

WJEC (Wales) Chemistry A-level

Topic 4.3 - Alcohols and Phenols

Flashcards

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What is the difference between a primary, secondary and tertiary alcohol?



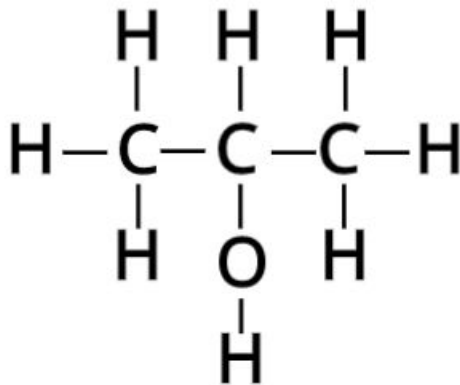
What is the difference between a primary, secondary and tertiary alcohol?

Consider the carbon atom which the alcohol group (-OH) is bonded to:

- If this carbon is bonded to only one other carbon, then it is called a primary alcohol.
- If this carbon is bonded to two carbons, then it is called a secondary alcohol.
- If this carbon is bonded to three carbons, then it is called a tertiary alcohol.

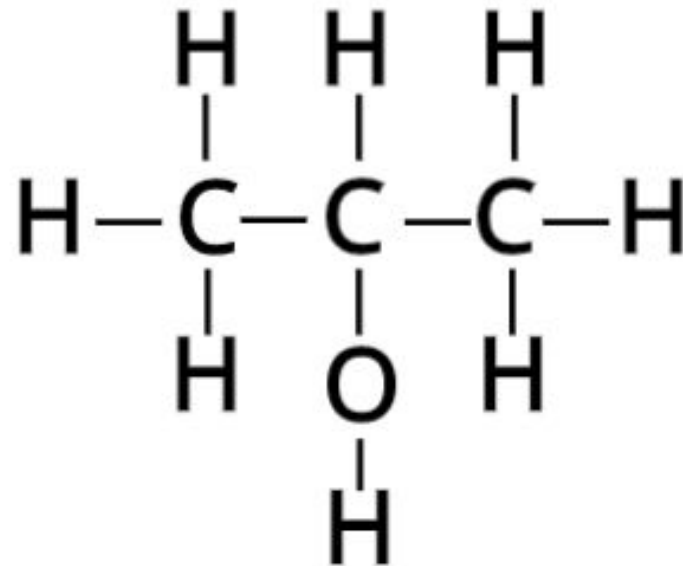


Identify the classification of the following alcohol



Identify the classification of the following alcohol

Secondary alcohol



What type of reaction can a halogenoalkane undergo to form an alcohol?



What type of reaction can a halogenoalkane undergo to form an alcohol?

Nucleophilic substitution



What reactants and conditions are required to form ethanol from bromoethane?



What reactants and conditions are required to form ethanol from bromoethane?

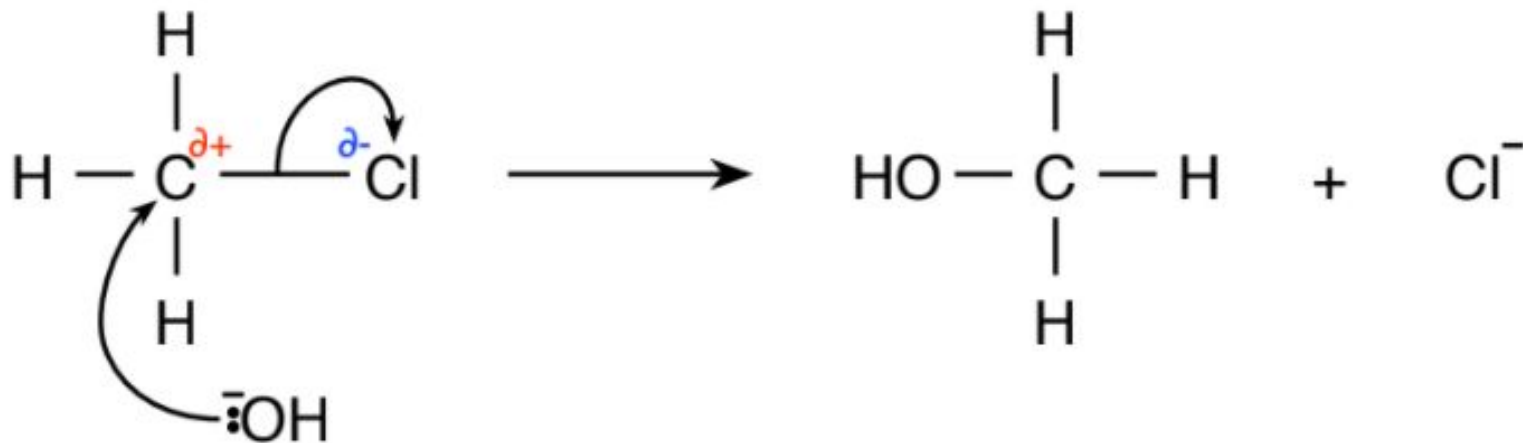
Warm aqueous sodium or potassium hydroxide ($\text{NaOH}_{(aq)}$ or $\text{KOH}_{(aq)}$)



Draw the mechanism for the reaction
which takes place between
chloromethane and warm aqueous
sodium hydroxide



Draw the mechanism for the reaction which takes place between chloromethane and warm aqueous sodium hydroxide



What acts as the nucleophile in the reaction between chloroethane and warm aqueous sodium hydroxide?



What acts as the nucleophile in the reaction between chloroethane and warm aqueous sodium hydroxide?

The hydroxide ion from sodium hydroxide: OH^-

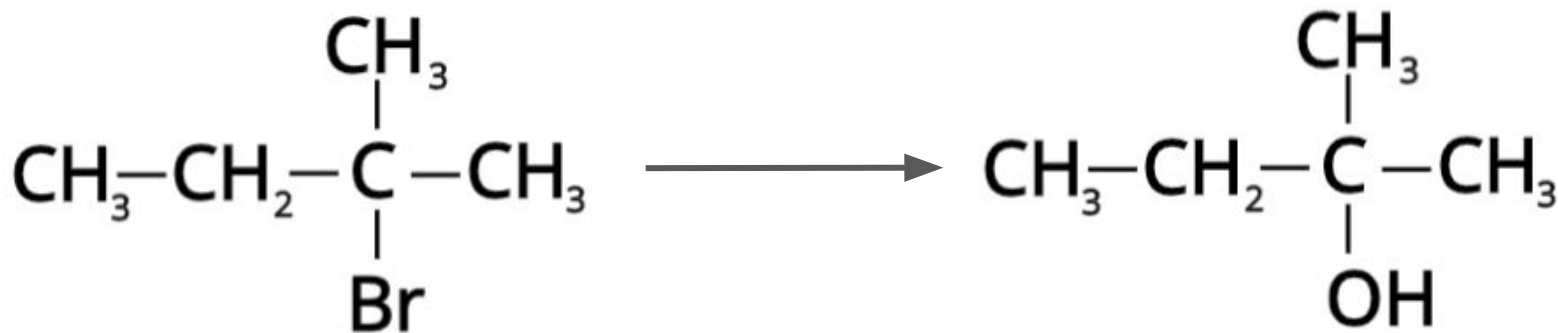


What is the classification of the alcohol formed if 2-bromo-2-methylbutane undergoes nucleophilic substitution with KOH?



What is the classification of the alcohol formed if 2-bromo-2-methylbutane undergoes nucleophilic substitution with KOH?

Tertiary alcohol



Give the reactants and conditions required for the formation of a hydroxynitrile from an aldehyde/ketone



Give the reactants and conditions required for the formation of a hydroxynitrile from an aldehyde/ketone

Potassium or sodium cyanide is added to sulfuric acid to produce hydrogen cyanide.

Temperature of 20°C .



Why is hydrogen cyanide not added directly to an aldehyde/ketone for a nucleophilic addition reaction?



Why is hydrogen cyanide not added directly to an aldehyde/ketone for a nucleophilic addition reaction?

Hydrogen cyanide is a very poisonous gas.

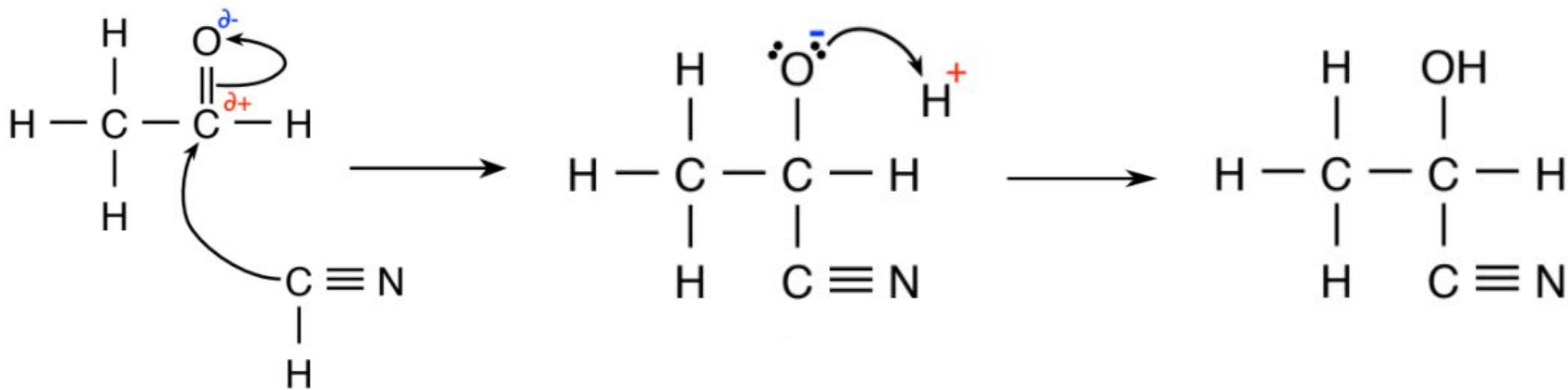


Draw and name the mechanism for the formation of 2-hydroxypropanenitrile from ethanal and hydrogen cyanide



Draw and name the mechanism for the formation of 2-hydroxypropanenitrile from ethanal and hydrogen cyanide

Nucleophilic addition



Name the type of reaction for the formation of alcohols from aldehydes and ketones



Name the type of reaction for the formation of alcohols from aldehydes and ketones

Reduction



What is the classification of the alcohols formed by the reduction of aldehydes and ketones?



What is the classification of the alcohols formed by the reduction of aldehydes and ketones?

Aldehydes will be reduced to primary alcohols.

Ketones will be reduced to secondary alcohols.



Give a reducing agent for the reduction of aldehydes and ketones to alcohols



Give a reducing agent for the reduction of aldehydes and ketones to alcohols

NaBH_4 dissolved in water with methanol



Write the chemical equation for the reduction of propanone to propan-2-ol



Write the chemical equation for the reduction of propanone to propan-2-ol



Name the mechanism for the reduction of propanal to propan-1-ol



Name the mechanism for the reduction of propanal to propan-1-ol

Nucleophilic addition



What reagent is required to reduce carboxylic acids to alcohols?



What reagent is required to reduce carboxylic acids to alcohols?



Why is NaBH_4 used for the reduction of aldehydes and ketones but not for carboxylic acids?



Why is NaBH_4 used for the reduction of aldehydes and ketones but not for carboxylic acids?

NaBH_4 is not reactive enough to reduce carboxylic acids.



Why are primary and secondary alcohols useful for organic synthesis reactions?



Why are primary and secondary alcohols useful for organic synthesis reactions?

The -OH functional group is able to react with various different compounds.



What type of organic product is produced in the reaction between alcohols and hydrogen halides?



What type of organic product is produced in the reaction between alcohols and hydrogen halides?

Halogenoalkanes



What catalyst is required for the reaction of primary and secondary alcohols with hydrogen chloride?



What catalyst is required for the reaction of primary and secondary alcohols with hydrogen chloride?

Anhydrous zinc chloride



What are the reagents required for the reaction of ethanol to form bromoethane?



What are the reagents required for the reaction of ethanol to form bromoethane?

Instead of directly adding hydrogen bromide, ethanol requires a mixture of potassium or sodium bromide and concentrated sulfuric acid. This will produce the hydrogen bromide which will react with ethanol to form bromoethane.



What reagents are required to replace the -OH group with an iodide atom?



What reagents are required to replace the -OH group in an alcohol with an iodide atom?

Sodium or potassium iodide is reacted with concentrated phosphoric acid. This produces hydrogen iodide which reacts with the alcohol, replacing the -OH group with an iodine atom.



What is the IUPAC name for the product of the reaction between 2-methylbutane-1,3-diol and excess hydrogen bromide?



What is the IUPAC name for the product of the reaction between 2-methylbutane-1,3-diol and excess hydrogen bromide?

1,3-dibromo-2-methylbutane



Name the mechanism for the reaction
between acyl chlorides and alcohols



Name the mechanism for the reaction between acyl chlorides and alcohols

Nucleophilic addition-elimination



Draw the mechanism for the reaction
between ethanoyl chloride and methanol



What is formed when an alcohol reacts with a carboxylic acid?



What is formed when an alcohol reacts with a carboxylic acid?

An ester



What is the functional group of an ester?



What is the functional group of an ester?

-COO-



What condition and catalyst is required for an esterification reaction?



What condition and catalyst is required for an esterification reaction?

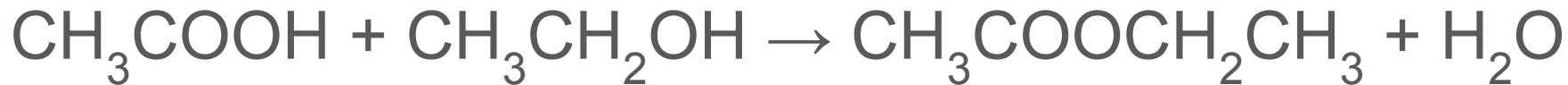
The alcohol and carboxylic acid must be heated in the presence of a strong acid catalyst, e.g. concentrated sulfuric acid.



Give the chemical equation for the reaction between ethanoic acid and ethanol



Give the chemical equation for the reaction between ethanoic acid and ethanol



Name the ester formed in the reaction between butanoic acid and propanol



Name the ester formed in the reaction between butanoic acid and propanol

Propyl butanoate



What are the identifying properties of esters?



What are the identifying properties of esters?

Esters are sweet smelling compounds which are often used in flavourings and perfumes. They have low boiling points and make good solvents for other polar molecules.

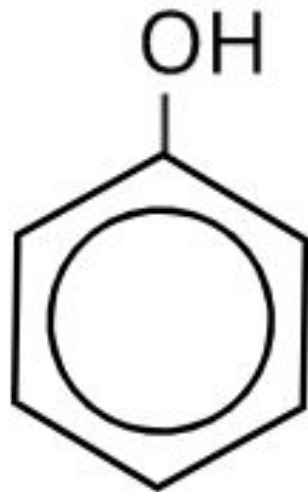


What is phenol?



What is phenol?

Phenol is an aromatic alcohol. It consists of a benzene ring and an -OH alcohol group.



What is the acidity of phenol?



What is the acidity of phenol?

Phenol is very weakly acidic. It has a pH between 5 and 6.



What can be observed when phenol reacts with bromine?



What can be observed when phenol reacts with bromine?

The bromine water will decolourise and a white precipitate will form.



Why does phenol generally react more readily than benzene?



Why does phenol generally react more readily than benzene?

The increased reactivity of phenol is because of the lone pair of electrons on the oxygen atom. This electron pair is delocalised into the ring structure. This increases the electron density of the ring, making it more susceptible to attack from electrophiles.



Considering the acidity of phenol, does phenol react with NaOH or Na₂CO₃?



Considering the acidity of phenol, does phenol react with NaOH or Na_2CO_3 ?

Phenol will react with NaOH but since it is only weakly acidic it will not react with Na_2CO_3 .



What is the IUPAC name of the product formed when phenol reacts with ethanoyl chloride?



What is the IUPAC name of the product formed when phenol reacts with ethanoyl chloride?

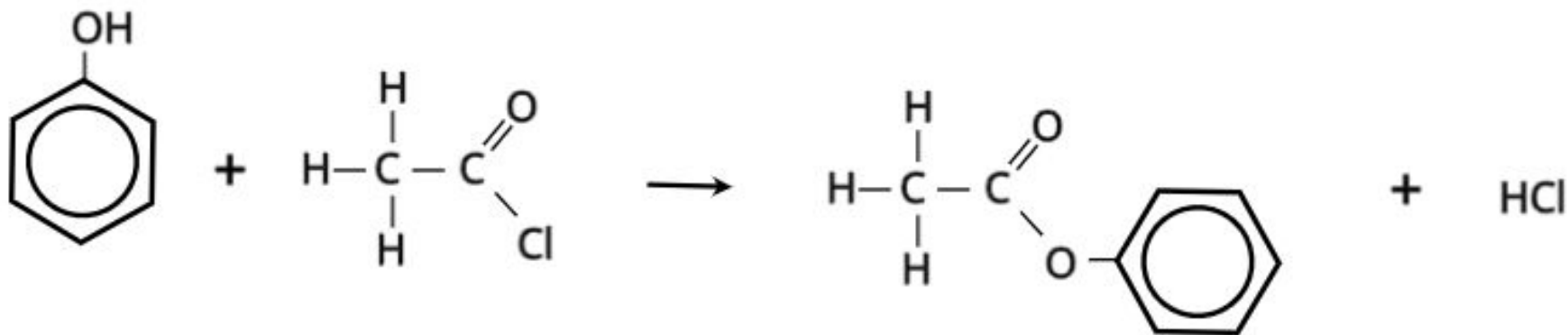
Phenyl ethanoate



Give the chemical equation for the reaction between phenol and ethanoyl chloride



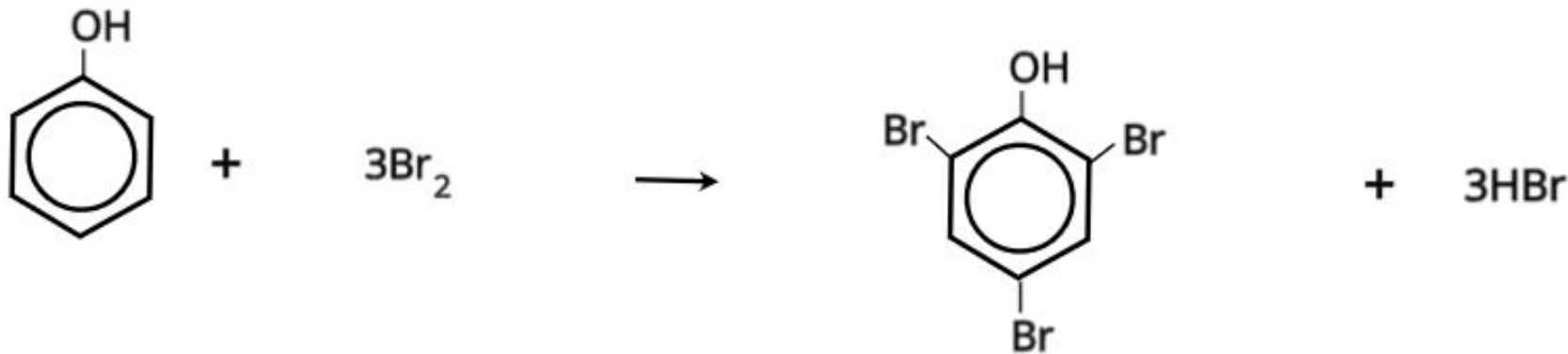
Give the chemical equation for the reaction between phenol and ethanoyl chloride



Give the chemical equation for the reaction between phenol and bromine



Give the chemical equation for the reaction between phenol and bromine



Describe the test for phenols



Describe the test for phenols

Aqueous ferric chloride (FeCl_3) can be used to test for the presence of phenols. Compounds containing phenols will cause the solution to turn a vivid purple, blue, green or red colour - depending on the nature of the phenol.



What is the observed colour change when ferric chloride is added to phenol?



What is the observed colour change when ferric chloride is added to phenol?

On the addition of ferric chloride, the solution will turn a vivid violet-purple colour.

