AQA Chemistry A-level

3.3.8: Aldehydes and Ketones

Detailed Notes

3.3.8.1 - Aldehydes and Ketones

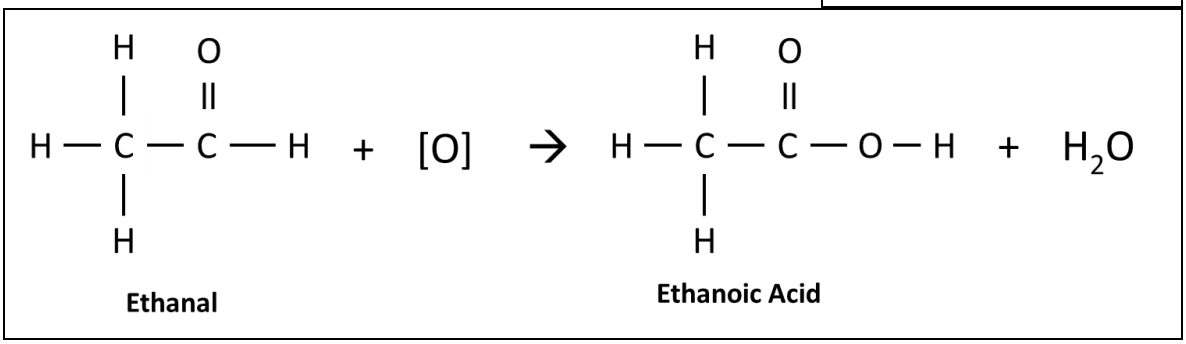
Aldehydes

These organic compounds are recognised by the **functional group -CHO** containing a **carbonyl group** (C=O). They are produced from the initial oxidation and distillation of 1° alcohols.

Aldehydes will readily **oxidise further**, in the presence of acidified potassium dichromate to produce **carboxylic acids**.

Example:

Image courtesy of anhourofchemaday.wordpress.com



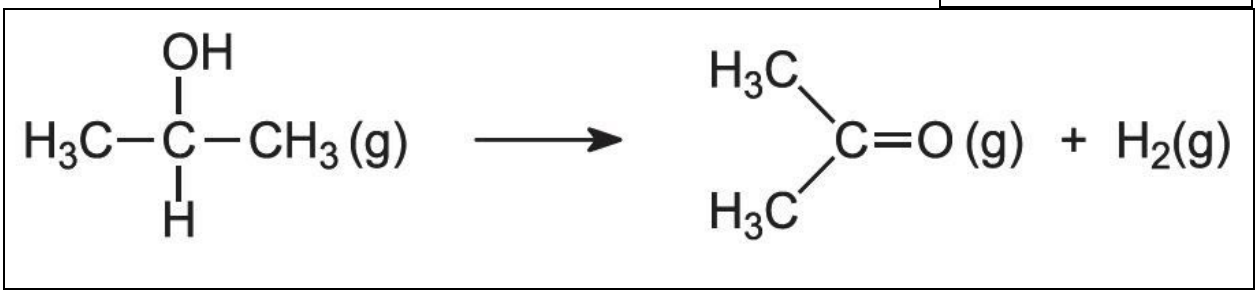
Aldehydes are tested for using **Tollen's reagent or Fehling's solution** as they produce a positive result in both tests if present.

Ketones

These organic compounds are recognised by the **functional group -C=O,** a carbonyl group. They are produced from the oxidation of 2° alcohols with acidified potassium dichromate.

Example:

Image courtesy of essentialchemicalindustry.org

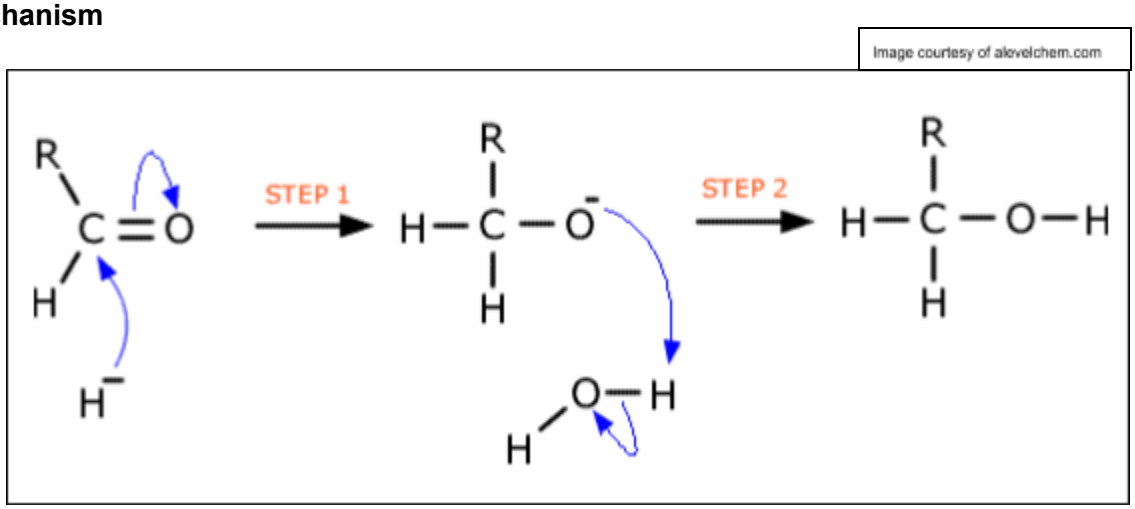


There is **no further oxidation of ketones** and they produce no visible change with both Tollen's reagent and Fehling's solution.

Reduction

All of the oxidation reactions involved in the production of the species above can be **reversed via reduction reactions**. In these reactions, a **reducing agent of $NaBH_4$** is used and it is an example of **nucleophilic addition**.

Mechanism

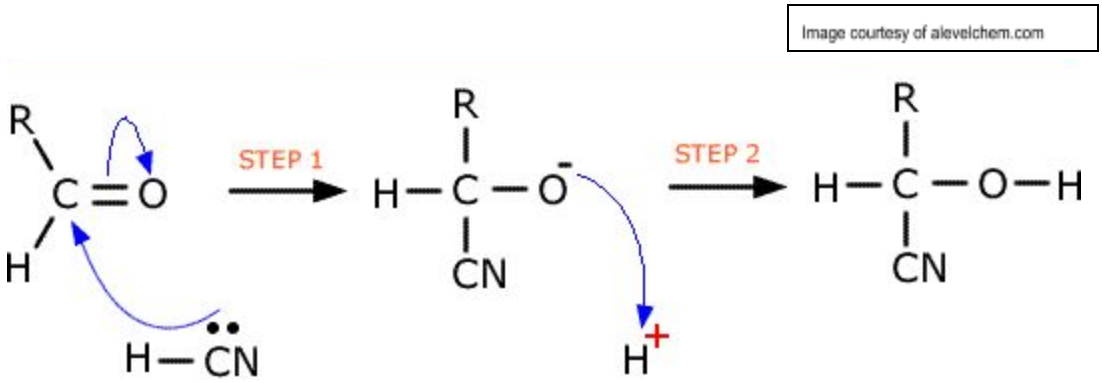


The reducing agent $NaBH_4$ provides the **$H:^-$ nucleophile**. However, a **H^+ ion** is also required so the reaction takes place under **aqueous** conditions.

Hydroxynitriles

Nucleophilic addition reactions can also take place with the **$:CN^-$ nucleophile**. This is a form of **synthesis** as it causes the carbon chain to be **extended** by one carbon atom. The product of the reaction is a **hydroxy-nitrile**.

Mechanism



KCN (potassium cyanide) is often used as the reagent to provide the nucleophile instead of **HCN** (hydrogen cyanide). This is because HCN is **hard to store** as a gas and reacts to produce **dangerous byproducts**.

Hydroxy-nitriles commonly contain a **chiral carbon centre** meaning optical isomers of the product exist. The :CN- nucleophile can attack from either above or below the double bond, causing different **enantiomers** to be produced.

Naming Hydroxynitriles

When naming these compounds, the carbon on the nitrile group is **included in the carbon chain** and is taken to be **carbon number one**.

Example:

The following compound is 2-hydroxypropanenitrile.