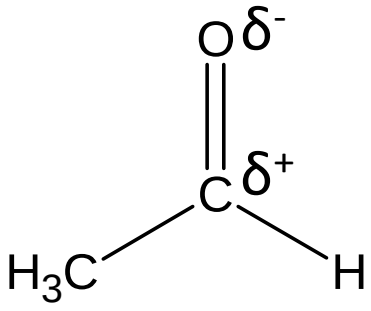
Aldehydes and Ketones

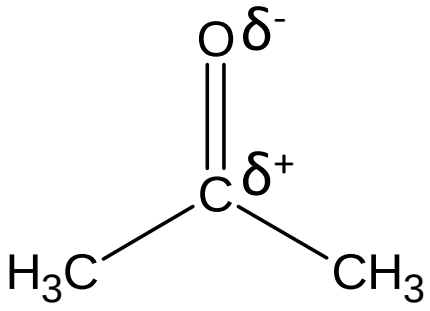
What intermolecular forces do you think aldehydes and ketones have?

How will these intermolecular forces affect their:

- Melting and boiling points compared to alkanes
- Solubility in water



aldehyde



ketone

Dipole-dipole intermolecular forces but not hydrogen bonding

Naming aldehydes and ketones

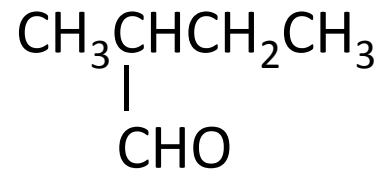
Aldehydes are named with the suffix –anal
Ketones are named with the suffix –anone

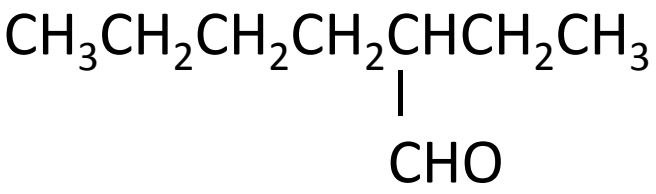
Name and classify the following compounds:

$CH_3CH_2CH_2CH_2CH_2CH_2CHO$

$CH_3CH_2COCH_2CH_2CH_3$

$CH_3CH(CH_3)COCH_2CH_3$





Making aldehydes and ketones

How could you prepare a sample of butanal and butanone?

Aldehydes and ketones are prepared by the oxidation (using $KMnO_4/H^+$ or $K_2Cr_2O_7/H^+$) of alcohols.

Aldehydes are prepared by the oxidation of primary alcohols (using distillation to prevent forming the carboxylic acid).
Ketones are prepared by the oxidation of secondary alcohols.

What alcohol could be used to form the following compounds?

2-hexanone

butanal

3-chloropropanal

2-methylpentan-3-one

Reactions of aldehydes and ketones

The focus this year is telling the difference between aldehydes and ketones. We can do this in many ways.

Aldehydes are better reductants than ketones.

1. **Oxidation** – aldehydes can be oxidised with $KMnO_4/H^+$ (purple to colourless) or $K_2Cr_2O_7/H^+$ (orange to green), ketones can not.

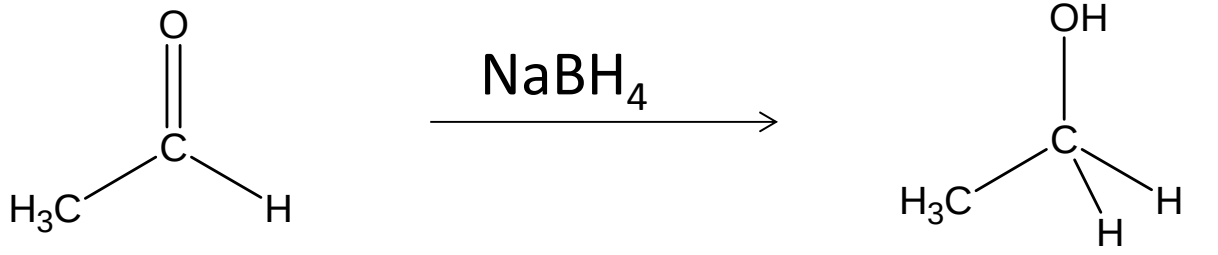
2. **Benedict's or Fehling's solution** – blue Cu^{2+} solution, different anions. Aldehydes can reduce the Cu^{2+} to Cu^+ which forms a red precipitate, ketones do not react.

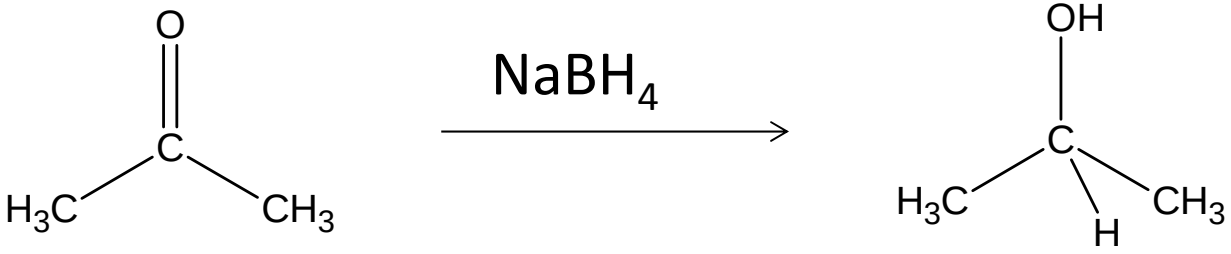
3. **Tollens' reagent** – $AgNO_{3(alc)}$. Aldehydes can reduce Ag^+ to Ag forming a 'silver mirror', ketones do not react.

Reactions of aldehydes and ketones

<u>Reduction</u>

Aldehydes and ketones can be reduced with $NaBH_4$ to alcohols.
Aldehydes are reduced to primary alcohols.
Ketones are reduced to secondary alcohols.





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Exam questions

Usually focus on distinguishing between compounds with a reagent and observations or filling in a reaction scheme.

2012 exam Q1 b)
2014 exam Q2 a) (ii)
2013 sample exam Q3