

Scheme of work: ASC **6c Organic chemistry**

The following scheme of work offers a route through the Applied General Science Unit 6C Organic chemistry, covering all the sections in a logical order. The order is by no means prescriptive and there are many alternative ways in which the content could be organised.

Assumed coverage

This scheme of work is a plan of what will be covered in each week or session of the learning programme or course. It will detail over 30 weeks the delivery of the applied science course content for the examination. The scheme of work will also give resources and ideas for practical work that can illustrate the written content.

PO1 Identify molecular structure, functional groups and isomerism

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| **Specification content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | P1:  Outline bonding, structure, nomenclature and types of formulas for compounds and functional groups. | Tutor observation of diagrams and completed pro forma (**P1**).  Oral communication during discussion.  Spelling and scientific nomenclature for written work.  Practical drawing skills. | 1 | Tutor led introduction and discussion to organic (aliphatic and aromatic) chemistry:   * bonding * structure * nomenclature * formulas * functional groups.   Some of this can be illustrated using molecular models.  [Understanding chemistry](http://www.chemguide.co.uk/orgmenu.html)  (Good website for all of **PO1**)  [Organic chemistry tutorials](http://www.chemhelper.com/tutorials.html)  This can be carried out as a series of diagrams and pro forma.  Learner led activity for **P1** to draw diagrams for the above bullet points and fill out a pro forma showing functional groups. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | P2:  Research suitable spectroscopic techniques and spectra. | Research findings and notes made during research and written report (**P2**).  Spelling and scientific nomenclature for written work.  Research. | 2 | Tutor led introduction to the electromagnetic spectrum as a basis of spectroscopy.  Learner led research into different spectroscopic techniques; mass spectroscopy, ultraviolet visible spectroscopy, infrared spectroscopy and nuclear magnetic resonance spectroscopy.  MSU [MSU - Introduction to spectroscopy](https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/spectro.htm)  (This website also shows spectra).  [SpectraSchool - Introduction to spectroscopy](http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction) |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | M1:  Describe how infrared NMR and mass spectra are obtained and outline the scientific principles involved. | Tutor observation of research.  Written work (**P2**, **M1**).  Research.  Spelling and scientific nomenclature for written work. | 3 | Learner led progression of **P1** to describe how infrared NMR and mass spectra are obtained and the scientific principles involved.  [What is spectroscopy?](http://loke.as.arizona.edu/~ckulesa/camp/spectroscopy_intro.html)  (This looks at spectroscopy in astronomy).  [Nuclear magnetic resonance spectroscopy](http://teaching.shu.ac.uk/hwb/chemistry/tutorials/molspec/nmr1.htm) (NMR)  [The mass spectrometer](http://www.chemguide.co.uk/analysis/masspec/howitworks.html) |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | D1:  Explain how spectra can provide specific information about structure of compounds. | Tutor observation of research.  Written work (**P2, M1, D1).**  Research.  Spelling and scientific nomenclature for written work. | 4 | Learner led research into the interpretation of spectroscopic spectra.  This could include how this information is used in medical commercial or industrial applications.  [Understanding Chemistry - Nuclear Magnetic Resonance Menu](http://www.chemguide.co.uk/analysis/nmrmenu.html)  [Interpreting an Infra-red Spectrum](http://www.chemguide.co.uk/analysis/ir/interpret.html)  [Infra-red spectroscopy menu](http://www.chemguide.co.uk/analysis/irmenu.html)  [UV-visible specstroscopy menu](http://www.chemguide.co.uk/analysis/uvvisiblemenu.html)  Independent research and work. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | P3:  Identify **one** group of compounds with a commercial or industrial use and outline their structure. | Tutor observation of written work (**P3**).  Research.  Spelling and scientific nomenclature for written work. | 5 | Learner led activity to select a group of compounds used commercially or industrially.  Give an outline of their structure and how they are used.  [docbrown.info/uses.htm](http://www.docbrown.info/uses.htm) |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | M2:  For **two** different kinds of compound, provide:   * structure * skeletal formulas * functional groups.   Use correct nomenclature and scientific terminology throughout. | Written work (**P3, M2).**  Research.  Spelling and scientific nomenclature for written work. | 6 | Learner led progression of P3, showing full structures, formulas and functional groups for **two different** kinds of compounds.  [docbrown.info/uses.htm](http://www.docbrown.info/uses.htm)  Independent research and work. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | D2:  Explain why the structure and/or functional groups of a group of compounds make them suitable for use in medical, commercial or industrial applications. | Written work (**D2**).  Research.  Spelling and scientific nomenclature for written work. | 7 | Learner led research into the structure, function and uses of compounds and functional groups.  Taking the basic information from Week 1 and expanding the information on organic compounds and their functional groups on the uses these compounds have.  eg alcohols (-OH) used as fuel, solvents etc.  Independent research and work |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | P4:  Outline the different types of isomerism including suitable examples of each. | Written work (**P4**).  Research.  Spelling and scientific nomenclature for written work. | 8 | Teacher led [introduction to isomerism](http://www.chemguide.co.uk/basicorg/isomermenu.html); structural, geometric and optical. This can also be illustrated using molecular models.  Learner led activity to outline all the different types of isomerism and give examples of each. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | M3:  Explain the different types of isomerism with detailed examples linked to discussions of shapes and molecular geometry. | Written work (**P4, M3).**  Research.  Spelling and scientific nomenclature for written work. | 9 | Tutor led discussion on shapes and molecular geometry of isomers.  [Types of isomerism in organic chemistry](http://www.compoundchem.com/2014/05/22/typesofisomerism/)  Learner led extension to P4, this is an explanation of all the different types of isomerism with detailed examples. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | P5:  Provide one example of a compound with isomers that have biochemical activity, identifying the actions. | Tutor observation of discussion.  Written work (**P5**).  Oral communication during discussion.  Written communication for report. | 10 | Tutor led introduction to biochemistry and recap of isomers. Discussion on compounds that are part of biochemical pathways that have isomers e.g. constitutional isomers glucose/fructose/galactose.  [Types of isomer](http://www.chem.ucalgary.ca/courses/351/Carey5th/Ch07/ch7-1.html)  Learner led work giving one example of an isomer that has biochemical activity. |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | M4:  Explain the importance of stereoisomerism in biochemical systems. Provide one example of a compound with specific uses, effects or actions. | Written work (**P5, M4).**  Research.  Spelling and scientific nomenclature for written work. | 11 | Learner led research into the importance of the shape of compounds that determines their use/efficiency eg. ibuprofen, starch, amino acids etc.  [Biological importance of stereochemistry](http://www.chemhelper.com/biostereo.html) |
| **PO1**:  Identify molecular structure, functional groups and isomerism. | D3:  Provide a detailed account of one compound which is biologically active, explaining the benefits and/or detrimental effects of its isomers in medical, commercial or industrial applications. | Written work (**P4, M3, D3).**  Research.  Spelling and scientific nomenclature for written work. | 12 | Learner led progression of **P4** and **M3** to give a detailed account of **one** biologically active compound. This includes the benefits and/or detrimental effects in medical, commercial or industrial applications.  Medical application could be isomers of Insulin.  Commercial applications be isomers of aspirin.  Industrial applications could be ethylene, butane, xylene, toluene etc. |

PO2 Understand reactions of functional groups

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| **Specification content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO2**:  Understand reactions of functional groups. | P6:  Provide examples of the reactions of **five** functional groups, stating:   * reagents * conditions * observations   and providing equations and explanations of the changes that occur to the functional groups. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Plenary of results.  Practical skills and health and safety.  Recording data.  Writing up report using correct scientific terminology. | 13 | Tutor led introduction to the procedure for experiments to illustrate reactions of **five** functional groups.  Learners to produce risk assessments for each experiment. Carry out practical work, adhering to the procedure and the risk assessment. Write up a report for the experiments including all the requirements of **P6.**  [Alkanes](http://chemstuff.co.uk/unit-2/functional-groups/alkanes/)  [Alcohols](http://www.nuffieldfoundation.org/practical-chemistry/oxidation-alcohols)  [Aldehydes and ketones](http://academics.wellesley.edu/Chemistry/chem211lab/Orgo_Lab_Manual/Appendix/ClassificationTests/aldehyde_ketone.html)  [Carboxylic acid](http://swc2.hccs.edu/pahlavan/2425L8.pdf)  [Esters](http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch20reactionsesters.html) |
| **PO2**:  Understand reactions of functional groups. | P6:  Provide examples of the reactions of **five** functional groups, stating:   * reagents * conditions * observations   and providing equations and explanations of the changes that occur to the functional groups. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Plenary of results.  Written work (**P6**).  Practical skills and health and safety.  Recording data.  Writing up report using correct scientific terminology. | 14 | Continuation of practical work from previous week. Risk assessments from previous week still apply.  Learners to carry out practical tasks and to write up a report for the experiments including all the requirements of **P6.**  **Learners work independently and adhere to the risk assessment.** |
| **PO2**:  Understand reactions of functional groups. | M5:  Explain how **two** of the reactions may be used as qualitative tests for functional groups. | Written report covering **P6, M5.**  Spellings and grammar used in report.  Ability to work unsupervised.  Research skills. | 15 | Learner led activity to select two of the tests carried out for PO2 and explain how they used to determine the presence of a specific functional group.  Independent working. |

PO3 Prepare organic compounds

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| **Specification content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO3**:  Prepare organic compounds. | P7:  Describe the standard preparative and purification techniques used in organic chemistry, with **one** example of a preparation that uses each type of technique. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Written work (**P7).**  Practical work and health and safety.  Following instructions. | 16 | Tutor led introduction into the techniques used in organic chemistry to prepare and purify compounds eg distillation, sublimation and crystallisation.  Give an example of how each of the techniques is used.  Group to prepare a risk assessment for each of the experiments.  This could be carried out as a series of demonstrations or a circus of experiments.  [Separation and purification techniques](http://www.slideshare.net/sureshselvaraj108/seperation-and-purification-techniques) |
| **PO3**:  Prepare organic compounds. | P7:  Describe the standard preparative and purification techniques used in organic chemistry, with one example of a preparation that uses each type of technique.  P8:  Carry out risk assessments and use standard procedures to prepare **two** different types of organic compounds. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Written work (**P7, P8).**  Practical work and health and safety.  Following instructions.  Spellings and grammar used in written work. | 17 | Tutor led introduction to the procedures for the preparation of organic compounds. Introducing learners to each technique to be used and risk assessments for each procedure **P8**.  Learners should become familiar with the procedures and the equipment before starting each experiment.  Learner led activity to describe each technique for **P7.**  [Aspirin](http://filestore.aqa.org.uk/subjects/AQA-2420-W-TRB-PSA16.PDF)  [Ethyl ethanoate](http://www.docbrown.info/page04/OilProducts10b.htm)  Independent working. |
| **PO3**:  Prepare organic compounds. | P8:  Carry out risk assessments and use standard procedures to prepare **two** different types of organic compounds. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Practical work and health and safety.  Following instructions. | 18 | Continuation of learner led activity to prepare organic compounds.  Learner led activity to take account of the full risk assessments for the preparations.  Learners should keep a log of equipment used, procedure and results for the final report.  Learners adhere to risk assessment. |
| **PO3**:  Prepare organic compounds. | P8:  Carry out risk assessments and use standard procedures to prepare **two** different types of organic compounds. | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Practical work and health and safety.  Following instructions. | 19 | Continuation of learner led activity to prepare organic compounds.  Learner to take account of the full risk assessments for the preparations.  Learners should keep a log of equipment used, procedure and each stage of the results for the final report.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible/accurate, and correct units used. |
| **PO3**:  Prepare organic compounds. | P8:  Carry out risk assessments and use standard procedures to prepare **two** different types of organic compounds. | Tutor observation of practical techniques.  Tutor observation of risk assessment.  Practical work and health and safety.  Following instructions. | 20 | Continuation of learner led activity to prepare organic compounds.  Learner to take account of the full risk assessments for the preparations.  Learners should keep a log of equipment used, procedure and each stage of the results for the final report.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible/accurate, and correct units used. |
| **PO3**:  Prepare organic compounds. | P9:  Calculate percentage yields for each compound made and carry out melting or boiling points to assess purity. | Tutor observation of calculations (**P9).**  Calculations of percentage yield. | 21 | Learner led continuation of the previous week. Learners will take samples of pure and impure chemicals and measure the boiling points and melting points, depending on the chemical.  The learner will calculate the [percentage yields](http://www.docbrown.info/page04/4_73calcs14other2a.htm) for each compound made.  Calculations carried out with no help from the tutor. |
| **PO3**:  Prepare organic compounds. | P9:  Calculate percentage yields for each compound made and carry out melting or boiling points to assess purity. | Tutor observation of calculations (**P9).**  Calculations of percentage yield. | 22 | Learner led continuation of the previous week. Learners will take samples of pure and impure chemicals and measure the boiling points and melting points, depending on the chemical.  The learner will calculate the [percentage yields](http://www.docbrown.info/page04/4_73calcs14other2a.htm) for each compound made.  Calculations carried out with no help from the tutor. |
| **PO3**:  Prepare organic compounds. | M6:  Describe how melting points and boiling points are measured and give a full description of the effects of impurities on their values. | Written work **(P9, M6).**  Calculations for percentage yield.  Written work for descriptions. | 23 | Calculations worked out from previous week used for **M6.**  [Melting point](http://www.chem.ucalgary.ca/courses/351/laboratory/meltingpoint.pdf)  There are many videos on You Tube showing the technique for measuring melting point e.g. – [Melting point determination](https://www.youtube.com/watch?v=T3HzRPKj1YE)  [You Tube showing the technique for measuring melting point.](https://www.youtube.com/watch?v=T3HzRPKj1YE) |
| **PO3**:  Prepare organic compounds. | M7:  Justify the choice of preparative methods including reference to yield, rate and purity or any other relevant factors. | Notes made in preparation for the written report including **P8, M7.**  Spelling and scientific nomenclature for written work.  Calculations for % yield, rate and purity. | 24 | Learner led activity to justify the methods used to prepare the compounds and show they produced the best yield, rate, purity and any other criteria they feel is relevant. Calculations made using the results from the experimental work carried out over the previous weeks.  This could include photographic evidence as well as written.  Learner led activity to start to write a report of the standard procedures **(P8**). |
| **PO3**:  Prepare organic compounds. | D4:  Compare the preparative methods used with those for the industrial/commercial synthesis of the compounds. | Research.  Notes for final report **(P8, M7, D4).**  Spelling and scientific nomenclature for written work.  Research. | 25 | Learner led written work to show the advantages and the disadvantages of the methods used for their experiments and those used for the preparation of the same compounds in industry.  [Aspirin](http://www.madehow.com/Volume-1/Aspirin.html)  [Ethyl ethanoate](http://www.eurochemengineering.com/Innovation-in-the-production-of-acetic-acid-and-ethyl-acetate.aspx) |
| **PO3**:  Prepare organic compounds. | M8:  Compare the differences between researched literature values and experimental values for   * melting and boiling points * yield obtained. | Tutor observation of research.  Notes for **P9, M8.**  Calculations.  Research. | 26 | Learner led activity, using research to compare their own results with those results found in the literature.  Learners should comment on the comparison and work out the theoretical yield.  [Melting point](http://www.ehow.com/how_6593146_compare-point-based-compound-structure.html)  [Boiling point](http://www.masterorganicchemistry.com/2010/10/25/3-trends-that-affect-boiling-points/)  [Theoretical yield](http://chemistry.about.com/od/workedchemistryproblems/a/How-To-Calculate-Theoretical-Yield-Of-A-Chemical-Reaction.htm) |
| **PO3**:  Prepare organic compounds. | D5:  For **one** of the compounds prepared/extracted, choose a suitable spectroscopic technique and provide a detailed explanation of how it is used to assess purity and characterise the compound. | Research notes for **D5.**  Written notes, spelling and grammar.  Independent research. | 27 | Learner led research into the identification of **one** of the compounds prepared in the previous experiments. Learners are required to select a **spectroscopic** technique and give details of how it is used to identify and assess the purity of the chosen compound.  This could also include any commercial or industrial applications of this technique.  Independent working |
| **PO3**:  Prepare organic compounds. | P10:  Produce a report on each preparation, describing the methodology, equipment used and outcomes for each. | Written report (**P8, P9, P10, M7, M8, M9, D4, D5, D6).**  Calculations for percentage yield.  Spelling, grammar and scientific nomenclature in reports.  Independent working. | 28 | Learner led written reports for the preparation of two different types of organic compounds. This could be carried out as **two** separate reports.  The report could take the following structure:   * aim * hypothesis * apparatus * method * results * conclusion * evaluation * references.   Report could include photographic evidence and witness testimonies.  [Report writing](http://unilearning.uow.edu.au/report/2b.html)  Independent working. |
| **PO3**:  Prepare organic compounds. | M9:  Draw conclusions which are linked to the yields obtained and levels of purity achieved for each organic compound. | Written report (**P8, P9, P10, M7, M8, M9, D4, D5, D6).**  Calculations for percentage yield.  Spelling, grammar and scientific nomenclature in reports.  Independent working. | 29 | Learner led continuation of the report from the previous week. Learners to make conclusions and link these to the yields obtained and the purity they achieved for their compounds.  Independent working. |
| **PO3**:  Prepare organic compounds. | D6:  Suggest improvements to increase the yield and purity of the compounds. | Written report **(P8, P9, P10, M7, M8, M9, D4, D5, D6).**  Calculations for percentage yield.  Spelling, grammar and scientific nomenclature in reports.  Independent working. | 30 | Learner led continuation of the report from the previous week. Learners are to give their ideas for any improvements that could be made to the experiment to increase yield and purity. Are there any other improvements that could be made?  Independent working. |