

CIE Chemistry A-Level

Topic 17 - Hydroxy Compounds

Flashcards

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What is the chemical equation for the complete combustion of ethanol?



What is the chemical equation for the complete combustion of ethanol?



What condition is required to ensure complete combustion takes place?



What condition is required to ensure complete combustion takes place?

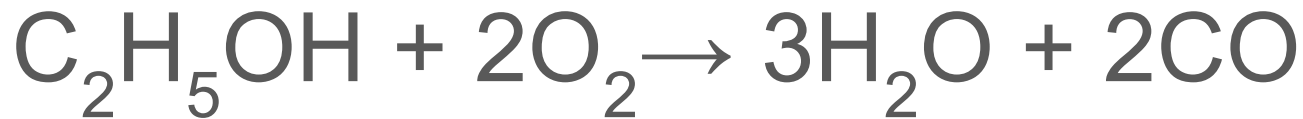
Excess oxygen



What is the chemical equation for the incomplete combustion of ethanol to produce carbon monoxide?



What is the chemical equation for the incomplete combustion of ethanol to produce carbon monoxide?



How do alcohols react to form halogenoalkanes?



How do alcohols react to form halogenoalkanes?

There are multiple ways alcohols can react to form halogenoalkanes:

- React with sodium halides and sulfuric acid.
- React with sodium or potassium iodide and concentrated phosphoric (V) acid.



How do alcohols react with sodium?



How do alcohols react with sodium?



Ethanol reacts with sodium to form hydrogen gas and sodium ethoxide (an alkoxide).

If the solution is evaporated, sodium ethoxide remains as a white solid.

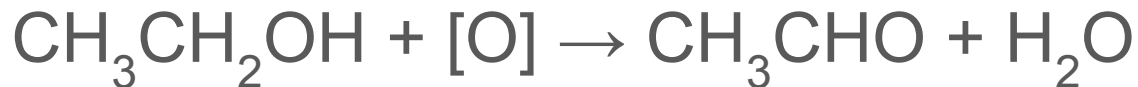


How are primary alcohols oxidised to aldehydes?



How are primary alcohols oxidised to aldehydes?

If you heat a primary alcohol with acidified potassium dichromate(VI), the alcohol will be oxidised to form an aldehyde:



The acidified potassium dichromate(VI) will change colour from orange to green.

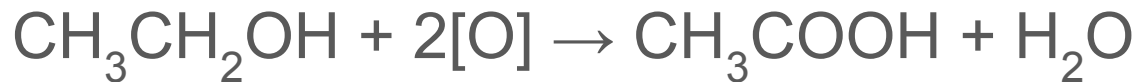


How are primary alcohols oxidised to carboxylic acids?



How are primary alcohols oxidised to carboxylic acids?

If a primary alcohol is heated under reflux with acidified potassium dichromate(VI), the alcohol will be oxidised form a carboxylic acid.



The acidified potassium dichromate(VI) will change colour from orange to green.



How are secondary alcohols oxidised to ketones?



How are secondary alcohols oxidised to ketones?

If a secondary alcohol is heated under reflux with acidified potassium dichromate (VI), the alcohol will be oxidised to form a ketone:



The acidified potassium dichromate(VI) will change colour from orange to green.



How do alcohols undergo dehydration reactions?



How do alcohols undergo dehydration reactions?

Alcohols undergo dehydration reactions to form an alkene and a water molecule.

Two options to carry out dehydration:

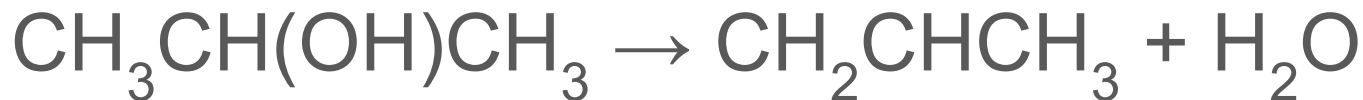
- Heat with strong acid catalyst.
- Pass alcohol vapour over Al_2O_3 powder.



What is the chemical equation for the dehydration of propan-2-ol to form prop-2-ene?



What is the chemical equation for the dehydration of propan-2-ol to form prop-2-ene?



How do alcohols react with carboxylic acids?



How do alcohols react with carboxylic acids?

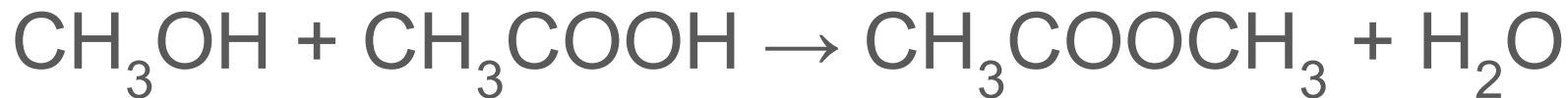
Alcohols react with carboxylic acids to form esters. This process is called esterification and requires heating with a sulfuric acid catalyst.



What is the chemical equation for the reaction between methanol and ethanoic acid? Give the name of the ester formed



What is the chemical equation for the reaction between methanol and ethanoic acid? Give the name of the ester formed



Product $\text{CH}_3\text{COOCH}_3$ is methyl ethanoate.



How do acyl chlorides react to form an ester? **(A-Level only)**



How do acyl chlorides react to form an ester?

(A-Level only)

Acyl chlorides react with primary alcohols to form esters. Hydrogen chloride is also produced during the reaction.

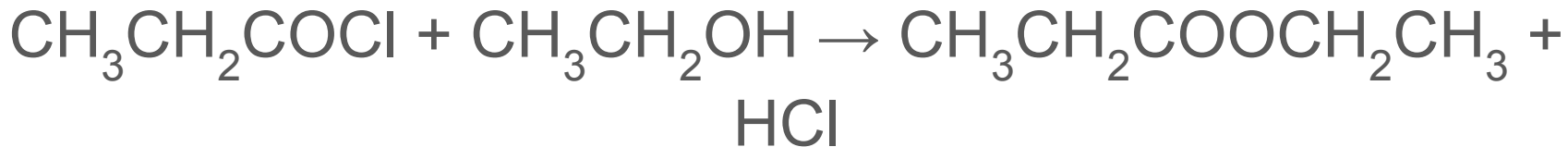


What is the chemical equation for the reaction between ethanol and propanoyl chloride? Give the name of the ester formed

(A-Level only)



What is the chemical equation for the reaction between ethanol and propanoyl chloride? Give the name of the ester formed **(A-Level only)**



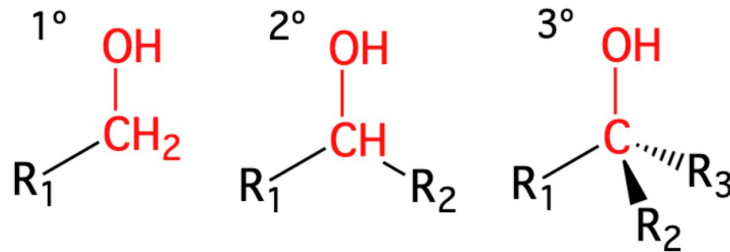
The product $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$ is ethyl propanoate.



How are alcohols classified?



How are alcohols classified?



- Primary, 1° - The carbon bonded to the alcohol group is bonded to one R (alkyl) group only.
- Secondary, 2° - The carbon bonded to the alcohol group is bonded to two R groups.
- Tertiary, 3° - The carbon bonded to the alcohol group is bonded to three other R groups.



How can you distinguish between primary, secondary and tertiary alcohols?



How can you distinguish between primary, secondary and tertiary alcohols?

- Tertiary cannot be oxidised and therefore there's no colour change (remains orange) when heated with acidified potassium dichromate (VI).
- Primary and secondary alcohols are able to be oxidised and so there would be a colour change from orange to green.
- You could run further tests on the resulting solutions from primary and secondary alcohols by using Fehling's or Tollens' reagent.



How can you deduce the presence of a $\text{CH}_3\text{CH}(\text{OH})-$ group in an alcohol?



How can you deduce the presence of a $\text{CH}_3\text{CH}(\text{OH})-$ group in an alcohol?

- Iodine is added to a small volume of alcohol.
- Some sodium hydroxide is then added to decolourise the iodine.
- The presence of a $\text{CH}_3\text{CH}(\text{OH})-$ group is indicated by a very pale yellow precipitate known as tri-iodomethane, CHI_3 .



How does phenol react with bases, e.g.
NaOH? **(A-Level only)**



How does phenol react with bases, e.g. NaOH?

(A-Level only)

Phenol reacts with sodium hydroxide to form sodium phenoxide and water.



What is the chemical equation for the reaction of phenol with sodium hydroxide?
(A-Level only)



What is the chemical equation for the reaction of phenol with sodium hydroxide? **(A-Level only)**



How does phenol react with sodium?
(A-Level only)



How does phenol react with sodium? **(A-Level only)**

Phenol reacts with sodium to form sodium phenoxide and hydrogen gas.



What is the chemical equation for the reaction of phenol with sodium?
(A-Level only)



What is the chemical equation for the reaction of phenol with sodium? **(A-Level only)**



How does phenol react with diazonium salts?

(A-Level only)



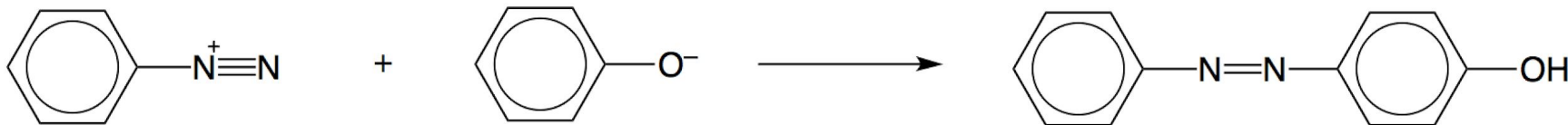
How does phenol react with diazonium salts?

(A-Level only)

In a coupling reaction:



The sodium phenoxide solution reacts with a benzenediazonium salt solution:



How does phenol react with dilute nitric acid?

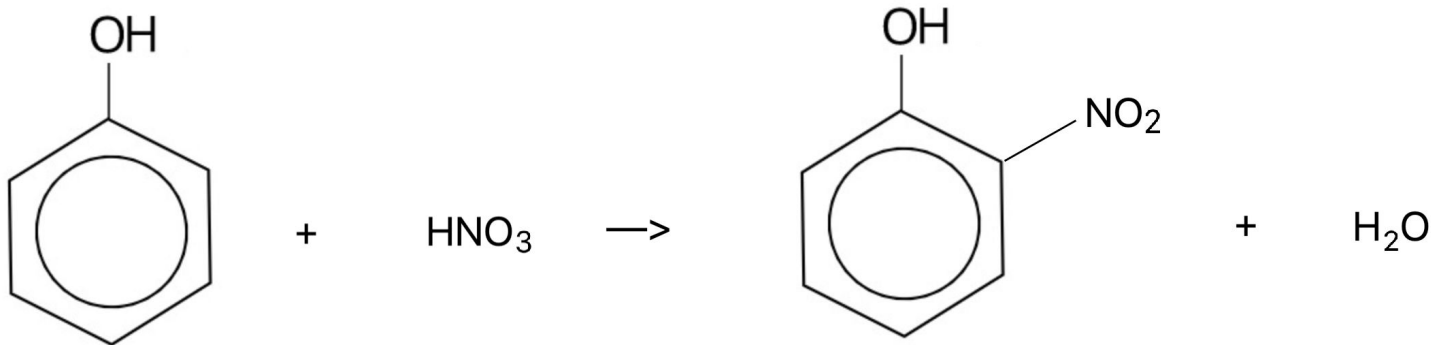
(A-Level only)



How does phenol react with dilute nitric acid?

(A-Level only)

Phenol reacts readily with dilute nitric acid at room temperature to form a mixture of 2-nitrophenol and 4-nitrophenol.

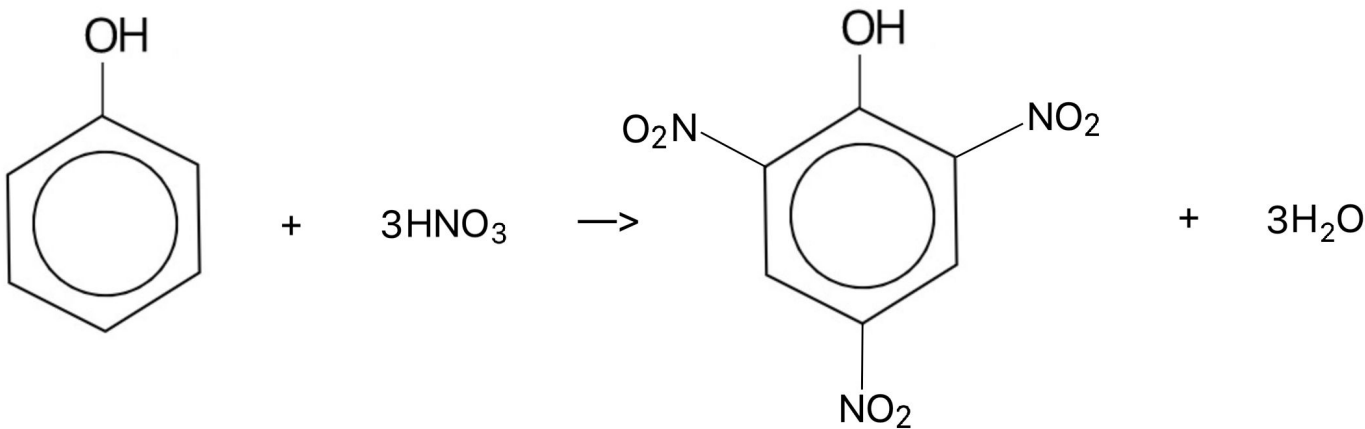


How does phenol react with
concentrated nitric acid?
(A-Level only)



How does phenol react with concentrated nitric acid? (A-Level only)

Phenol reacts with concentrated nitric acid to form 2,4,6-trinitrophenol.



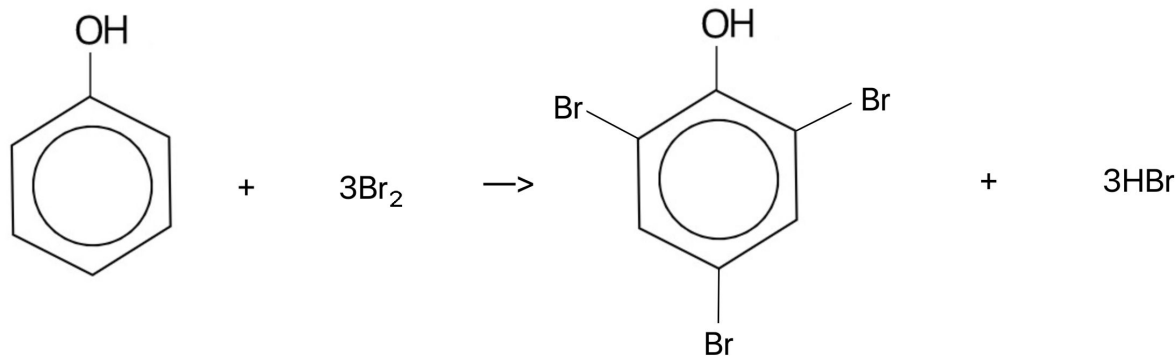
How does the bromination of phenol
occur?
(A-Level only)



How does the bromination of phenol occur?

(A-Level only)

Phenol reacts with bromine to form a white precipitate of 2,4,6-tribromophenol.



What are the relative acidities of water,
phenol and ethanol?
(A-Level only)



What are the relative acidities of water, phenol and ethanol? **(A-Level only)**

Phenol > water > ethanol

Phenol is the most acidic.

Ethanol is the least acidic.



Explain the relative acidities of water,
phenol and ethanol
(A-Level only)



Explain the relative acidities of water, phenol and ethanol **(A-Level only)**

- Phenol is the most acidic because the phenoxide ion is relatively stable. The lone pair on the oxygen atom is delocalised into the pi system meaning the negative charge is dispersed among the carbon atoms so phenol is most likely to donate a hydrogen ion.
- Ethanol and water have similar acidities but ethanol is the least acidic. This is because of the positive inductive effect. The alkyl group in the ethoxide ion “pushes” electrons away from itself. This increases the electron density of the oxygen, making it more likely to bond to a hydrogen ion and reform ethanol.

