

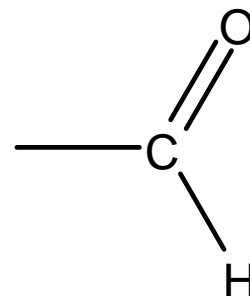
# Chemistry 3.5

## Advanced Organic Chemistry

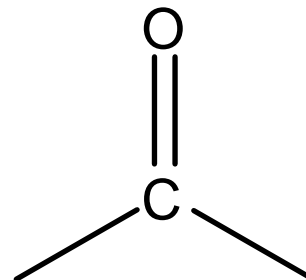
Aldehydes and Ketones

# Carbonyl group

- Carbonyl group, C=O
- If the carbonyl group located in the 1<sup>st</sup> carbon, it is an aldehyde (suffix *anal*)



- If the carbonyl group located within the chain, it is a ketone (suffix *an-#-one*)



# Aldehyde oxidation

As mentioned before

- Aldehydes can be further oxidized to form carboxylic acid



- This can be done by oxidising agent such as  $\text{KMnO}_4$  or  $\text{K}_2\text{Cr}_2\text{O}_7$
- $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  can oxidize  $1^\circ$ ,  $2^\circ$  alcohol as well as aldehyde because they are strong oxidising agent

# Tollens and Benedict/Feblings

- Tollens reagent as well as Benedict/ Feblings reagent are mild oxidising agent
- They only oxidize aldehydes and not alcohols
- Tollens  $[\text{Ag}(\text{NH}_3)_2]^+$ 
  - Colourless  $\rightarrow$  shiny grey solid (or silver mirror)
  - $[\text{Ag}(\text{NH}_3)_2]^+ + e^- \rightarrow \text{Ag} + 2 \text{NH}_3$
- Benedict/Feblings  $\text{Cu}^{2+}$  complex
  - Blue to red-brown precipitate
  - $\text{H}_2\text{O} + 2\text{Cu}^{2+} + e^- \rightarrow \text{Cu}_2\text{O} + 2\text{H}^+$

# Reduction of Aldehyde and Ketone

- With a strong reducing agent  $\text{NaBH}_4/\text{OH}^-$ , ketone and aldehyde can be reduced back to the respective alcohols.
- However,  $\text{NaBH}_4$  is not strong enough to reduce carboxylic acid back to aldehyde.