L3 ORGANIC COMPOUNDS
CHEAT SHEET

STUDY TIME

ABOUT THE STANDARD

- This standard is broken in to a few key parts
    - Naming
    - Isomers
    - Solubility, melting points and boiling points
    - Esters
    - Reactions
    - Polymers
- There will be be explicit questions on each of these areas, but expect naming and reactions to pop up throughout the paper

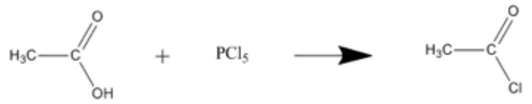
STRATEGIES FOR SUCCESS

- Naming and drawing are still really important but all of these skills carry over from level 2 so go ahead and check out the cheat sheet for that standard for tips on this!
- Reactions:
  The big one that everyone freaks out over. ORGANIC CHEMISTRY IS NOT ABOUT MEMORISATION! While yes there are bits you will need to memorise but it's no more than any other subject.
    - The thing about trying to memorise a big sheet the one you were probably given is that it doesn't get you to think about the chemistry that's actually going on. Instead of memorising statements like "alkene + acidified water goes to alcohol" try to think about the type of reaction that could possibly occur.
    - For example, if we had this reaction:

    - What would the product be? Well if we had a bit of a mind blank in the exam and forgot our statement then we would pretty much be out of luck. However we can apply some logic and reasoning to predict the outcome!
    - Think about the five different types of reaction there are in level 3 organics: Addition, elimination, oxidation, reduction, and substitution. This reaction has to fit into one of those categories right?
    - If we learn what happens in each reaction, and what sort of molecules do each kind of reaction, then we can just fit our example into one of those categories and take it from there.
    - For a more in depth guide to this thinking check out the StudyTime walkthrough but let's just run through this one really quick.

    - When looking at a question like this we can ask, is this an addition reaction? Well addition reactions are where a carbon-carbon double bond is broken and something new is put on each carbon. Well since our reactant doesn't have a double bond it can't be an addition reaction.

- Is this an elimination reaction? Well there are only two eliminating agents that we know of, concentration H_2SO_4 (for alcohols) and alcoholic KOH (for haloalkanes). PCl_5 is neither of these so it is not an elimination reaction.
- Is this an oxidation reaction? Well we can oxidise alcohols but to do that we need to use either MnO_4^- (permanganate) or $Cr_2O_7^{2-}/H^+$ (dichromate). Again, PCl5 is neither of those so its not oxidation.
- So therefore it must be a substitution reaction which is just a swapping reaction. Looking at our reagents what is likely to be swapped? Well the OH looks like something that would swap out since the C = O is pretty stable so what are we going to put there? It has to come from PCl_5 but we aren't just going to put an PCl_5 group on in its place? Looking at our reagent a Cl looks like the most likely thing to put on in place of that OH, and so we arrive at our answer.



- **The esters question:**

  There is very likely going to be a question on esters in the exam and I have some good news! It's literally almost exactly the same each year they decide to put it in!

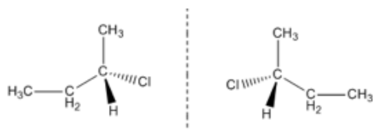
  - The thing to realise with esters is the only thing you can really do with them is make them and break them. To make an ester you use a carboxylic acid and an alcohol, mix it with a little acid as a catalyst and some heat and you've got an ester! Don't forget about the water that comes off as a by-product.
  - When breaking up an ester, you can do it two ways. Both require water, but you can do it using either an acidic solution or a basic solution.
  - When you do acidic hydrolysis (that's the fancy word for breaking up an ester by the way) You end up back where you started with the carboxylic acid and the alcohol.
  - When you do basic hydrolysis you still get back the alcohol but instead of the carboxylic acid you get back the carboxylate ion. Essentially in the basic solution your carboxylic acid gets deprotonated to become its conjugate base instead.

  And that's the whole question! There will be some variations on that theme but it basically always boils down to knowing about the different hydrolysis conditions for you ester.

- **The enantiomers question:**

  Like the esters question, its very common to have an enantiomers question to which the answer is almost always the same. First comes identifying the chiral carbon which is a carbon that has four different groups attached to it.

  - Then it's all about drawing it in 3D so make sure you are comfortable doing this! Draw it once in whatever order you like and then just take the mirror image by drawing a mirror line next to it and reflecting it through.



  - Then comes telling the examiner how you would distinguish between the two. Remember the chemical properties of enantiomers are exactly the same so they will undergo the exact same reactions. The only difference between a set of enantiomers is that they "rotate plane polarised light in different directions". This is a phrase you can just learn and throw into any answer to do with enantiomers and you'll get the mark.

- Be aware that these can also be referred to as optical isomers.

- **The distillation vs reflux question:**

Much like the esters question there is also commonly a distillation vs reflux question. In this one it's important to know the apparatus involved as you make have to pick them out of a line up. You also need to be able to describe in words how they work and what they do so look out for that.

- First let's quickly remind ourselves that when you oxidise a primary alcohol it goes in two steps, first you get the aldehyde and then you get the carboxylic acid.
- Distillation is used is used to separate compounds based on their boiling points and is also used to isolate aldehydes. The reaction vessel with your alcohol is heated up and some oxidising agent is added. As soon as the aldehyde is produced it evaporates and flows up to here where we have cold water flowing around the outside. The aldehyde condenses here and flows down to the waiting beaker where it can be collected.

NOTE: STEAL THESE DIAGRAMS FROM THE STUDYTIME GUIDE AND THE ANNOTATIONS

- Reflux is used to make sure reactions go to completion (which just means everything reacts). Again we heat up the reaction vessel but this time there is no side arm so when anything evaporates, it condenses on the tube and falls back down to keep reacting. The heat means the reaction will go faster but also means we don't lose any liquid so our concentrations stay the same.
- Quite often in NCEA you would use this when you wanted to ensure you made the carboxylic acid instead of the aldehyde but something they have been doing more recently is to just use it in any old reaction. Again, this is just because using reflux, reactions happen faster and also it ensures more of our reagent reacts.

OVERALL

- Everything comes down to naming and reactions, and they can appear all over the place in the exam and are not confined to single question like say polymers or esters.
- We've covered some important strategies and things to remember, but we haven't covered everything.
- We really recommend going through the last 3-4 years of exam papers, and also using the StudyTime Walkthrough Guide and Checklist to really check and consolidate your knowledge and feel 100% prepared!