

Exercise walk-through

4.5.5

Names, carbon counts and completed organic formulae

Pearson Edexcel · International A-Level · Chemistry

Find the temperature boundary

Your turn

$\Delta H = +36.0 \text{ kJ mol}^{-1}$; $\Delta S(\text{system}) = +120 \text{ J mol}^{-1} \text{ K}^{-1}$. Which condition gives positive total entropy?

- A. T below 300 K
- B. T above 300 K
- C. Every temperature
- D. No temperature

Hydrogen bonds require a donor and acceptor

- 1** Carbonyl O accepts a hydrogen bond from water. Simple aldehydes/ketones lack an O–H donor.
- 2** Acids form hydrogen-bonded associations; compare similar-sized molecules for boiling points.
- 3** A longer non-polar chain can reduce water solubility without removing the polar group.

Independent structural identification

Your turn

$\text{C}_3\text{H}_6\text{O}$ has two carbon-13 signals, gives iodoform and no Tollens' silver. Which structure fits?

- A. Propanal
- B. Propanone
- C. Propan-1-ol
- D. Ethanoic acid

Exercise 2.1

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

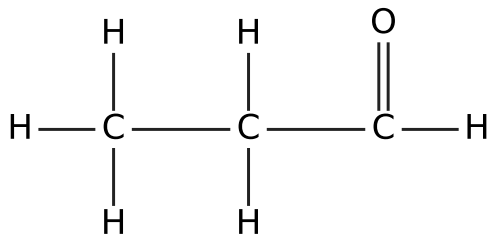
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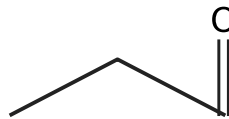
2.1 $\text{CH}_3\text{CH}_2\text{CHO}$.

Propanal

Displayed formula



Skeletal formula



Displayed: B1 correct carbon skeleton/terminal carbonyl and B1 all H/bonds correct.
 Skeletal: B1 three-carbon skeleton with terminal $\text{C}=\text{O}$ and B1 correct implied carbon valences.

Exercise 2.2

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

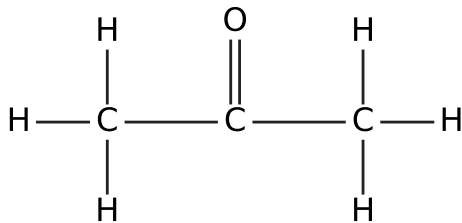
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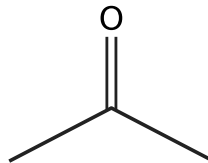
2.2 CH_3COCH_3 ; the $-\text{one}$ suffix denotes an internal ketone carbonyl, whereas $-\text{al}$ denotes the terminal aldehyde group.

Propanone

Displayed formula



Skeletal formula



Displayed: B1 correct carbon skeleton/central carbonyl and B1 all H/bonds correct.
Skeletal: B1 three-carbon skeleton with internal $\text{C}=\text{O}$ and B1 correct implied carbon valences.

Exercise 2.3

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

3 Exam-style questions

Exercise 2.3

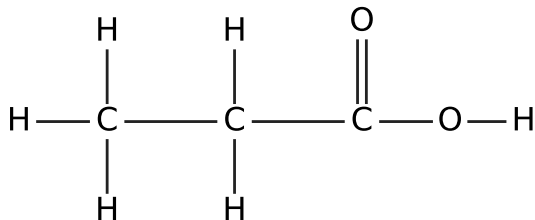
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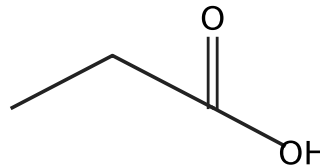
2.3 $\text{CH}_3\text{CH}_2\text{COOH}$.

Propanoic acid

Displayed formula



Skeletal formula



Displayed: B1 correct acid skeleton and B1 every atom/bond correct. Skeletal: B1 three-carbon acid-side skeleton and B1 $\text{C}=\text{O}$ plus explicitly shown OH.

Exercise 3.1

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

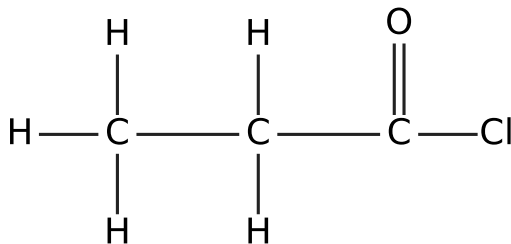
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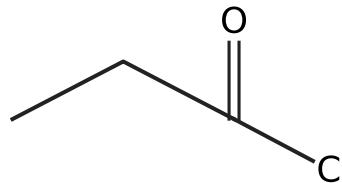
3.1 $\text{CH}_3\text{CH}_2\text{COCl}$; water gives propanoic acid, with HCl also formed.

Propanoyl chloride

Displayed formula



Skeletal formula



Displayed: B1 correct acyl skeleton and B1 all atoms/bonds correct. Skeletal: B1 three-carbon skeleton and B1 terminal $\text{C}=\text{O}/\text{Cl}$ connectivity.

Exercise 3.2

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]

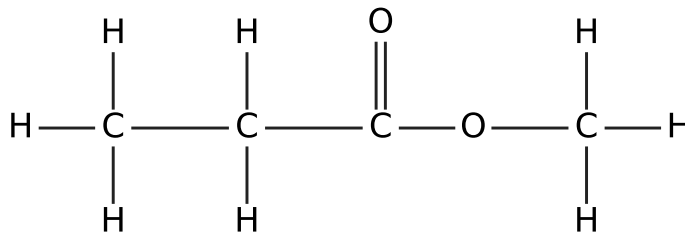
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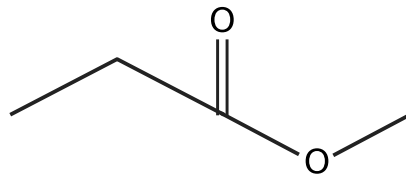
3.2 Methyl propanoate, $\text{CH}_3\text{CH}_2\text{COOCH}_3$.

Methyl propanoate

Displayed formula



Skeletal formula



Displayed: B1 correct three-carbon acid-side skeleton and B1 $-\text{CO}-\text{O}-\text{CH}_3$ with all H correct. Skeletal: B1 correct acid-side skeleton/ $\text{C}=\text{O}$ and B1 explicit ester O with one carbon on its methyl side.

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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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3.3 $\text{CH}_3\text{COOCH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{COOCH}_3$. Both have $\text{C}_4\text{H}_8\text{O}_2$; same molecular formula but different atom connectivity makes them structural isomers. Their hydrolysis alcohols are ethanol and methanol respectively.