

## 6.1.2 Carbonyl compounds

<b>Reactions of carbonyl compounds</b>					
(a) oxidation of aldehydes using $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$ (i.e. $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ ) to form carboxylic acids					
(b) nucleophilic addition reactions of carbonyl compounds with: (i) $\text{NaBH}_4$ to form alcohols (ii) $\text{HCN}$ [i.e. $\text{NaCN}_{(\text{aq})}/\text{H}^+_{(\text{aq})}$ ], to form hydroxynitriles (see also 6.2.4 b)					
(c) the mechanism for nucleophilic addition reactions of aldehydes and ketones with $\text{NaBH}_4$ and $\text{HCN}$					
<b>Characteristic tests for carbonyl compounds</b>					
(d) use of 2,4-dinitrophenylhydrazine to: (i) detect the presence of a carbonyl group in an organic compound (ii) identify a carbonyl compound from the melting point of the derivative					
(e) use of Tollens' reagent (ammoniacal silver nitrate) to: (i) detect the presence of an aldehyde group (ii) distinguish between aldehydes and ketones, explained in terms of the oxidation of aldehydes to carboxylic acids with reduction of silver ions to silver.					

## 6.1.3 Carboxylic acids and esters

<b>Properties of carboxylic acids</b>					
(a) explanation of the water solubility of carboxylic acids in terms of hydrogen bonding					
(b) reactions in aqueous conditions of carboxylic acids with metals and bases (including carbonates, metal oxides and alkalis)					
<b>Esters</b>					
(c) esterification of: (i) carboxylic acids with alcohols in the presence of an acid catalyst (e.g. concentrated $\text{H}_2\text{SO}_4$ ) (ii) acid anhydrides with alcohols					
(d) hydrolysis of esters: (i) in hot aqueous acid to form carboxylic acids and alcohols (ii) in hot aqueous alkali to form carboxylate salts and alcohols					
<b>Acyl chlorides</b>					
(e) the formation of acyl chlorides from carboxylic acids using $\text{SOCl}_2$					
(f) use of acyl chlorides in synthesis in formation of esters, carboxylic acids and primary and secondary amides.					