



Organic Chemistry Revision Sheets

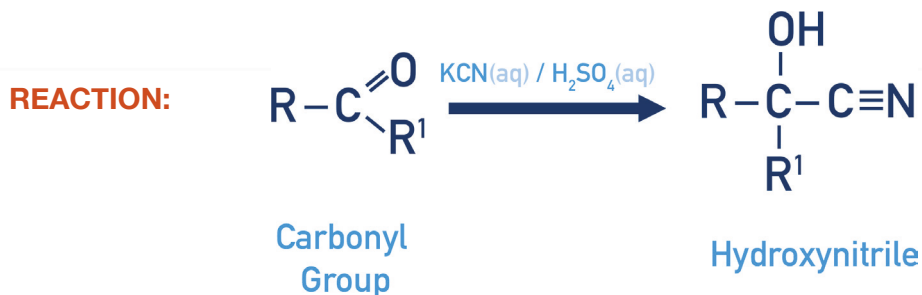
Carbonyl Compounds | Nucleophilic Addition (KCN, H⁺)

Reaction

REACTANTS: Carbonyl (aldehyde or ketone) and KCN (in acid)

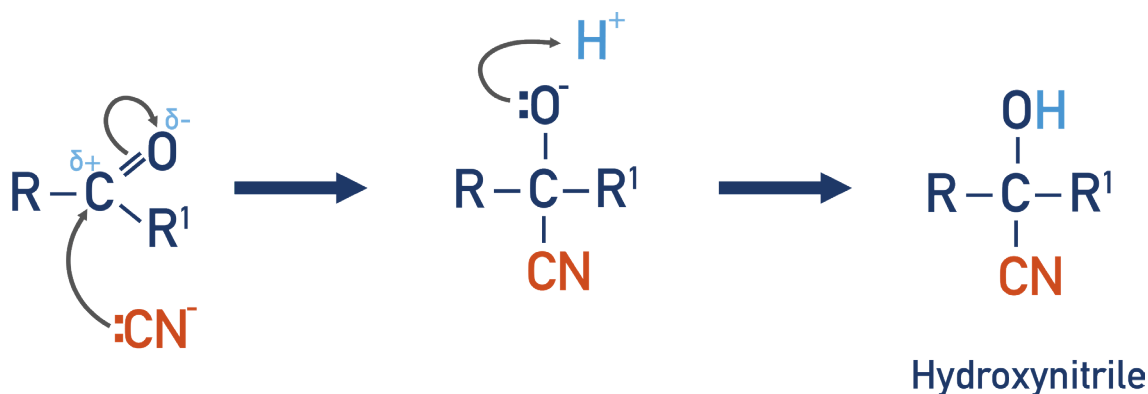
PRODUCT: Hydroxynitrile

REACTION TYPE: Nucleophilic Addition



Mechanism

Cyanide ion (:CN⁻) comes from KCN(aq) and **acts as a nucleophile due to its lone pair of electrons, attacking the carbon (with partial positive charge) in the carbonyl group**. Carbon-carbon bond forms. The carbon-oxygen double bond breaks to a single bond, giving the oxygen a negative charge. The negative oxygen is protonated in dilute acid (H₂SO₄), forming a hydroxyl group. Hydroxynitrile is formed. CN and H are added to the carbonyl. **Addition reaction.**



Notes:

- HCN is sometimes written as the reactant, but HCN is very reactive and dangerous however. By using KCN in dilute acid, the same product can be formed as with HCN.



- If a chiral carbon centre is formed in the product, the final product mixture will be **racemic** containing both enantiomers in a 50:50 ratio. This is because carbonyl groups are planar and there is equal chance of the :CN⁻ nucleophile attacking the carbonyl group from above or below the plane - producing two possible enantiomers in equal amounts.