

AQA Chemistry A-level

Topic 3.5 - Alcohols

Flashcards

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What is the functional group of an alcohol?



What is the functional group of an alcohol?

Hydroxyl group -OH



What is the general formula of an alcohol?



What is the general formula of an alcohol?



How do you name alcohols (one prefix, one suffix)?



How do you name alcohols (one prefix, one suffix)?

Hydroxyl- or -OH



What kind of intermolecular forces do alcohols have?
Why?



What kind of intermolecular forces do alcohols have?
Why?

Hydrogen bonding, due to the electronegativity difference in the OH bond



How do alcohols' m.p. And
b.p. Compare to other
hydrocarbons' of similar C
chain lengths? Why?



How do alcohols' m.p. And b.p. Compare to other hydrocarbons' of similar C chain lengths? Why?

Higher, because they have hydrogen bonding → stronger than Van der Waals forces



Are alcohols soluble in water? Why does solubility depend on chain length?



Are alcohols soluble in water? Why does solubility depend on chain length?

Soluble when short chain - OH hydrogen bonds to hydrogen bond in water

Insoluble when long chain - non-polarity of C-H bond takes precedence



What makes an alcohol primary?



What makes an alcohol primary?

C bonded to OH is only bonded to one other C atom



What makes an alcohol secondary?



What makes an alcohol secondary?

C bonded to OH is bonded to two other C atoms



What makes an alcohol tertiary?



What makes an alcohol tertiary?

C bonded to OH is bonded to three other C atoms



How can ethanol be made from crude oil?



How can ethanol be made from crude oil?

Hydration of ethene via electrophilic addition
(phosphoric acid catalyst H_3PO_4)



What are the advantages and disadvantages of this method?



What are the advantages and disadvantages of this method?

Advantages - fast, continuous process, ethanol has a high purity

Disadvantages - not renewable as from crude oil



How can ethanol be made by fermentation?



How can ethanol be made by fermentation?

Plant carbohydrates broken down and fermented by enzymes in yeast → ethanol



What conditions are needed
for this reaction to take
place?



What conditions are needed for this reaction to take place?

Enzymes in yeast as catalyst, 35°C, anaerobic conditions



Write an equation for the reaction which takes place.





Write an equation for the reaction which takes place.



What are the advantages and disadvantages of this method?



What are the advantages and disadvantages of this method?

Advantages - renewable as from plants

Disadvantages - slow, batch process, enzymes stop working at 15% alcohol so solution is not pure, needed to be fractionally distilled



In the future, how might most ethene be made? Why is it not made like this at the moment?



In the future, how might most ethene be made? Why is it not made like this at the moment?

Dehydrate ethanol made by fermentation →
ethene

Not economical at the moment



Define carbon neutral



Define carbon neutral

No net addition of CO_2 to the atmosphere -
carbon dioxide released when combusted =
carbon dioxide absorbed as a plant



Explain how using ethanol in petrol engines could be considered to be carbon neutral.



Explain how using ethanol in petrol engines could be considered to be carbon neutral.

Carbon dioxide released in fermentation and combustion = carbon dioxide absorbed when growing



Why would it probably not be entirely carbon neutral to use ethanol?



Why would it probably not be entirely carbon neutral to use ethanol?

Other “carbon costs” associated with it e.g.
Transport



What is a commercial fuel that uses ethanol? What else does it contain and why?



What is a commercial fuel that uses ethanol? What else does it contain and why?

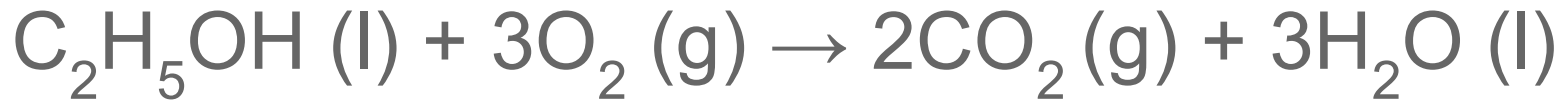
Methylated spirits - methanol (toxic, so it can't be drunk)



Write an equation for the
combustion of ethanol.



Write an equation for the combustion of ethanol.



What is an elimination reaction?



What is an elimination reaction?

The removal of a smaller molecule from a larger one



Which group leaves the parent molecule in the case of alcohols?



Which group leaves the parent molecule in the case of alcohols?

OH and a H (to form water)



What physical conditions are needed for the elimination reaction from alcohols to alkenes? (2 alternatives)



What physical conditions are needed for the elimination reaction from alcohols to alkenes? (2 alternatives)

Excess hot concentrated sulphuric acid or pass vapour over hot aluminium oxide



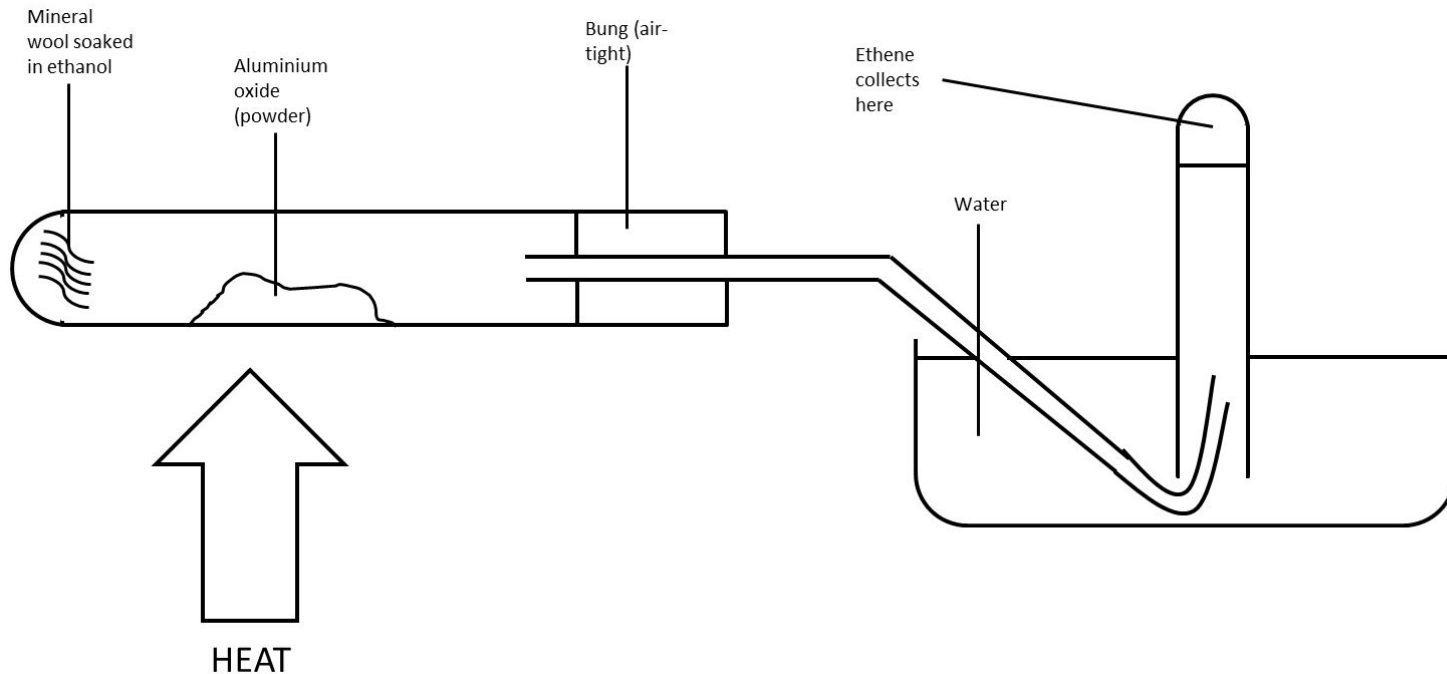
Draw a mechanism for the
dehydration of ethanol.



Draw a method for
dehydration of ethanol in the
lab.



Draw a method for dehydration of ethanol in the lab.



What forms if you partially oxidise a primary alcohol?



What forms if you partially oxidise a primary alcohol?

An aldehyde



What conditions are needed to partially oxidise a primary alcohol?



What conditions are needed to partially oxidise a primary alcohol?

Dilute sulphuric acid, potassium dichromate (VI), distill product as it's produced, gentle heating



Write an equation for the partial oxidation of ethanol





Write an equation for the partial oxidation of ethanol



What forms if you fully oxidise a primary alcohol?



What forms if you fully oxidise a primary alcohol?

A carboxylic acid



What conditions are needed for this reaction?



What conditions are needed for this reaction?

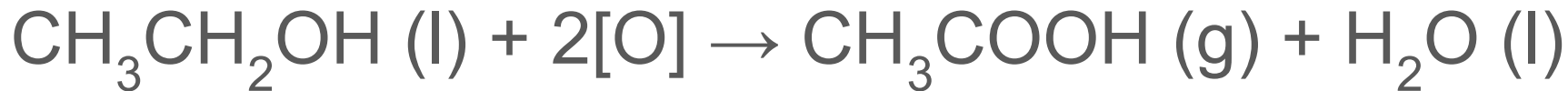
Concentrated sulphuric acid, potassium dichromate (VI), reflux for about 20 mins, strong heating



Write an equation for the full
oxidation of ethanol



Write an equation for the full oxidation of ethanol



What forms if you oxidise a secondary alcohol?



What forms if you oxidise a secondary alcohol?

A ketone



Why can it not be oxidised further and why can't a tertiary alcohol be oxidised?



Why can it not be oxidised further and why can't a tertiary alcohol be oxidised?

A carbon-carbon bond would have to break



What conditions are needed
for the oxidation of a
secondary alcohol?



What conditions are needed for the oxidation of a secondary alcohol?

Concentrated sulphuric acid, potassium dichromate (VI), reflux for about 20 mins, strong heating



Write an equation for the oxidation of propan-2-ol.



Write an equation for the oxidation of propan-2-ol.



What is an aldehyde? What is its functional group?



What is an aldehyde? What is its functional group?

Molecule with C=O group at the end of a carbon chain, carbonyl functional group (C=O)



How do you name
aldehydes? Give an
example.



How do you name aldehydes? Give an example.

Suffix -al

e.g. ethanal



What is a ketone? What is its functional group?



What is a ketone? What is its functional group?

Molecule with $\text{C}=\text{O}$ group in the middle of a carbon chain,
carbonyl functional group ($\text{C}=\text{O}$)



How do you name ketones?
Give an example?



How do you name ketones? Give an example?

Suffix -one

e.g. propanone



What is a carboxylic acid?
What is its functional group?



What is a carboxylic acid? What is its functional group?

Molecule with a COOH group, which has to be at the end of a carbon chain.

Carboxyl functional group (made up of carbonyl $\text{C}=\text{O}$ and hydroxyl $-\text{OH}$ group)



How do you name
carboxylic acids? Give an
example



How do you name carboxylic acids? Give an example

Suffix -oic acid

e.g. propanoic acid



What does the Tollens' test give a positive result for?



What does the Tollens' test give a positive result for?

aldehydes



What is in Tollens' reagent?
How does this react with the
substance to be tested?



What is in Tollens' reagent? How does this react with the substance to be tested?

Silver nitrate in NH_3 (aq) - oxidises aldehydes but not ketones

Complex silver (I) ions reduced to $\text{Ag}(s)$



How do you carry out the Tollens' test?



How do you carry out the Tollens' test?

Add equal volumes of substance being tested and tollens' reagent to a test tube, leave in water bath for 10mins and observe any changes



What is the result of the Tollen's test for aldehydes and ketones?



What is the result of the Tollen's test for aldehydes and ketones?

Aldehydes - silver mirror forms (solid Ag)

Ketones - no visible change



What does Fehling's solution give a positive test result for?



What does Fehling's solution give a positive test result for?

aldehydes



What is in Fehling's? How does this react with the substance to be tested?



What is in Fehling's? How does this react with the substance to be tested?

Blue copper (II) complex ions - gentle oxidising agent

Reduced to Cu^+ ions (brick red)



What conditions do you need to use the Fehling's solution?



What conditions do you need to use the Fehling's solution?

Heat



What result do aldehydes
and ketones give in the
fehling's test?



What result do aldehydes and ketones give in the Fehling's test?

Aldehydes- brick red ppt

Ketones- no visible change

