

# WJEC (Wales) Chemistry A-level

## Topic 4.4 - Aldehydes and Ketones

### Flashcards

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Name the type of reaction alcohols undergo to form aldehydes and ketones



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Oxidation



How can you tell whether the oxidation of an alcohol will produce an aldehyde or ketone?



How can you tell whether the oxidation of an alcohol will produce an aldehyde or ketone?

A primary alcohol will form an aldehyde when oxidised.

A secondary alcohol will form a ketone when oxidised.



Why is immediate distillation required for the oxidation of an alcohol to an aldehyde?



Why is immediate distillation required for the oxidation of an alcohol to an aldehyde?

The alcohol undergoes oxidation to form the aldehyde and the aldehyde must be distilled off immediately because otherwise it will undergo further oxidation to form a carboxylic acid.



What is a common oxidising agent used in the oxidation of alcohols?





What is a common oxidising agent used in the oxidation of alcohols?

Acidified potassium dichromate(VI)



What is observed when an alcohol undergoes oxidation by acidified potassium dichromate(VI)?



What is observed when an alcohol undergoes oxidation by acidified potassium dichromate(VI)?

The orange dichromate(VI) ion,  $\text{Cr}_2\text{O}_7^{2-}$ , is reduced to the green chromium(III) ion,  $\text{Cr}^{3+}$ .

This means the solution changes colour from orange to green.



What would be observed when acidified potassium dichromate is added to a tertiary alcohol?



What would be observed when acidified potassium dichromate is added to a tertiary alcohol?

The solution will remain orange because potassium dichromate(VI) does not react with tertiary alcohols as they cannot be oxidised.



Give the chemical equation for the oxidation of propan-2-ol to propanone



Give the chemical equation for the oxidation of propan-2-ol to propanone

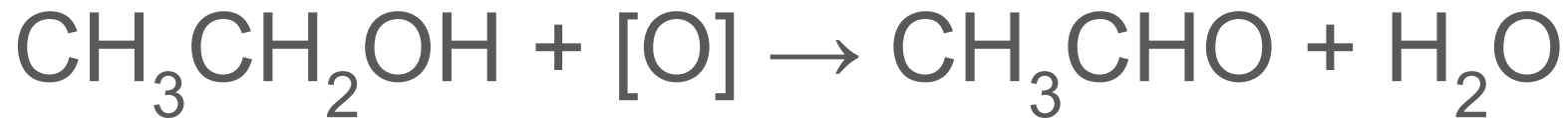


Give the chemical equation for the  
oxidation of ethanol to ethanal





Give the chemical equation for the oxidation of ethanol to ethanal



Name the two reagents which can be used to distinguish between aldehydes and ketones



Name the two reagents which can be used to distinguish between aldehydes and ketones

Tollens' reagent

Fehling's reagent



How can Tollens' reagent be used to determine whether you have an aldehyde or a ketone?



How can Tollen's reagent be used to determine whether you have an aldehyde or a ketone?

Tollen's reagent forms a silver mirror on the test tube only when warmed with an aldehyde and not a ketone.



How can Fehling's reagent be used to determine whether you have an aldehyde or a ketone?



How can Fehling's reagent be used to determine whether you have an aldehyde or a ketone?

Fehling's reagent is blue.

If Fehling's reagent is added to an aldehyde then the blue solution will form a brick red precipitate.

If Fehling's reagent is added to a ketone, nothing happens.



Name the type of reaction aldehydes and ketones undergo to form alcohols





Name the type of reaction aldehydes and ketones undergo to form alcohols

Reduction



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



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

Aldehydes will be reduced to a primary alcohol.

Ketones will be reduced to a secondary alcohol.



What is a common reducing agent used in the reduction of aldehydes and ketones to alcohols?



What is a common reducing agent used in the reduction of aldehydes and ketones to alcohols?

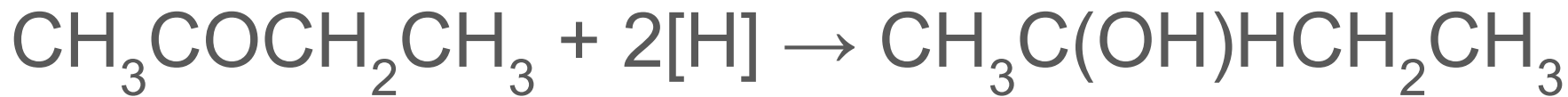
$\text{NaBH}_4$  dissolved in water with methanol



Give the chemical equation for the reduction of butanone to butan-2-ol



Give the chemical equation for the reduction of butanone to butan-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



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 and is also hard to store.

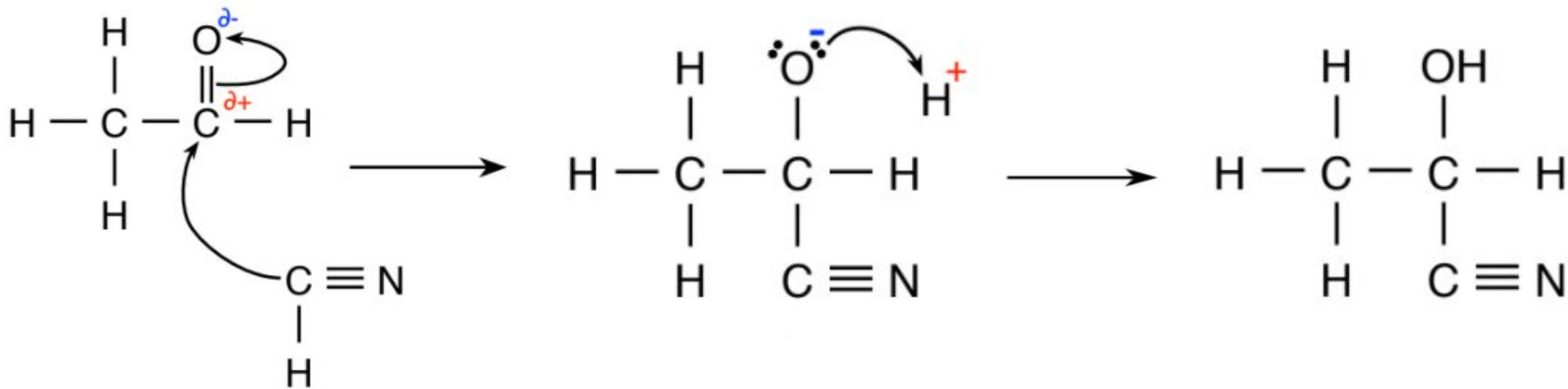


Draw and name the mechanism for the formation of 2-hydroxypropanenitrile from ethanal and hydrogen cyanide



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

Nucleophilic addition



# Why are hydroxynitriles important?





## Why are hydroxynitriles important?

Hydroxynitriles can be hydrolysed to form hydroxy acids which are very useful and are commonly used in the cosmetics industry.



How does the addition of HCN to ethanal affect the C-C chain length?



How does the addition of HCN to ethanal affect the C-C chain length?

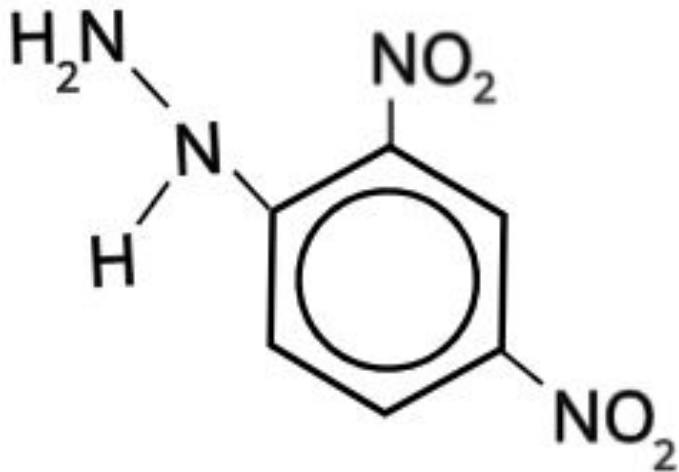
The C-C chain length will increase by one carbon atom due to the carbon atom in the cyanide ion,  $\text{CN}^-$ .



Give the structural formula for  
2,4-dinitrophenylhydrazine (2,4-DNP)



Give the structural formula for  
2,4-dinitrophenylhydrazine (2,4-DNP)



Name the type of reaction taking place when aldehydes and ketones react with 2,4-dinitrophenylhydrazine



Name the type of reaction taking place when aldehydes and ketones react with 2,4-dinitrophenylhydrazine

Nucleophilic addition-elimination reaction  
(condensation reaction)



How can 2,4-dinitrophenylhydrazine be used to test for aldehydes and ketones?





How can 2,4-dinitrophenylhydrazine be used to test for aldehydes and ketones?

An orange-yellow precipitate is formed when 2,4-dinitrophenylhydrazine reacts with aldehydes or ketones.



How can 2,4-dinitrophenylhydrazine be used to identify specific aldehydes and ketones?



How can 2,4-dinitrophenylhydrazine be used to identify specific aldehydes and ketones?

Add 2,4-DNP so that a precipitate forms. Purify the solid by recrystallisation. Compare the melting point of the pure crystals formed with the melting points of 2,4-dinitrophenylhydrazones of all the common aldehydes and ketones.



What reagents can be used for the triiodomethane (iodoform) test?



What reagents can be used for the triiodomethane (iodoform) test?

Iodine and sodium hydroxide solution

or

Potassium iodide and sodium chlorate(I) solutions



Describe the method and results of the triiodomethane test



## Describe the method and results of the triiodomethane test using iodine and sodium hydroxide

Iodine is added to a small amount of aldehyde/ketone, followed by some sodium hydroxide to remove the iodine colour. A very pale yellow precipitate will be formed if an aldehyde or ketone is present.



What is the triiodomethane (iodoform) test used to identify?





What is the triiodomethane (iodoform) test used to identify?

The triiodomethane test is used to identify  $\text{CH}_3\text{CO}-$  groups. This means it can be used to identify aldehydes and ketones.

