WM.a-j - What's in a medicine? | WM1-5

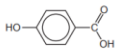
Commented [1]: NOTICE: For anyone using these flashcards feel free to learn definitions and equations but for other concepts (e.g. reflux) the wording of the flashcard is suited to Destine needs, so please for the sake of your Grade in chemistry change the flashcard to suite your needs (Don't make life difficult on yourself) Notice: Some of these flashcards may be difficult without context (especially those with mnemonics or anagrams) Come up to me (Destine) and ask!

WM.Q Exam questions from past papers

3 Parabens are compounds used as preservatives in some cosmetics.

A paraben can be made from the reaction between 4-hydroxybenzoic acid and ethanoic anhydride.

(a) 4-hydroxybenzoic acid has the following structural formula.



4-hydroxybenzoic acid reacts with both sodium hydroxide and sodium carbonate solutions.

The reaction with sodium hydroxide gives a compound with the molecular formula $C_7H_4O_3Na_2$.

The reaction with sodium carbonate gives a compound with the molecular formula $C_7H_5O_3Na$.

Use acid-base chemistry to explain these observations and include the structural formula for the organic product of each reaction.

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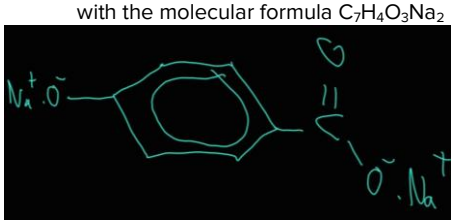
..... [3]

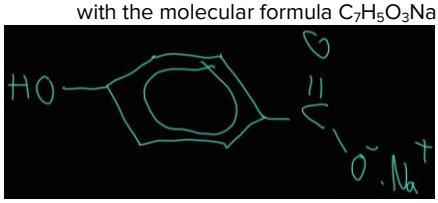
Use acid-base chemistry to explain these observations and include the structural formula for the organic product of each reaction.

- 4 hydroxybenzoic acid reacts with both sodium hydroxide and sodium carbonate solutions

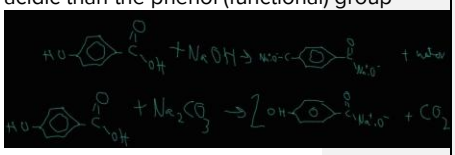
1. The reaction with sodium hydroxide gives a compound with the molecular formula $C_7H_4O_3Na_2$



2. The reaction with sodium carbonate gives a compound with the molecular formula $C_7H_5O_3Na$



- NaOH reacts with both the phenol and carboxyl (functional) groups to give $NaOC_6H_4COONa$
- Na_2CO_3 only reacts with the carboxyl (functional) group to give HOC_6H_4COONa
- The carboxyl (functional) group is more acidic than the phenol (functional) group



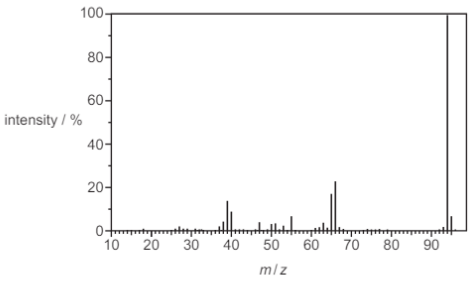
(iii) The impure liquid organic product of the reaction of limonene with bromine is dried after it has been prepared.

Name a drying agent that could be used.

..... [1]

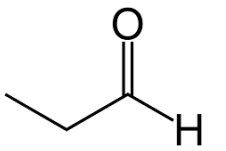
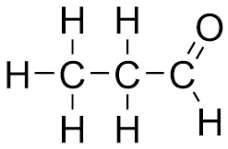
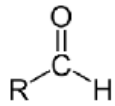
Name a drying agent that could be used?

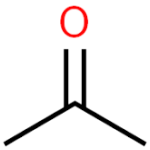
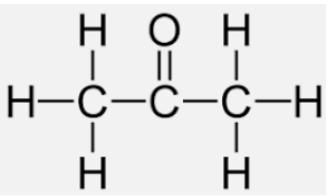
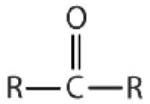
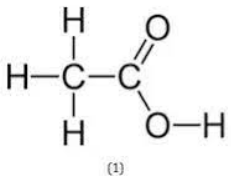
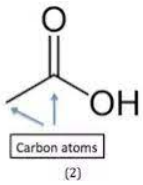
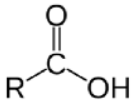
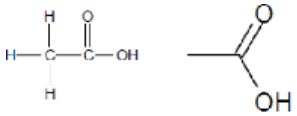
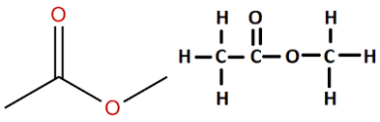
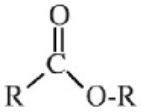
- Sodium sulfate (Anhydrous)
- Conc H_2SO_4
- Silica gel
- Sodium carbonate (Anhydrous)

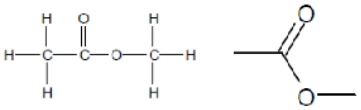
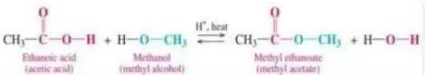
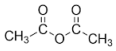
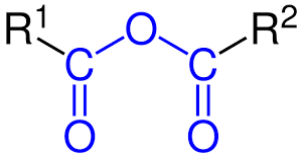
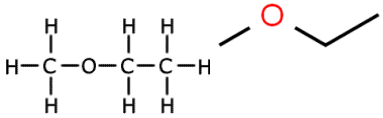
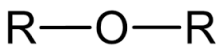
	(Anhydrous) sodium sulfate *or other salt with an anhydrous and hydrated form* ✓ | 1 | **ALLOW** conc. H_2SO_4 / silica gel, b **ALLOW** correct formula. **ALLOW** sodium carbonate **IGNORE** calcium carbonate and so
(c) The mass spectrum of phenol is shown below.  Give the formula of the ion that causes the peak at $m/z = 95$. .....[2] Give the formula of the ion that causes the peak at m/z = 95? (2)	**(c)** $^{13}CC_5H_5OH^+$/ $^{13}CC_5H_6O^+$ ✓✓ for completely correct ✓ if + sign omitted **or** ^{13}C shown but it is not clear there's only one. (not both) ● $[^{13}CC5H5OH]^+$ / $[^{13}CC5H6O]^+$
33 Parabens are used as antifungal preservatives in cosmetic products like shaving gel. Parabens are esters of 4-hydroxybenzoic acid, HOC_6H_4COOH (4-HBA). 4-HBA is a white solid. **(c)** The student places some aqueous sodium carbonate into a test-tube and adds small quantities of 4-HBA. **(i)** Describe **two** things that the student would observe. 1 .... 2 .... [1] Describe 2 things that the student would observe? 4-HBA is solid.	✓ *for any* **two** *from:* • effervescence **AW** • powder/solid/4-HBA disappears/dissolves **AW** • a colourless solution (forms) • change in temperature | 1 | 2.7 | **ALLOW** Fruity smell (as an ester is formed) 1. Fizzing 2. Solid dissolves 3. A colourless solution 4. Change in temperature *Allow fruity smell (as an ester is formed)*
Describe the practical procedure used to measure the melting point of an organic solid. You **do not** need to discuss the type of melting point apparatus you use. ....[3] Describe the practical procedure used to measure the melting point of an organic solid?	Seal/melt end of melting point/capillary tube (in Bunsen) ✓ Tap/tip/pack a small amount of solid to bottom of tube ✓ Put tube in mp apparatus, allow temperature to rise slowly until solid melts **OR** record when it first starts to melt and when it finishes ✓ | 3 | If unusual methods used please contact team leaders e.g. Siwoloboff's method, melting point bench ● Seal/melt end of melting point/capillary tube ● Tap/tip/pack a small amount of solid to bottom of tube ● Put tube in mp apparatus allow temperature to rise slowly until solid melts OR record when it first starts to melt and when it finishes

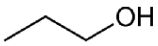
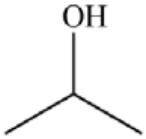
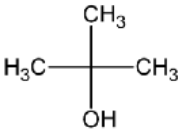
The students carry out thin layer chromatography of the phenyl benzoate formed. One student states that this will enable them to assess the purity of their product. Comment on the validity of this statement. You should describe any possible observations to back up your comments. .... [4] Comment on the validity of this statement? Phenyl benzoate is the ester that is formed in esterification from phenol and benzoic acid	if more than one spot shows up on tlc ✓ phenyl benzoate impure ✓ ORA for mp 1 and 2 however cannot assess overall purity/cannot tell how pure or impure it is✓ not quantitative / is qualitative ✓ 4 **Diagrams can be used here** **ALLOW** 'quantity' or references to % by mass of product ● If more than 1 spot shows up on TLC ● Phenyl benzoate impure ● However cannot assess overall purity / cannot tell how pure or impure it is ● It's not quantitative / it's qualitative

WM.a-b - Organic functional groups | WM1 | WM2 |

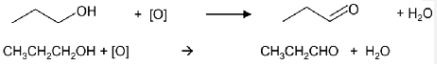
Functional group and suffix of aldehydes and name this compound (Think primary carboxyl group)  	 ● Functional group: ● Suffix: -al ● Propanal

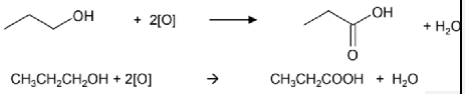
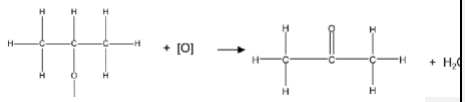
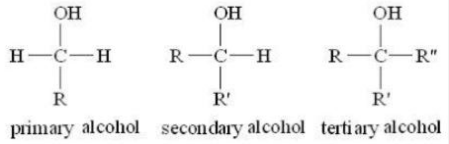
Functional group and suffix of ketones and name this compound (Think secondary carboxyl group)  	● Functional group:  ● General formula: $C_nH_{2n}O$ ● Suffix: -one ● Propanone ● Ketone not bonded to one carbon
Functional group and suffix of carboxylic acids and name this compound  (1)  (2)	● Functional group:  ● General formula: $C_nH_{2n+1}COOH$ ● Suffix: -oic acid ● Ethanoic acid  *E.g., ethanoic acid.*
Functional group and suffix of esters and name this group and also How are esters named 	● Functional group: ● General formula: $C_nH_{2n}O_2$  ● Suffix -yl -oate ● Methyl ethanoate

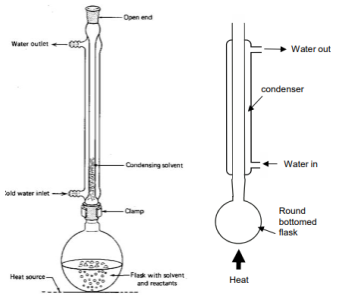
	 *E.g., methyl ethanoate.* *The alcohol ends in -yl and is the prefix. The carboxylic acid ends in -anoate and is the suffix* 
Functional group and suffix of acid anhydrides and name this compound 	• Functional group:  • Suffix: -oic anhydride • Ethanoic anhydride *The branches from R_1 and R_2 are always symmetrical for this course*
Functional group and suffix of ethers and name this compound :) 	• Functional group:  • Suffix: -oxy- • Methoxyethane

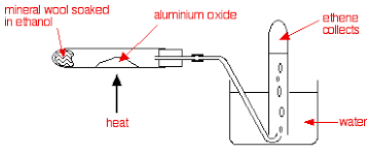
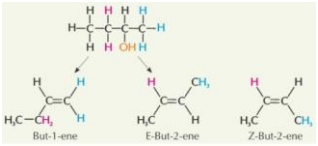
What are the 3 degrees of alcohol?	● Primary (1st degree): -OH bonded to one other carbon atom  *The carbon which the functional group is attached to is only attached to one other carbon.* ● Secondary (2nd degree): -OH bonded to a carbon bonded to two other carbon atoms  ● Tertiary (3rd degree): -OH bonded to a carbon bonded to three other carbon atoms 

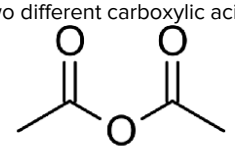
WM.c-g - Organic reactions | WM1 | WM2 | WM5 |

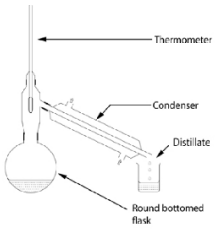
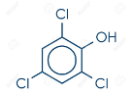
Why are shorter chain alcohols more soluble in water?	The functional group which forms hydrogen bonds with water molecules making it soluble forms a greater proportion of the molecule
What are the oxidising agents (reagents) for the oxidation of primary and secondary alcohols and where are they from?	● An excess of ($Cr_2O_7^{2-}/H^+$) from the solution of acidified potassium dichromate (VI) (ADP) ● Or potassium dichromate (VI) and sulfuric acid *Something such as hydrochloric acid cannot be used as the dichromate ions would rather oxidise this*
What is the equation for the partial oxidation (with distillation) of primary alcohols?	A primary alcohol reacts with [O] (an oxidising agent) to form an aldehyde and water  $CH_3CH_2CH_2OH + [O] \rightarrow CH_3CH_2CHO + H_2O$ *E.g., propan-1-ol to propanal.*

What are the reaction conditions for the partial oxidation of primary alcohols and why?	Distilling the aldehyde as it forms otherwise it will continue onto form a carboxylic acid
What is the equation for the full oxidation of a primary alcohol?	Primary alcohol + 2[O] -> carboxylic acid + water  $CH_3CH_2CH_2OH + 2[O] \rightarrow CH_3CH_2COOH + H_2O$ *You can distil afterwards to remove any unreacted alcohol molecules*
What is the equation for oxidation of secondary alcohols?	Secondary alcohol + [O] -> ketone + water 
What are the reaction conditions for the full oxidation of primary alcohols and oxidation of secondary alcohols? AND Why?	Heating under reflux to prevent loss of reactants/products by evaporation
Why won't tertiary alcohols oxidise?	As you need to remove a hydrogen atom from the carbon the -OH is bonded to (alongside the ^1H from the -OH group) Yet no hydrogen is bonded to said carbon 
What is observed (colour-wise) under the oxidation of primary and secondary alcohols?	**Orange** to **green** colour change [The orange dichromate (VI) ion, $Cr_2O_7^{2-}$ (aq), is **reduced** to green chromate (III) ions, Cr^{3+} (aq), in the reaction. From textbook]

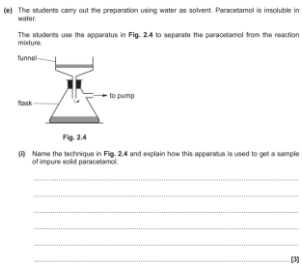
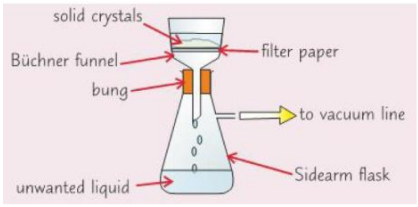
Describe and draw reflux setup?	 ● Open end - prevents build up of gas that can cause explosion ● Anti-bumping granules - prevents vigorous and uneven boiling by forming smaller bubbles ● Don't draw lines between flask and condenser ● Don't have top of condenser sealed ● Condenser must have outer tube for water that is sealed at top and bottom ● Condenser must have two openings for water in and out that are open For drawing labels ● Rounded bottomed flask/pear shaped ● Condenser ● Water in ● Water out
When is the reflux setup most often used?	When boiling organic reaction mixtures for long periods *Don't say **heating** as some MS don't allow*
What are the products and conditions for the dehydration of alcohols and why?	● Forming an alkene and water from an alcohol ● Heat under reflux with concentrated sulphuric acid or ● Heat Alumina (Al_2O_3) at 300 degrees (using the setup as if we were cracking a long chain molecule) ● As we dont want any water to form alcohols again *In short, the same catalyst, however without water*

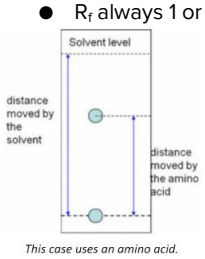
What is the apparatus for the dehydration of alcohols using heated alumina at 300 degrees?	 *Same apparatus as cracking a long chain alkane*
What type of reaction is the dehydration of alcohols? And why?	● Elimination ● The -OH group (and a H on an adjacent carbon) is eliminated forming an unsaturated molecule
When and why are isomers formed from the dehydration of alcohols?	● From secondary or tertiary alcohols ● As an H is removed from either one of the two/three adjacent carbons to the carbon the -OH is bonded to 
How are haloalkanes formed from alcohols?	Alcohols react with halide ions in the presence of a strong acid via nucleophilic substitution
Describe the esterification using an acid catalyst?	● Carboxylic acid + alcohol <-> ester + water ● Few drops of conc HCl or conc H_2SO_4 required for H^+ ions (We use a strong acid catalyst as the reaction would be slow with a weak) ● Heat under reflux ● Reversible reaction and so there are reactants and products ● Ester is separated using distillation and is purified *Conc H2SO4 or other acid acts as a catalyst by removing water molecules so the POE would shift more to the right don't believe we need to know how they remove water molecules but its a good thought*
Describe the esterification using an acid	● Acid anhydride + alcohol -> ester +

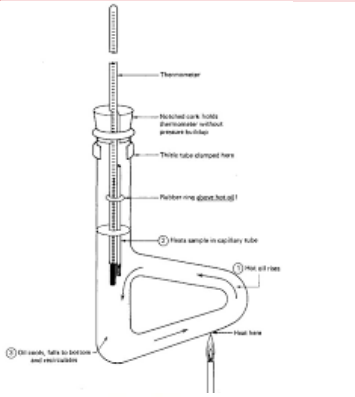
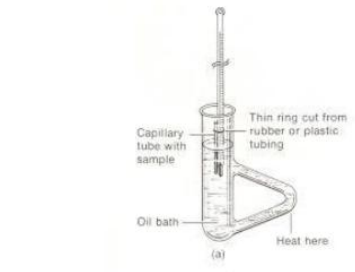
anhydride with conditions? And what is achieved from using this compared to an acid catalyst	carboxylic acid ● Heating under reflux ● High yield achieved of ester compared to carboxylic acid as its not reversible
What is an acid anhydride?	Two different carboxylic acids joining together  *Ethanoic anhydride*
How can you purify an organic liquid?	1. **Pour** the distillate (something formed from distillation) of impure product into a separating funnel 2. **Wash** with: a. $NaHCO_3$ solution **to neutralise any acid impurities** shake (and release pressure from CO_2 produced, add small volumes at a time, keep adding until no fizzing) b. ~~Saturated NaCl solution to separate layers~~ 3. **Allow** layers to separate and discard aqueous layer (the organic layer will be on top usually due to a lower density) 4. **Run** organic layer into clean dry conical flask 5. **Add** a drying agent and swirl mixture (e.g. anhydrous sodium sulfate or calcium chloride) to dry liquid. When its dry it should be clear 6. **Decant** off liquid into flask 7. **Redistill** to collect pure product Remember this as PWARADR Please Write Addition Reactions And Draw Reactants *Decant means carefully pour the organic liquid in a separate beaker leaving the drying agent in the conical flask*
What are the stages in order for purifying an organic liquid product?	1. Distillation 2. Neutralisation 3. Separation 4. Drying 5. Redistillation *Although some questions tend to not mention the 1st step*

Describe the setup for distillation with an explanation for key points	 *Some setups may have a receiver at the end of the condenser.* ● Bulb of thermometer at T-junction - to displace the correct b.p ● Water entering via bottom of condenser - entire condenser will fill up before water exits ● Electric heater - prevents highly flammable organic compounds setting alight under a live flame *If water enters via the top of the condenser, it would trickle down and leave without filling the whole condenser*
How is a separation funnel used? 	1. Shake the reaction mixture then allow to settle into a dense aqueous layer (containing the impurities bottom layer) and a less dense organic layer (top layer) 2. Open the tap to run off the aqueous layer (bottom layer)
What should you ensure with the drying agent for purifying organic liquids?	● Be insoluble in the organic liquid ● Not react with the organic liquid
How do alcohols react with bases?	They don't because they are not acidic (pH = 7)
What is phenol? And name this please? 	● A benzene group with a -OH directly attached ● 2,4,6trichlorophenol
What type of acid is phenol and how will it react with NaOH (aq) and Na_2CO_3 (aq) ?	1. A weak acid 2. Reacts with NaOH (sodium salts) 3. Does not react with strong bases such as Na_2CO_3

	 THIS INCLUDES ANY OTHER AROMATIC COMPOUND WITH AN -OH.
How can you distinguish between a phenol and a carboxylic acid? (Test to see whether a compound is a phenol or carboxylic acid)	Carboxylic acids will react with Na_2CO_3 producing effervescence (as CO_2 is produced) **<u>however</u>** phenols will not react
Does carboxylic acids react with NaOH (aq) and Na_2CO_3 (aq)	● They react with NaOH ● They react with Na_2CO_3
Do alcohols react with NaOH (aq) and Na_2CO_3 (aq) ?	Does not react with both as its pH = 7
What is the test for phenols?	Add Iron(III) chloride and turns solution from yellow to purple
What is the equation for esterification using phenols?	● Phenol + acid anhydride -> ester + carboxylic acid ● At RTP
Do phenols react with carboxylic acids to form esters like alcohols?	No as they are both acids
Rank in order for alcohols (ethanol), carboxylic acids, phenol and water which are least to most acidic? (These represent the acidic properties of the -OH group)	1. Ethanol (weakest) 2. Water (dissociates so some extent) 3. Phenol (weak acid reacts with strong bases) 4. Carboxylic acids (Weak acid reacts with strong base)
How is the solvent for recrystalisation chosen? Why? Otherwise what happens?	● **<u>Choose</u>** a solvent that dissolves when hot and doesn't dissolve when cold ● If not soluble enough hot solvent won't dissolve it all and so would not crystallise when cooling (1) ● If too soluble in cold solvent most will remain in solution when cooling giving low yield
How can you purify an organic solid by recrystallisation? Why is each step used?	1. **<u>Choose</u>** a solvent that dissolves when hot and doesn't dissolve when cold (Explained on a different FC) 2. **<u>Dissolve</u>** the mixture in the minimum quantity of hot solvent **(To ensure a saturated solution)** 3. **<u>Filter</u>** using filter paper **(To remove any insoluble impurities)** 4. **<u>Cool</u>** filtrate until crystals form **(So crystals form but soluble impurities remain in**

	solution) 5. **<u>Filter</u>** the crystals by vacuum filtration **(To separate out crystals)** 6. **<u>Wash</u>** the crystals with a cold solvent then **<u>dry</u> (To remove soluble impurities)** Remember this as CDFCFW Can Deaf Fruity Crayons For Work *If solvent is mentioned e.g. ethanol make sure to say use cold or hot ethanol not just 'solvent'* *You can also scratch the inside surface with a glass rod to initiate crystallisation*
By what 3 ways is yield lost under recrystalisation?	1. Crystals lost when filtering/washing 2. Some product stays in solution afterwards 3. Side reactions occuring
 (e) The students carry out the preparation using water as solvent. Paracetamol is insoluble in water. The students use the apparatus in **Fig. 2.4** to separate the paracetamol from the reaction mixture. funnel flask to pump **Fig. 2.4** (i) Name the technique in **Fig. 2.4** and explain how this apparatus is used to get a sample of impure solid paracetamol. [3] Describe the process of vacuum filtration (3)?	● Wash filter paper with water with organic solid (or solvent) [1] ● The suction would remove the water from filter paper (or solvent) [1] ● Organic solid is left on filter paper in the funnel [1] vacuum filtration/filtration under reduced pressure/suction ✓ **AND** **Any two from:** Moisten/damp(en) filter paper /wash paper with water ✓ wash solid/paracetamol with water ✓ suck dry / sucks to remove water/solvent ✓ crude paracetamol/solid left (on filter paper/in funnel) ✓ 3 — **2.7** — **3.4 x2** Allow the word "pull" rather than "suck" In flask is a **CON**
Draw the apparatus for vacuum filtration?	 ● Labelled: filter paper, buchner funnel, buchner flask, vacuum pump

Describe how a thin-layer chromatogram (TLC) is produced/Run? And mnemonic	● **Draw** a pencil line on TLC plate (1cm above the pencil line sometimes)* ● **Line** must be above solvent level * (so depth of solvent must be lower than the line) ● **Spot** mixture and pure samples onto pencil line * ● **Place** plate in a beaker of solvent * ● **Cover** the beaker with a lid * ● **Remove** plate when solvent front is near to top of plate ● **Mark** how far solvent has reached (in pencil) ● **Allow** plate to dry (by placing in a fume cupboard to evaporate solvent) ● **Locate** any spots with iodine crystals or using a UV lamp Use mnemonic: Remember this as DLSPCRMAL Do Line Solvent Properly Cause Ryan May Analyse Light * Can be achieved by drawing a labelled diagram
How to calculate an R_f value from TLC and GC?	● Distance moved by spot/ distance moved by solvent ● By comparing to database values ● R_f always 1 or less  *This case uses an amino acid.* *Each substance has its own unique retention factor*
What problems are there with TLC? Why?	Some substances wont separate since they have similar retention factors/retention times because they are structurally similar *It is often used alongside mass spectroscopy*

Describe how to melting point textbook   • Thermometer and capillary tube strapped together. • Heating oil with boiling point higher than sample and low flammability. • Constant stirring.	1. Seal the end of a glass melting point tube by heating it to melting in a bunsen flame 2. Tap the open end of the tube into the solid so a small amount goes into the tube. Tab the tube so that the solid falls to the bottom of the sealed end 3. Fix the tube in the melting point apparatus and heat the surroundings liquid gently, stirring to ensure even heating throughout. The temperature should rise very slowly 4. Note the temperature at which the solid starts and finishes melting. The difference between the highest and lowest temperatures recorded is know as the melting range 5. Compare the experimental value to the published value for the melting point. The wider the melting range, the more impure the substance. A pure compound will melt within 0.5 degrees of the true value
Give 2 ways melting point can be measured with a precaution?	• Using an electronic melting point machine • Putting a capillary tube (with the product inside) into heating oil with a thermometer • Heat slowly near melting point to record accurate temperature when it **just** melts
How can measuring the melting point of a product indicate purity?	• A very pure sample will have a sharp melting point (as quoted in data books) • One with impurities may have a **lower melting point** or may **melt over a range** of several degrees

Commented [2]: Amend and add if u want to but basic FC

What are the 2 types of reactions under atom economy?	• Addition - the reactants form a **single DESIRED product (100%)** • Substitution - the atom from a reactant are substituted by others leading to **more than one product** *Addition reactions are usually where a reactant is added to an unsaturated molecule to make saturated molecule*
What is the principle of waste prevention?	• It is better to prevent the production of waste than to deal with it after it has been created • As well as doing a reaction with less reagents and the number of steps
What is the principle of less toxic reactions?	• Reactions should be designed to have the least amount of toxic substances produced or used • Use renewable reactants/products • Also choose processes that minimise the potential for releasing gases, fire and explosions
What is the principle of safer solvents?	Reactions should be designed to minimise the use of organic solvents and separating agents that are dangerous
How can energy use be made more efficient in reactions?	• Reactions should be conducted at a lower temperature and pressure whenever possible • The use of electricity should be minimised and the source of the electricity should be assessed (whether renewable or not)
Why are catalysts environmentally friendly and reduce energy demand?	• Catalysts reduce the need for heating in a reaction which reduces the amount of energy used for the reaction as well as the waste produced and are also more efficient • (as they provide an alternate route of lower activation energy) • Catalysts lower temperatures for reactions -> less fossil fuels are used reducing CO_2 emissions

WM.h - Reaction mechanisms | WM1 |

Define elimination reaction?	A reaction where a small molecule is removed from a larger molecule leaving an unsaturated molecule *In the case of alcohols the small molecule is water*

WM.i-j - Modern analytical techniques | WM3 | WM4 |

(ii) Name the region of an infrared spectrum below 1500 cm^{-1} and explain the significance of this region.

.....

.....

..... **[2]**

Name the region of an infrared spectrum below 1500 cm–1 and explain the significance of this region? (2)

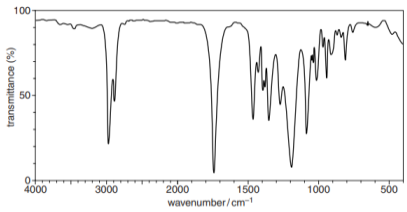
Fingerprint (region) ✓ Unique/distinct/characteristic (part of the IR spectrum) to the compound *AW* **OR** can be used to identify the compound (by comparison with a database) **OR** Can differentiate between similar molecules **OR** Unique for every molecule✓	2	**ALLOW** 'molecule', 'substance', 'chemical' for compound **DO NOT ALLOW** 'element'

- Fingerprint region (1st)
- Can be used to identify the compound (1)
- Or unique to the compound (1)
- Or can differentiate between similar molecules (1)
- Or unique for every molecule

Characteristic infrared absorptions in organic molecules

Bond	Location	Wavenumber/cm^{-1}
C–H	Alkenes	2850–2950
	Alkenes, arenes	3000–3100
C–C	Alkanes	750–1100
C=C	Alkenes	1620–1680
aromatic C=C	Arenes	Several peaks in range 1450–1650 (variable)
C=O	Aldehydes	1720–1740
	Ketones	1705–1725
	Carboxylic acids	1700–1725
	Esters	1735–1750
	Amides	1630–1700
	Acyl chlorides and acid anhydrides	1750–1820
C–O	Alcohols, ethers, esters and carboxylic acids	1000–1300
C≡N	Nitriles	2220–2260
C–X	Fluoroalkanes	1000–1350
	Chloroalkanes	600–800
	Bromoalkanes	500–600
O–H	Alcohols, phenols	3200–3600 (broad)
	Carboxylic acids	2500–3300 (broad)
N—H	Primary amines	3300–3500
	Amides	*ca.* 3500

(ii) A student carries out the oxidation of **ethanol**, which can form two different oxidation products. The infrared spectrum of the compound the student obtained is given below.



Use the spectrum to identify the compound formed.

..... **[1]**

(iii) Explain how the spectrum in **(ii)** shows that no ethanol remains.

.....

.....

..... **[2]**

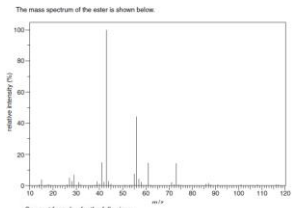
Explain how the spectrum in (ii) shows that no ethanol remains? (2)

There is no peak/trough/absorbance between 3200 to 3640 ✓ indicating there is no O-H bond ✓ Two marks for: There is no peak between 3200 to 3600 that would indicate an OH bond ✓✓	2	**ALLOW** any number or range at, or above, 3200 **ALLOW** OH bond, but not –OH bond Ignore references to other peaks/troughs Mark independently.

- There is no peak between 3200 and 3640cm^{-1} (1)
- Indicating there is no O-H bond (1)

What are the lines on a mass spectrum?

- If analysing elements they're isotopes
- If analysing compounds they're fragment

	ions
What is the M+1 peak caused by and why is there unlikely to be a M+2 peak? (1)	The presence of a ^{13}C isotope and the chance of 2 ^{13}C is small (1)
 Formula Species which gives the peak at m/z 73 Species lost from the molecular ion Mass spectrum for ester $C_6H_{12}O_2$/ CH3COOCH2CH2CH2CH3 (3)	**peak at *m*/z 73:** CH_3COOCH_2 / $C_3H_5O_2$ ✓ positive charge on any formula ✓ **species lost:** $CH_2CH_2CH_3$ / C_3H_7 (NO charge) ✓ ● Peak at m/z 73: $[CH_3COOCH_2]+$/$[C_3H_5O_2]+$ or [C4H9]+ (1) ● Positive charge on any formula (1) ● Species lost: CH2CH2CH3/C3H7 or C2H3O/CH3CO (NO charge) (1)
Steps for doing 4-6 markers for both Mass spectrometry and Infrared spectroscopy questions?	● Use Infrared to identify any functional groups in your unknown sample ● Use mass spectrometry to identify the structure and the mass of the molecule from fragment patterns (depending on the question they might give you the percentage composition by mass of the compound)