A-LEVEL CHEMISTRY • HOLIDAY HOMEWORK

17 Aldehydes and ketones – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
aldehyde			
ketone			
C=O carbonyl			
reduction			
hydrogen cyanide			
nucleophilic addition			

Recall

From the Alcohols sheet you know that oxidising an alcohol can give an **aldehyde** or a **ketone** . Both contain the **C=O carbonyl** group.

- They are made by oxidising alcohols.
- The carbonyl carbon is slightly positive, so it is attacked by nucleophiles.

Nothing here is harder than IGCSE – it just adds the reactions.

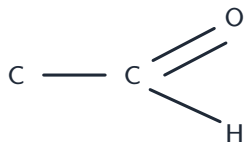
New ideas

Read these first, then do the Practice.

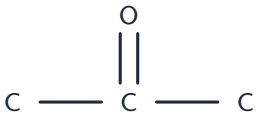
1 Aldehyde vs ketone

Both have the **C=O** group, but in a different place:

- in an **aldehyde** the C=O carbon is on the **end** of the chain (it also has an H) – written –CHO.
- in a **ketone** the C=O carbon is in the **middle**, between two carbons.



aldehyde (end)



ketone (middle)

2 Making and reducing them

- oxidise a **primary** alcohol (with distillation) → an **aldehyde**.
- oxidise a **secondary** alcohol → a **ketone**.
- **reduction** ($NaBH_4$ or $LiAlH_4$) turns them back into alcohols.

3 Nucleophilic addition

The reaction with **hydrogen cyanide** (HCN) is a **nucleophilic addition** . The carbonyl carbon is $\delta+$ (oxygen pulls the electrons):

1. the **CN^-** nucleophile attacks the $\delta+$ carbon.
2. the C=O breaks, leaving a negative oxygen (O^-).
3. the O^- takes an H^+ to finish the product.

CN^- attacks

hydroxynitrile

Watch out: an aldehyde has its C=O at the *end* of the chain (–CHO); a ketone has it in the *middle*. The HCN reaction is *addition* – the C=O opens and nothing leaves (unlike substitution).

Practice

Try these in order.

17.1 Name the functional group in aldehydes and ketones. [1]

17.2 State where the C=O group sits in (a) an aldehyde, (b) a ketone. [2]

17.3 Which class of alcohol is oxidised to a ketone? [1]

17.4 What is formed when an aldehyde is reduced? [1]

17.5 Why is the carbonyl carbon open to attack by a nucleophile? [2]

17.6 Name the type of mechanism when HCN reacts with a carbonyl compound. [1]

17.7 Challenge. Explain why the reaction of a carbonyl compound with HCN is called nucleophilic *addition* rather than substitution. [2]