

Exercise walk-through

Formulas, functional groups and the naming of organic compounds ■ 13.1

eXercise

You must be able to

- define hydrocarbon and explain what a functional group is
- interpret and use general, molecular, structural, displayed and skeletal formulas
- name simple organic molecules systematically

Method — Functional groups and formulas

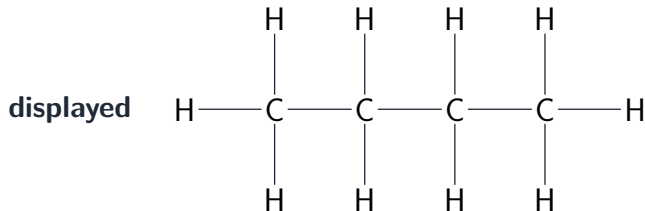
A **hydrocarbon** contains only C and H. A **functional group** is the reactive part that dictates a compound's properties (e.g. -OH in alcohols).

- **general** (family pattern, e.g. alkanes $\text{C}_n\text{H}_{2n+2}$); **molecular** (C_4H_{10}); **structural** ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$); **displayed** (every bond drawn); **skeletal** (lines; C at corners).

Method — Functional groups and formulas

molecular C_4H_{10}

structural $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$



skeletal



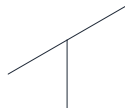
Butane shown four ways: molecular, structural, displayed and skeletal

Method — Functional groups and formulas

chain

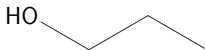


butane

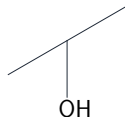


2-methylpropane

positional



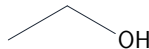
propan-1-ol



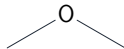
OH

propan-2-ol

functional



ethanol (alcohol)



methoxymethane (ether)

Naming distinguishes structural isomers

Method — Naming

Stem for carbons (meth/eth/prop/but/pent/hex = 1–6); ending for the functional group; numbers for positions. E.g. $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ = propan-2-ol.

Practice 2.1 ■ 1 mark

Define the term **hydrocarbon**.

Solution 2.1

Method: Functional groups and formulas

Worked steps

a compound made up of only carbon and hydrogen atoms **B1**.

Practice 2.2 ■ 1 mark

Give the molecular formula of the alkane with 5 carbons (using C_nH_{2n+2}).

Solution 2.2

Method: Functional groups and formulas

Worked steps

C_5H_{12} **B1**.

Exam-style 3.1 ■ 1 mark

Which formula shows the simplest whole-number ratio of atoms?

A molecular

B empirical

C displayed

D skeletal

Solution 3.1

Method: Functional groups and formulas

A molecular

B empirical 

C displayed

D skeletal

Worked steps

B. The empirical formula is the simplest whole-number ratio.

Exam-style 3.2 ■ 1 mark

What is the name of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$?

A propan-1-ol

B propan-2-ol

C propanal

D propanoic acid

Solution 3.2

Method: Functional groups and formulas

A propan-1-ol



B propan-2-ol

C propanal

D propanoic acid

Worked steps

A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is propan-1-ol.

Exam-style 3.3 ■ 2 marks

- (a) Draw the skeletal formula of 2-methylbutane.
- (b) Give the structural formula of butan-2-ol.

Solution 3.3

Method: Functional groups and formulas

Worked steps

(a) a four-carbon zigzag with a methyl branch on the second carbon **M1** **A1** *chain, branch in the correct place.*

(b) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ **B1**.

Exam-style 3.4 ■ 2 marks

Explain why all members of a homologous series have similar chemical properties.

Solution 3.4

Method: Functional groups and formulas

Worked steps

they all have the same functional group **M1**, which determines their chemical reactions **A1**.