * Enzymes * Structures of amino acids * Enzyme structure and function * Primary structure * Secondary structure * Tertiary structure * Quaternary structure * Model for the action of enzyme * Lock and key model * Denaturation * Addition of chemicals * Change in pH * zwitterions * Increased temperature * Competitive enzyme inhibitors * How they work * Examples | 15 |  | SAB PA 22 Action of catalysts—peroxide and enzymes  SAB WS 36 Enzymes—formation, structure and function |  | |
| **Area of Study 2 REVIEW Questions** SAB WS 38 and SAB selected Past VCAA Exam questions | | | | | |
| **Term 3 holidays – move as needed – may contain Trial exams in some schools** | | | | | | |
| 15 | Revision |  |  |  |  | |
| 16 | Revision and thinking of leaving school and all that involves! Possibly finishing. |  |  |  | **Trial exam** | |
| 17 | Revision – leaving school or have finished - a messy week! |  |  |  |  | |

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| **This following period for the Practical Investigation is moveable. Needs 10 hours so 2-3 weeks.**  (Practical investigation could be done at end of Unit 3 or during Unit 4.) | | | | | |
| **Semester 2: Unit 4: How are carbon-based compounds designed for purpose?**  **Area of Study 3: How is scientific inquiry used to investigate the sustainable production of energy and/or materials?** | | | | | |
| Week 1 of task | Practical investigation | 1  VCAA Study Design  VCAA Support materials  SAB pages 236-237 and Toolbox |  | Your choices will be from Unit 3 or Unit 4 and you could modify and extend pracs of your choice according to the outcome statement. The VCAA says the assessment task is:  Communication of the design, analysis and findings of a student-designed and student-conducted scientific investigation through a structured scientific poster and logbook entries.  The poster should not exceed 600 words. | **Outcome 3 statement**  Design and conduct a scientific investigation related to the production of energy and/or chemicals and/or the analysis or synthesis of organic compounds, and present an aim, methodology and method, results, discussion and conclusion in a scientific poster.  **Contribution to SAC grade**  • contributes 10% |
| Week 2 of task | Practical investigation |  |  |  |  |
| Week 3 of task | Practical investigation  Complete poster (U4AoS3) |  |  |  | **Outcome 3: Present as digital scientific poster** |