

## 4.5.5 Names, carbon counts and completed organic formulae

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ Total: **33** marks

**KEY WORDS** displayed formula • skeletal formula

### Objective

Convert names into structural, displayed and skeletal formulae for carbonyls, acids, acyl chlorides and esters. Questions and completed answer drawings are original.

### 1 Key knowledge and worked examples

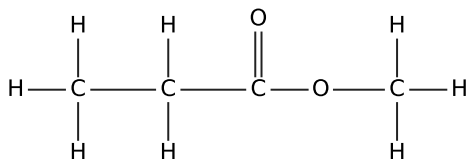
Count the carbonyl carbon as part of the named parent chain. An aldehyde ends in  $\text{-CHO}$ ; a ketone has carbon groups on both sides of  $\text{C=O}$ . A carboxylic acid ends in  $\text{-COOH}$ ; an acyl chloride in  $\text{-COCl}$ . An ester is  $\text{R-CO-O-R'}$ : its alkyl name comes from  $\text{R'}$  and its alkanoate name includes the carbonyl carbon on the acid side.

#### ■ Worked name-to-structure route

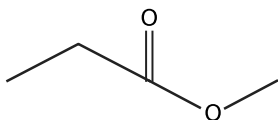
For methyl propanoate, the acid-side parent has three carbons including  $\text{C=O}$ ; the alcohol-side methyl adds one more. The condensed structural formula is  $\text{CH}_3\text{CH}_2\text{COOCH}_3$ , molecular formula  $\text{C}_4\text{H}_8\text{O}_2$ . Do not attach the methyl directly to carbonyl carbon: the ester oxygen must lie between it and the acid-side carbonyl.

#### Methyl propanoate

Displayed formula



Skeletal formula



A displayed formula shows every atom and bond. A skeletal formula uses unlabelled carbon ends/vertices with implied H to complete carbon valence; show O, Cl and any H bonded to oxygen explicitly. A double line to O is  $\text{C=O}$ , not another carbon atom. Check that each carbon has total bond order four and oxygen has its appropriate bonding.

## 2 Practice

**2.1** Draw displayed and skeletal formulae for propanal. Give its condensed structural formula. [5]

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**2.2** Draw displayed and skeletal formulae for propanone. Give its condensed structural formula and explain the naming difference from propanal. [6]

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**2.3** Draw displayed and skeletal formulae for propanoic acid. Give its condensed structural formula. [5]

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### 3 Exam-style questions

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**3.1** Draw displayed and skeletal formulae for propanoyl chloride. Give its condensed structural formula and state the organic product with water. [6]

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**3.2** An ester gives methanol and propanoic acid on acid hydrolysis. Name it, give its condensed structural formula, and draw its displayed and skeletal formulae. [6]

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**3.3** Give condensed structural formulae for ethyl ethanoate and methyl propanoate. Show that their molecular formulae are the same, explain their structural-isomer relationship and predict their different hydrolysis alcohols. [5]

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