

## Carbonyl compounds – Reduction reactions

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Aldehydes and Ketones can undergo \_\_\_\_\_ reactions to produce \_\_\_\_\_ an \_\_\_\_\_. These are \_\_\_\_\_ reactions.

A reducing agent is used:

A reducing agent can be represented as:

Aldehydes are reduced to a \_\_\_\_\_ alcohol.

Reducing agent:

Conditions:

Ketones are reduced to a \_\_\_\_\_ alcohol.

Reducing agent:

Conditions:

$\text{LiAlH}_4$  is a much \_\_\_\_\_ reducing agent. This can also reduce a \_\_\_\_\_.

Reducing agent:

Conditions:

## Difference between $C=C$ and $C=O$

Both  $C=C$  and  $C=O$  have a \_\_\_\_\_ bond in them. This means they can both undergo \_\_\_\_\_ reactions. The \_\_\_\_\_ for this addition reaction is different.

This is due to the difference in \_\_\_\_\_ between the carbon and oxygen. Oxygen is more \_\_\_\_\_ therefore the  $C=O$  is \_\_\_\_\_.

This means \_\_\_\_\_ are attracted to the \_\_\_\_\_ carbon.

### Reaction mechanism:

(Reduction to an \_\_\_\_\_ )

The nucleophile is represented as \_\_\_\_\_.

### Explaining the mechanism:

1. The \_\_\_\_\_ pair on the \_\_\_\_\_ ion is attracted to the \_\_\_\_\_ carbon atom.
2. This forms a \_\_\_\_\_ bond between the \_\_\_\_\_ ion and the carbon atom of the  $C=O$ .
3. The \_\_\_\_\_ bond in the  $C=O$  breaks via \_\_\_\_\_ fission to form a charged intermediate.
4. The \_\_\_\_\_ pair on the \_\_\_\_\_ charged oxygen atom forms a covalent bond with H atom in water. The \_\_\_\_\_ bond breaks to form a \_\_\_\_\_ ion. This is known as \_\_\_\_\_ by water.

### Overall equation:

## Reaction of carbonyl compounds with HCN

This is used to increase the chain length which is useful in organic synthesis.

A mixture of sodium cyanide ( ) and an acid is used to provide HCN as HCN is an extremely liquid.

The product formed is called a .

### Reaction mechanism:

(Reduction to a ).

1. The pair on the ion is attracted to the carbon atom.
2. This forms a bond between the ion and the carbon atom of the  $C=O$ .
3. The bond in the  $C=O$  breaks via fission to form a charged intermediate.
4. The charged oxygen donates a pair of electrons to a ion. This is known as .

### Overall equation:

### Naming hydroxynitriles

The CN is always position .

**Questions:**

**1) Write the overall equation and describe the mechanism when butanal is reduced using  $\text{NaBH}_4$ . Name the product.**

**2) Write the overall equation and describe the mechanism between butanone and hydrogen cyanide. Name the product.**