

I. The Carbonyl Group

pages 743-752

(i) The **C=O** double bond is central to the chemistry of not just **aldehydes** and **ketones**, but also **carboxylic acids** and their **derivatives**. The geometry around the carbonyl carbon is planar due to the **SP²** hybridization. The electronic structure has a δ^+ on the carbon and a bond dipole of 2-4 Debyes from the carbon to the oxygen.

(ii) The general reactions of the carbonyl group can be classified as follows :

- | | | |
|-----|--|---------|
| A.1 | Nucleophilic Addition | ANIMATE |
| A.2 | Nucleophilic Addition followed by dehydration | ANIMATE |
| B. | Nucleophilic Acyl Substitution | ANIMATE |
| C. | Reactions at the α -carbon : enolate anion formation | ANIMATE |

II. Aldehydes / Ketones : Nomenclature

pages : 754-756

- (i) - locate the longest continuous chain containing the C=O group and replace the *-ane* suffix with *-al* for aldehydes and *-one* for ketones
 - number the chain from the end containing the C=O group
 - number all substituents and place names in alphabetical order
 - when identified as a substituent the C=O group is termed the **acyl** group

III. Aldehydes / Ketones : Reactions involving Nucleophilic Addition pages : 760-764

General features of many of these reactions include :

- the attacking nucleophile can be either charged (⁻OMe) or neutral (HOMe)
- aldehydes are generally more reactive than ketones for **steric** & **electronic** reasons
- many reactions can be catalyzed by both base **and** acid
- many, if not most, of these reactions are **reversible** in nature (i.e. involve equilibria)

Specific reactions of interest :

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pages : 777-780

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- Amine addition - 1^o amines add with dehydration to give **imines** , while 2^o amines add with dehydration to give **enamines**. ANIMATE1 ANIMATE2
- Acetal / Ketal formation - involves the addition of two alcohol molecules under acidic conditions. ANIMATE
- Conjugate Addition - these are reactions possible with α,β - unsaturated ketones, often termed **enones**. Nucleophilic addition is now possible at the β -carbon, often called **Michael addition**. ANIMATE

IV. Aldehydes / Ketones : Miscellaneous - the protecting group

pages : 682-683

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This is the general process for **protecting** the carbonyl group during a reaction ANIMATE

- formation of the inert derivative - involves **acetal/ketal** formation, often using ethylene glycol, with removal of water
- carrying out the specified reaction
- removal of the acetal / ¹ketal using simple hydrolysis under **aqueous acid** conditions