**Topic 3: Organic and Biological Chemistry**

Part1: Subtopics 3.1-3.6

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**Table of Contents**

[Context](#_3q5rljvh2soa)

[Unit Overview](#_bo8qmbuv9vs5)

[Investigations (Pracs)](#_nyx8sdc63abn)

[Week 1](#_nuh92i6cq8vq)

[Week 2](#_bedk8f3te7mp)

[Week 3](#_s88ti7x64zq1)

[Lesson Plans](#_6d009toaxzz2)

[Week 1](#_uyuvzheh3big)

[Week 2](#_jtoams2orkt5)

[Week 3](#_4a8gto6xidf)

[Week 4](#_5z35b0q43yj1)

[Additional Resources:](#_l98s9f2lsg1j)

[VisChem](#_qu3v9b46ib57)

[Resources I Made](#_yu36j6b8t5nj)

[Revision/ Extension Material](#_14ypba6ddcev)

[Worksheets](#_l4vk69w082e8)

[Alignment to SACE Subject Outlines.](#_uruycmaamnxo)

[Week 1](#_lkjn05kehvjz)

[Week 2](#_cjub2g34jrgf)

[Week 3](#_g2j9ejteu305)

[TODO List](#_tzddja7vuag4)

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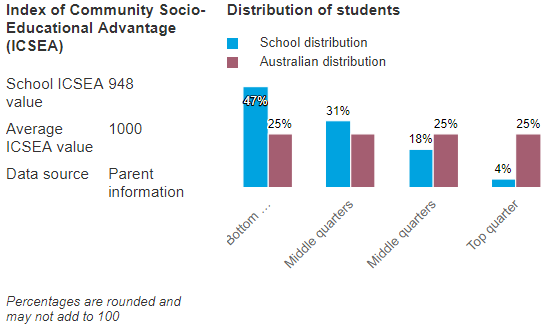
# Context

For my context I chose Valley View Secondary School (<http://www.valleyview.sa.edu.au/>), as I am tutoring a year 10 student there right now so I have a little more information on how the school is run currently (finding information from websites alone was tough!). That being said, there was a bunch of useful information on their website, including their core values (respect, integrity, optimism, responsibility, support), their vision statement, and their code of practice. There was also a 2016 context statement (included in folio folder), which had a few interesting quotes:

* “Students come from a diverse range of cultural and socio-economic backgrounds providing a student population that is rich in world experiences”
* “Valley View Secondary School is a lead school in the Advanced Technology Project (ATP) with links to the School of Computer Science, Engineering and Mathematics at Flinders University and Materials Science Research at UniSA.”
* Valley View is classified federally as having a high level of disadvantage, there is considerable diversity amongst the student population. Approximately 22% of students are from a Non-English Speaking Background (NESB). In excess of 20 languages are spoken by students and their families. Approximately 42% are School Card Holders. 37 students have a Negotiated Curriculum Plan and 19 students identify themselves as Aboriginal.

A bunch of statistics where also available from the myschool.edu.au site, which disagreed with the school context statement on a number of points… but I’m assuming that is because the school context statement is from 2016 and the myschool.edu.au stats are more up-to-date:

* 25 Teaching Staff (20 FTE teaching staff).
* 281 students, (141 boys, 140 girls).
* 7% of students identify as indigenous or torrens strait islander.
* 6% of students have a language background other than english.
* Socio-Educational Advantage demographic as shown below:



In summary, Valley View High is a diverse and challenging school in which significant proportion of students are likely to be struggling either financially, culturally, or linguistically. It is also a school with a notable and successful Science and Maths program. In order to tailor for this I attempted to design a unit plan that was flexible, leaving extra time at towards the end of the 4-week period to allow for additional time (and alternative approaches) to be spent (provided) on whichever topics turn out to be problematic for the students. Because the school is so challenging in so many different aspects, I feel like it is important to have a flexible design that allows for the teacher to adapt to the difficulties of the particular class, which could be very different from class to class. I expect if I were to teach this same unit to two classes of students at Valley View in parallel, I would likely end up teaching it very differently, with each class spending time and focusing on different aspects.

**ICT:** The school has institutes a laptop program, providing a substantial subsidy so that every student from year 10 onwards can have a laptop on which to do their school work. This allows for me to use ICT in ways that require the students to have access to an internet-enabled device in the knowledge that no student will be disadvantaged by me doing this.

**Class Schedule:** In terms of timing, Stage 2 chemistry will be taught with two regular classes, and one (slightly longer) laboratory prac per week. Hence, I have tailored my timing to fit into this weekly routine, with my expectation being that it should take about two classes and a prac to cover the material in each week-long chunk of material described below..

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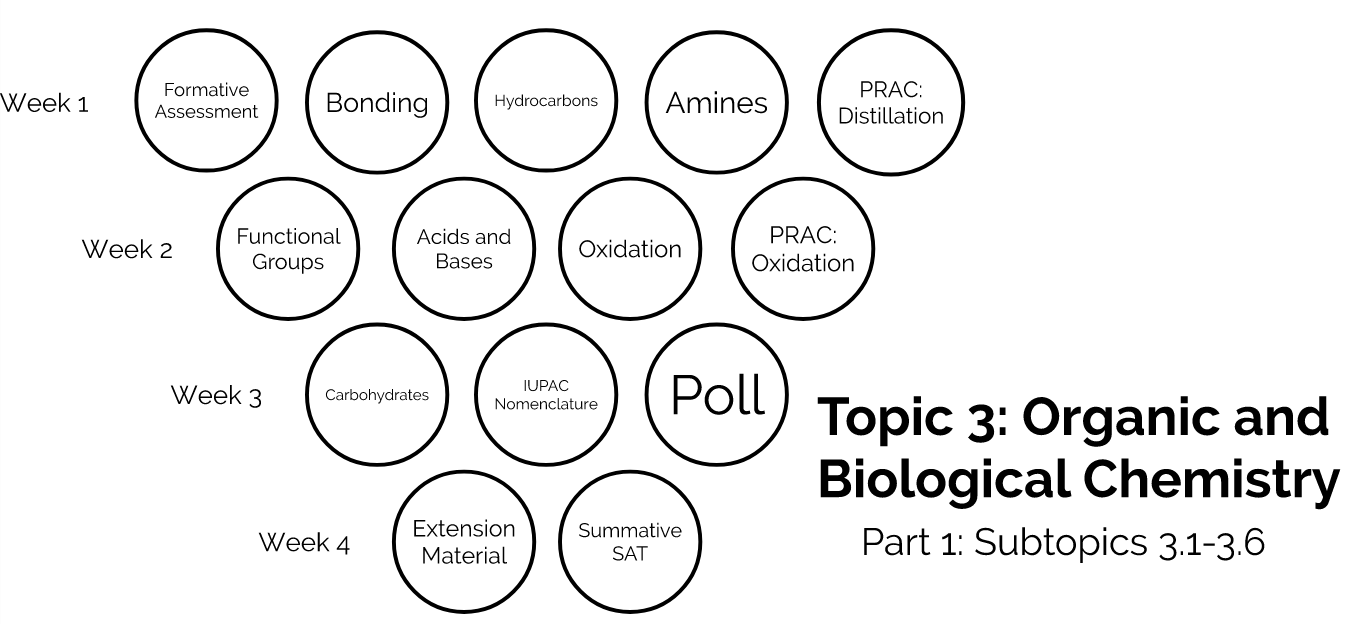
# Unit Overview

**Summary:** After having been introduced to simple alkanes and alkenes in Stage 1 Chemistry, this unit serves as an introduction to organic chemistry proper, starting with amines alcohols, aldehydes, ketones, carboxylic acids, and finally carbohydrates. There is a focus on systematic naming of organic compounds, and the physical and chemical properties of these functional groups. Carbohydrates offer a good avenue into SHE tasks, while classical organic chemistry provides a good backdrop for SIS tasks through laboratory and analytic/ critical thinking skills.

**Organisation:** I have organised my material in such a way that the primary resource is a single prezi, which contains material across the entire unit. The prezi contains much of the teaching resources, but not all. It is intended to serve as a prompt for when the other material is appropriate to be brought it, and includes in multiple places reminders to show a certain resource (such as a VisChem animation, etc.). The prezi, broadly speaking, is intended to contain concise summaries of each concept that can facilitate short (5-10min) periods of direct instruction, interrupted by exercises, interactive discussions, and other activities. This should also allow for the students to use the prezi itself as a summary of the material which they can use for revision purposes, etc. This prezi is available via the following link:

<https://prezi.com/view/xgYTeGVWG4WSMVQpqesk/>

The organisational structure of this prezi reflects the organisation structure of the unit, and is shown below:



**Timing:** As you can see from this outline, the material is organised into roughly week-length chunks of material, with the assumption being that revision of Stage 1 material should go more quickly, while more time should be spent on new and difficult topics, such as carbohydrates. There are numerous opportunities throughout for extension material to be discussed, but the expectation is that these do not need to be discussed, and they should only be explored if time permits, and it is in the teachers evaluation that the students would be interested in the extension material.

The intention of having all the material organised in one presentation like this is that it should allow greater flexibility in timing. If the formative assessment at the beginning of week 1 shows the students are totally on top of all the Stage 1 topics, they can be skipped, and “week 2” material could easily get started in week 1, etc. Similarly the suggested timing is very flexible about week 4, so if the material is taking longer to get through than expected, it could spill over into those lessons. The intention is that if you get through the material roughly on schedule, the poll at the end of week 3 can allow the class to decide how they want to spend the time in week 4 leading up to the SAT.

There is a lot of material scheduled for week 1 for example, but the majority of it is revision from stage 1. In contrast, there is comparatively little content in weeks 2 and 3, but it is mostly new Stage 2 material, and there is a lot of potential for discussion to develop around applications and relevance: biology implications, drug design and distribution, the petroleum industry, etc. Exploring the SHE aspect and understanding the content from different perspectives, essentially. I am hoping that the exact timing of the delivery of this material can be tuned to the particular cohort of students preferences and needs on the basis of the formative assessment in week 1, and from ongoing formative assessments in the form of open discussions with the class and quizzes through online tools such as mentimeter, poll everywhere, or similar tools.

**Note on Topic Sequence:** I don’t like how organic chemistry got split into subtopics, if it was up to me, I would teach it in the sequence alcohols then aldehydes/ ketones, then carboxylic acids (as I have laid out) and then I would cover Esters and polyesters as examples of polymers, before moving onto carbohydrates, because the esterification reaction is a nice way to think about/ compare to the reactions that occur with carbohydrates (both the ring/chain form transformation and the formation of larger polymers by condensation). Essentially I would group together all the Oxygen-based functional group topics together. Then I would group together all the Nitrogen-based functional group topics together, so Amines, Amides, and then Proteins (Amino Acids). As the only Nitrogen-based subtopic I got was amines, I just put it in the beginning with the nomenclature and solubility section, because that’s the only part it connected too (obviously solubility of drugs etc. motivates the solubility aspect of Amine chemistry but it doesn’t connect to any of the other subtopics otherwise. In practice if I was teaching the whole Organic Chemistry Topic I wouldn’t put it there, I would put it with all the Nitrogen-based chemistry later on.

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# Investigations (Pracs)

So I had an idea I liked for the pracs for this unit, but it is not yet fully fleshed out yet --- I guess I might get a chance to do that in the intensive in term 2? Anyway, I figured I would just lay out what my idea was here. The basic premise is that in week 1, the students would be presented with a bunch of flasks labelled only with “A, 100mL”, “B, 100mL”, etc. or something of the like, and told that they would do a few experiments involving these same liquids, and that by the end of the unit they would be expected to figure out (or make an educated guess), about what they started off as. They would all contain (probably) colourless liquids, of unknown composition --- although now that I write the colourless part down it makes me want to include some coloured solutions just to throw a curveball, something to keep in mind, anyway. I would have the actual compositions written down somewhere, of course --- they would all be different though, and what exactly would be in them might depend on what I can get a hold of, etc. There might also be safety standards and such which might limit the options. Most of the liquids would be mixtures, but I would have at least a couple of pure compounds just to keep them guessing. I might even have them separated into “difficulties”, with a “hard” difficulty including some mixtures of more than two liquids, or with some aqueous solids dissolved in solution that would leave a residue after distillation. This way any advanced students who might otherwise get bored would have something to challenge them. Could even make it some kind of class-based challenge: If you all work together and correctly identify these liquids, I could come up with some kind of reward, maybe an excursion or an early day off school or something else they might like to negotiate for. I would promise them that (of course) any of the non-”hard” solution would only include compounds covered in this topic --- water, alcohols, aldehydes, ketones, carboxylic acids. I probably wouldn’t include carbohydrates because they would burn in the distillation, and I probably wouldn’t be so mean as to include anything like glycerin or compounds with multiple functional groups of different types, at least not in the non-”hard” category.

## Week 1

They would pair up, or get into bigger groups depending on the availability of equipment, and each would distill a different unknown solution, carefully recording the temperature gradient over time, and collecting the distillate into separate aliquots of their choosing. They would then make a guess about if their solution was pure or a mixture, and give approximate ranges for what they think the boiling points of the components of the mixture would be. Careful labelling and bookkeeping would be needed to keep track of everything from week to week. To deal with volatility and flammability I might get them to use a water bath for heating initially instead of a flame. Really depends on the liquids I give them to distill.

## Week 2

They would take a small sample of each of their aliquots from week 1, carefully labelling which is which and so on, and they would expose them to acidified dichromate to test for a colour change, and record their observations. I would also try and facilitate any other experiments they suggest (within reason) to try and get more information on their compounds. Could try doing some AAS or something if they suspect halogens or something weird like that in the “hard” solutions.

## Week 3

I would get them to share all their results with the entire class and then together try to reach some consensus about trends in boiling point amongst groups of compounds of similar properties: for example, identify the alcohols and aldehydes by their reaction with dichromate, and then rank them by boiling point to get a ranking of their carbon chain length. Something along those lines. With information I gave them like “there are no carbon chains longer than 8” or something like that, and using the internet to find out the boiling points of various common alcohols and such they could make some educated guesses about the identity or at least narrow in on the identities of the compounds they have isolated.

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# Lesson Plans

Due to the deliberately flexible nature of the timing in the design of this unit, I’ve made a lesson plan (adopting the *Learning Design* model) for each roughly week-long chunk of material. As such, it is expected it would take roughly two lessons and one prac to get through each one of these lesson plans, but they could go faster, or slower, depending on the students interests and capabilities.

## Week 1

This plan should start with a formative assessment task designed to assess the students current knowledge and confidence, and this should be used to inform how quickly/ in how much detail to go through the revision material.

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| Learning Resources | Learning Activities | Learning Supports |
| 1. Prezi 2. Worksheets on valence electrons and electron-dot diagrams. 3. VisChem Animated Examples of Ionic, Covalent, and Metallic Bonding. 4. Website with explanation of dispersion forces: <https://www.chem.purdue.edu/gchelp/liquids/disperse.html> 5. VisChem Animated Examples of Melting Boiling, and ionic compounds Dissolving and Precipitating, and associated worksheets. 6. Video explaining different kinds of structural formulae: <https://www.youtube.com/watch?v=LW6T-TvKqvM> 7. VisChem Animation of Ammonia reacting with water as a base. 8. PRAC: Distillation | Primary and secondary bonds are revised from Stage 1, and students are  introduced to the idea of thinking about bonds in terms of electron density being shared between atoms to varying degrees, which also helps explain both dispersion forces and dipoles (1, 2, 3, 4).  The relationship between the strength of secondary interactions and physical properties such as melting and boiling point is explained by analogy to magnets --- “how much to molecules want to stick together” --- and through animated examples (1, 5).  Following on from secondary interactions, how this relates to two different compounds interacting: two polar compounds will interact strongly, and two non-polar compounds will too as they can form the same kinds of secondary interactions, but polar and non-polar compounds don’t mix well. Lead this into solubility (1, 5).  Students are introduced to common concepts around different representations of molecules (formulae, structure) (1, 6).  The group constructs a name for a fictional character (eg. “Sir George Washington The Brave”) and this is used to introduce the systematic naming concepts of prefix, “first name”, “last name”, and “suffix”, which will be used throughout to refer back too when explaining the naming of different organic compounds (1).  Amines are introduced, including their naming, and their behaviour in water is explored through an animation (1, 7).  Distillation investigation is used to demonstrate the different physical properties (boiling point) of organic compounds. | Face to face explanation (1).  Individual and self-guided revision(2, 4).  Guided/ peer/ individual exploration (3).  Analogy (1).  Guided/ peer/ individual exploration (5).  Face to face explanation (1).  Group exploration through videos (5)  Individual questions through worksheets (5)  Face to face explanation (1).  Additional independent revision (6)  Group construction  Face to face explanation  Peer exploration  Group Investigation |

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| Intended Learning Outcomes |
| * Revise (understand) Primary Interactions (bonding): Ionic, Covalent, Metallic. * Revise (understand) Secondary Interactions: Dispersion Forces, Dipole-Dipole Interactions, etc. * Predict the relative physical properties (higher/ lower boiling point, more/less soluble) of compounds based on their structure. * Draw extended or condensed structures for a compound given it’s skeletal structure. * Determine the molecular or empirical formula given a molecules structural formulae. * Systematically name simple hydrocarbons. * Classify amines as primary, secondary, or tertiary. * Systematically name amines. * Draw structural formula for amines given their systematic name. * Draw the structure of the protonated form of an amine given, its original neutral structure.   Note: these intended learning outcomes are broad and approximate, intended to give a general concept of the ideas taught. For a more precise alignment of the organisation of this unit to the SACE subject outlines science understanding topics, subtopics, and concepts therein see the attached file “Alignment to SACE”. |

## Week 2

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| --- | --- | --- |
| Learning Resources | Learning Activities | Learning Supports |
| 1. Prezi 2. VisChem Video on Acids and Bases, with associated worksheets. 3. Tyler DeWitt Video on oxidation state (number), <https://youtu.be/-a2ckxhfDjQ> 4. VisChem Video on Oxidation with associated worksheets. 5. PRAC: Oxidation. | Alcohols, Aldehydes, Ketones, and Carboxylic Acids are introduced including their structure and naming (1)  Concepts surrounding acids and bases are revised from Stage 1, including exploration through a VisChem Video and associated exercises (1, 2).  Concepts surrounding oxidation from Stage 1 are revised, including oxidation as loss of electrons, calculating oxidation state, and exploration through a VisChem Video (1, 4).  How alcohols and aldehydes oxidise, and ketones and carboxylic acids don’t, is introduced (1).  Exercise in which students are asked to calculate the oxidation state of the carbon in a primary alcohol, an aldehyde, and a carboxylic acid in order to show why these reactions with dichromate are called “oxidation” reactions (1).  Students can revise calculation of oxidation state if they need (3).  Silver nitrate, Tollens’ reagent, and acidified dichromate are introduced, and their behaviour is discovered through experimentation by reacting them with various organic compounds (1, 5). | Face to face explanation (1).  Face to face explanation (1).  Peer and group exploration (2).  Face to face explanation (1).  Peer and group exploration (4).  Face to face explanation (1).  Individual/ group exploration, with face to face guidance (1).  Self-directed revision (3).  Face to face explanation (1).  Guided and group discovery via investigation (5) |

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| Intended Learning Outcomes |
| * Revise (understand) acids and bases as ionisation, hydronium and hydroxide ions, as well as neutralisation reactions and the acidity of various oxides. * Revise (understand) oxidation as loss of electrons, oxidation state, the oxidation of alcohols and aldehydes, as well as their reactions with acidified dichromate and Tollens’ reagent. * Systematically name alcohols, aldehydes, ketones, and carboxylic acids given their structure, and given their systematic name draw their structure. * Classify alcohols as primary, secondary, or tertiary. * Predict the product of a reaction between an alcohol aldehyde ketone or carboxylic acid with acidified dichromate. * Predict the product of oxidation of an aldehyde under acidic vs. alkaline conditions.   Note: these intended learning outcomes are broad and approximate, intended to give a general concept of the ideas taught. For a more precise alignment of the organisation of this unit to the SACE subject outlines science understanding topics, subtopics, and concepts therein see the attached file “Alignment to SACE”. |

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## Week 3

|  |  |  |
| --- | --- | --- |
| Learning Resources | Learning Activities | Learning Supports |
| 1. Prezi 2. Nomenclature Worksheets (NEED TO TIDY THESE UP) 3. PRAC: Collate Data and Analysis. | Revision of polymers and condensation/ hydrolysis reactions.  Introduction to monosaccharides, disaccharides, polysaccharides, and carbohydrates in general, with specific examples of glucose, maltose, and cellulose.  Review of systematic naming of organic compounds (all compounds covered in the unit) (1, 2).  Analysis of trends in physical properties and reactivity of different organic compounds, as well as critical analysis of unknown samples through analysis prac. | Face to face explanation (1).  Face to face explanation (1).  Group construction (1)  Individual self-assessment (2).  Critical analysis, individual/ peer collaboration |

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| Intended Learning Outcomes |
| * Calculate the molecular formula of glucose, disaccharides, and polysaccharides made of glucose units. * Draw the structures of the individual monosaccharide units produced from the hydrolysis of a disaccharide given its structure. * Identify the repeating unit given the structure for a section of a long polysaccharide. * Given the systematic name for any of the compounds covered in this unit, be able to draw the structure, and given the structure be able to name it systematically.   Note: these intended learning outcomes are broad and approximate, intended to give a general concept of the ideas taught. For a more precise alignment of the organisation of this unit to the SACE subject outlines science understanding topics, subtopics, and concepts therein see the attached file “Alignment to SACE”. |

If the material has all been covered at this point, poll the students to find out what they would like to do in week 4, 2 options:

* Get the SAT over and done with on Monday, have Wednesdays class off.
* Do the SAT on Wednesday so the students have two extra days to prepare for it, and have an optional class in Monday’s lesson doing revision and answering questions/ going back over sections of the topic.

I had a really cute idea that you could get each student to add a shotglass of clear liquid into a beaker at the end of the class as it would be a class in the lab (at the end of the week), and have water be a vote for one outcome, and an organic compound (acetone, ethanol, hexane?) be a vote for the other, and then determine the outcome of the vote by measuring the specific gravity of the mixture, or if they are immiscible maybe even by eye. :)

If the students are particularly keen, I would also add the following options to the table (via discussion with them):

* Get the SAT over and done with on Monday, get started on the next topic on Wednesday.
* Do the SAT on Wednesday so the students have two extra days to prepare for it, but get started on the next topic on Monday.

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## Week 4

SAT and Revision or New Topic depending on results of Poll at the end of week 3.

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# Additional Resources:

There are alot of additional resources. A big part of the purpose of the prezi is to link them all in their appropriate context --- providing a single huge list doesn’t seem… useful. So I’ll just summarise some of the major categories of resources.

## VisChem

Have a series of educational chemistry videos from the early 1990’s. They are dated, but I feel like that gives them a certain charm --- they are high quality, and accurate representations of molecular interactions in 3D. There are alot of video resources out there, but I like using VisChem because their videos are all consistent to each other (use the same colours for the same elements and such), and they cover alot of the topics I wanted to talk about. I have a folder with only the selection of vischem animations and videos that I thought would be useful for this unit under resources, although there are alot more available from their website http://www.vischem.com.au/online-resources, although they ask you to log in through scootle to access them. Some of their videos and animations also have associated worksheets or video scripts that I thought might be useful, and these are embedded in the prezi, but are also available in the resources folder under vischem\_worksheets. I made a file where I compiled short summaries of all the VisChem modules, this is available under resources as well, as I used this to help me organise which VisChem modules would be helpful for which topics and I figured it might be useful for you to have as well if you ever wanted to use those resources in another context, or wanted to add more animations to this unit, etc.

## Resources I Made

I looked at alot of resources and ended up deciding that I wasn’t happy with them alot of the time, and made them from scratch myself. Ultimately the biggest resource is one I made myself which is the prezi, and I wrote all the text for the prezi myself. There are many molecular structures and figures in the prezi, some of which are from the internet, but many of which I just made myself. All the images included in the prezi are also available under the resources folder under images, in which there is a text file “sources.txt” which lists the origin of all images that I didn’t produce myself, just in case you ever need to track it down for some reason.

I also wasn’t happy with any of the IUPAC nomenclature worksheets I found lying around on the internet, so I made some of my own from scratch, but to be honest I’m not super happy with the ones I made either, so I sorta wasted a bunch of my time on that... but they are still available under resources, and also in the prezi.

## Revision/ Extension Material

I referenced a number of resources, mostly videos and websites, as either revision materials that could potentially provide students with resources they can check out to help them if they are struggling to keep up or to understand a particular concept and get another perspective/ alternative explanation of it and review material again in their own time if they are trying to catch up, or provide some extension beyond the scope of the course if they are interested and curious and want to learn more. Extension materials are not included in the lesson plans as I’m not planning on using them, but rather they are there for the students who are doing well and are interested. This could also be used as a behaviour management tool --- if some students are struggling and needing to go through the material more slowly, but others are on top of it they might get bored with the pace of the class and become disruptive, having extension materials on hand to give those students can be a step towards preventing that from happening.

* Different types of structural formulae: <https://youtu.be/LW6T-TvKqvM>
* Oxidation state (number): <https://youtu.be/-a2ckxhfDjQ>
* Carbohydrate Extension Material: Armando, <https://youtu.be/JxK5rZxbyQY>, and Dave, <https://youtu.be/wFYsufJ9XMM>, go beyond the scope of year 12 chemistry in explaining the biochemistry of carbohydrates in a little more detail.
* Explanation of Dispersion Forces: <https://www.chem.purdue.edu/gchelp/liquids/disperse.html>
* IUPAC Nomenclature wiki page:  
  <https://en.wikipedia.org/wiki/IUPAC_nomenclature_of_organic_chemistry>

## Worksheets

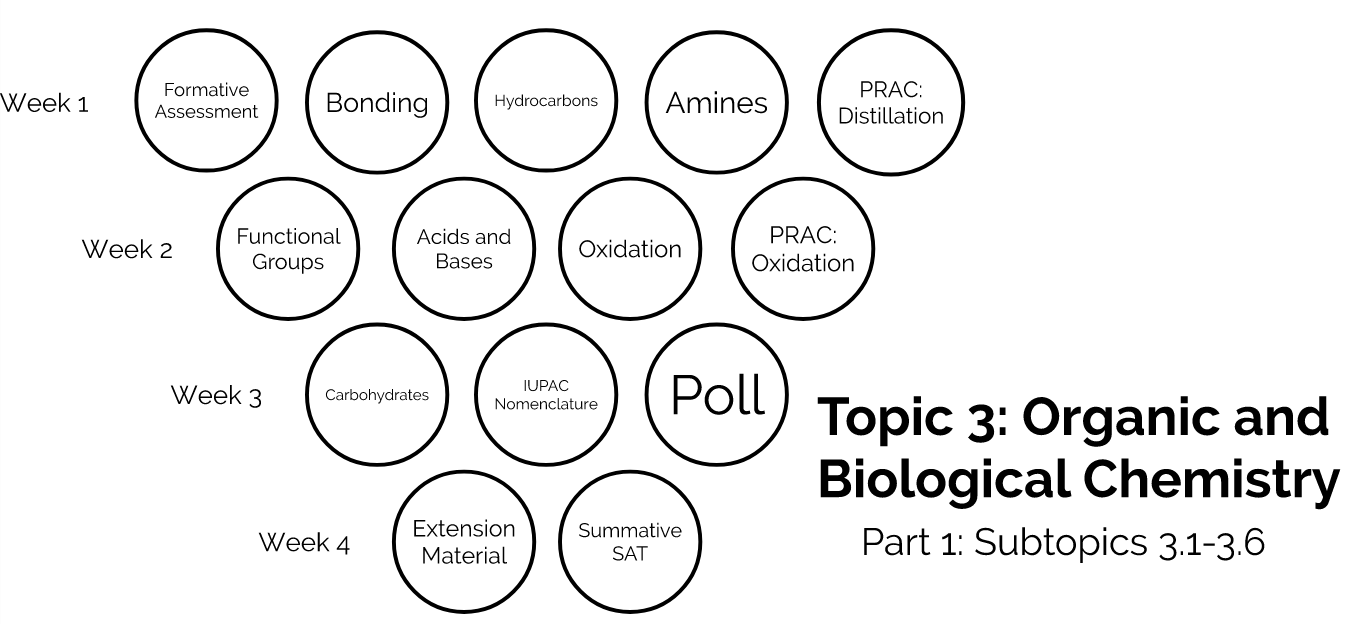
There were also a number of worksheets I found on the internet that I was somewhat happy with, and these are included under resources as well, and include worksheets on valence electrons and electron-dot representations, VisChem worksheets to follow their videos, and IUPAC nomenclature worksheets I made myself.

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# Alignment to SACE Subject Outlines.

This unit covers Stage 2 Chemistry SACE subtopics 3.1-3.6, and includes revision of parts of Stage 1 Chemistry SACE subtopics:

* Subtopic 2.2: Bonding between atoms
* Subtopic 3.2: Interactions between molecules
* Subtopic 3.3: Hydrocarbons
* Subtopic 3.4: Polymers
* Subtopic 4.1: Miscibility and solutions
* Subtopic 4.2: Solutions of ionic substances
* Subtopic 5.2: Reactions of acids and bases
* Subtopic 6.1: Concepts of oxidation and reduction

The organisation of the prezi slides for this unit provides a structure to the unit, shown below. 

What follows is a list of all the specific SACE Science Understanding points introduced in this unit, organised using the structure of the prezi slides above.

## Week 1

**BONDING**

Stage 1 Subtopic 2.2: Bonding between atoms

* Valence-shell electron thinking in terms of bonds (electron-dot diagrams etc.)

Stage 1 Subtopic 3.2: Interactions between molecules

* Secondary interactions between molecules are much weaker than primary metallic, ionic, and covalent bonds inside molecules.
* The shape, polarity, and size of molecules can be used to explain and predict the strength of secondary interactions
* Dispersion forces exist between all molecules. Their strength depends on the size and shape of the molecules.
* Dipole-Dipole interactions exist between polar molecules and their strength depends on the polarity and size of the molecules.
* Hydrogen bonding is a particularly strong example of dipole-dipole interaction.

Stage 1 Subtopic 4.1: Miscibility and solutions

* Solvents can be considered polar or non-polar.
* Polar molecules are more soluble in polar solvents than non-polar molecules of a similar size.
* Small non-polar molecules are more soluble in water than large non-polar molecules.
* Predict, given structural formulae, which of two compounds would be more soluble in polar and non-polar solvents.
* Compounds with both non-polar and polar or ionic components facilitate the mixing of polar and non-polar compounds.

Stage 1 Subtopic 4.2: Solutions of ionic substances

* Ion-dipole interactions, dissociation and hydration of ions in water. Precipitation of non-soluble ionic substances.

Stage 2 Subtopic 3.1: Introduction:

* Predict/ explain/ compare the melting points/ boiling points/ solubilities of organic compounds given their structural formula in water and in non-polar solvents.

**HYDROCARBONS**

Stage 1 Subtopic 3.3: Hydrocarbons:

* Different Formulae for molecules  
   - Empirical  
   - Molecular  
   - Structural  
   - Extended  
   - Condensed  
   - Skeletal.
* Structural Isomers Exist.
* Systematic Naming identifies the structure.  
   - Up to 8 carbons in the main chain  
   - Side chains up to 2 carbons in length  
   - One or more Alkene groups.
* Organic Molecules are hydrocarbons optionally with additional functional groups.

Stage 2 Subtopic 3.1: Introduction:

* Determine the molecular formula given either the extended, condensed, or skeletal structural formula.

**AMINES**

Stage 2 Subtopic 3.6: Amines:

* Classify amines as primary secondary or tertiary
* Name primary amines systematically with one or more amino groups.
* Draw the protonated form of a given compound and explain why it is more soluble in water.

## Week 2

**Functional Groups**

Stage 2 Subtopic 3.2: Alcohols

Stage 2 Subtopic 3.3: Aldehydes and ketones

Stage 2 Subtopic 3.5: Carboxylic acids

* Define alcohols, aldehydes, ketones, and carboxylic acids.
* Systematically name alcohols, aldehydes, ketones, and carboxylic acids with one or more hydroxyl groups, one or more aldehyde or ketone groups, and one or two carboxyl groups.
* Classify alcohols as primary, secondary, or tertiary.

Stage 2 Subtopic 3.5: Carboxylic acids

* Carboxylic acids are weak acids, and react as such. Explain why Sodium/ Potasium carboxylate salts are more soluble in water than their parent carboxylic acids.

**Acids and Bases**

Stage 1 Subtopic 5.2: Reactions of acids and bases

* Non-metal oxides are often acidic in water while metal oxides are often basic.
* Identify products of neutralisation reactions.
* The strength of acids is explained by the degree of ionisation in aqueous solution.

**Oxidation**

Stage 1 Subtopic 6.1: Concepts of oxidation and reduction

* REDOX reactions can be defined in terms of combination with oxygen, transfer of electrons (OIL RIG), or change in oxidation number.
* Write redox half-equations
* Identify oxidation and reduction
* Determine the oxidation states of atoms in elements and monatomic ions and in compounds and polyatomic ions.

Stage 2 Subtopic 3.2: Alcohols

Stage 2 Subtopic 3.3: Aldehydes and ketones

* Predict the product of oxidation of an alcohol, and describe how primary and secondary alcohols can be distinguished by their reaction (or lack thereof) with acidified dichromate solution.
* Aldehydes oxidise easily, ketones don’t. Predict the product of oxidation of an aldehyde in either acidic or alkaline solutions (carboxylate ion or carboxylic acid). Describe how acidified dichromate solution and Tollens’ reagent (ammoniacal silver nitrate solution) can be used to distinguish between aldehydes and ketones.

## Week 3

**Carbohydrates.**

Stage 2 Subtopic 3.1: Introduction:

* Condensation reactions occur when two organic molecules combine to form a larger molecule, also releasing another small molecule such as water.

Stage 1 Subtopic 3.4: Polymers

* Polymers are macromolecules are very large molecules composed of small repeating structural units.

Stage 2 Subtopic 3.4: Carbohydrates

* Monosaccharides are “polyhyrdroxy aldehydes or polyhydroxy ketones”. Carbohydrates are either monosaccharides or polymers that can be broken down into monosaccharides by hydrolysis. Disaccharides are the two-unit polymers that can be made out of two monosaccharides by a condensation reaction.
* Know the molecular formula of glucose C6H12O6 and for disaccharides and polysaccharides made out of glucose monomers.
* Given the structural formula of a disaccharide, draw structural formulae for the monosaccharide units resulting from its hydrolysis.
* Identify the repeating unit and draw the structural formula of the monomer, given the structural formula of a section of a polysaccharide.
* In aqueous solution there is an equilibrium between a ring form and a chain form of glucose. Explain why glucose can react as an aldehyde when in chain form but not when in ring form.

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# TODO List

This was literally my TODO list as I was working on this. I quickly came to realise as I was working on this that for every point I took off the TODO list two more bigger ones popped up. So I thought it could be valuable to leave this here, partly so you can see what I thought wasn’t very good about this unit plan as it stands right now, and partly so that if anyone goes ahead and uses this material they have some suggestions on where to start improving on it. Similarly, so if I ever use this I know what I wanted to get done before I start teaching with it.

Unit Overview:

* Add more detail on the formative assessment task for week 1.
* Add more detail/ flesh out the poll for week 3.

Lessons:

* Once I’ve added more resources to weeks 2 and 3, videos, worksheets, etc. I need to update and flesh out the lesson plans therein.

Pracs:

* Organise more detailed descriptions of pracs, and incorporate these into the lesson plans/ prezi as well.

Prezi:

* Hydrocarbons:  
   - Formulae: Add more resources (videos on structural formulae, etc.)  
   - Add multiple side-chain and ethyl examples  
   - Format and add summary and worksheets to Further Revision.
* Amines:   
   - Add extension material: Naming secondary and tertiary amines  
   - Add more examples.
* Functional Groups:  
   - Add more examples to ketones and aldehydes.  
   - Add extension naming of more complicated carboxylic acids.  
   - Improve the section on carboxylic acid acidity.
* Acids and Bases:  
   - Flesh out slides to provide a more indepth review of Stage 1 material and add more pictures/ multimedia/ examples/ exercises.
* Oxidation:   
   - I could flesh out this section, and condense the explanations provided, to just overall improve the quality it could just use another pass.
* Carbohydrates:  
   - Define polymers as macromolecules composed of small repeating structural units.
* IUPAC Nomenclature:  
   - sort out/ organise worksheets better  
   - just generally flesh this topic out abit better, maybe structure a lesson plan around doing revision for this topic, or a task students can do in their own time built around the worksheets to revise for tests/ exams.
* Extension Material:   
   - Flesh out this section with more resources and such.
* Overall:   
   - Add more SHE/ application exploration.  
   - Add a wider diversity of tasks and resources throughout, particularly in weeks 2 and 3.  
   - I think I should consider talking about the hydration of ions in solution, given how much we talk about ions in solution in the acid/ base reactions and oxidation reactions and such.