A-LEVEL CHEMISTRY • EXERCISE SHEET

13.1 Formulas, functional groups and naming of organic compounds

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS alkane 烷烃 • functional group 官能团 • hydrocarbon 碳氢化合物 • nomenclature 命名法 • skeletal formula 骨架式

Objective

Build the skills to answer exam questions on **formulas, functional groups and naming** — **hydrocarbons** 碳氢化合物, **functional groups** 官能团, the types of formula, and systematic **nomenclature** 命名法.

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

1 Worked examples

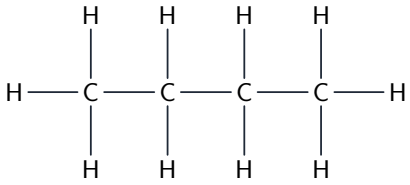
■ Functional groups and formulas

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).

molecular C_4H_{10}

structural $CH_3CH_2CH_2CH_3$

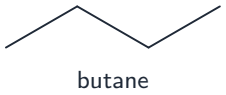
displayed



skeletal

The same molecule shown as molecular, structural, displayed and skeletal formulas

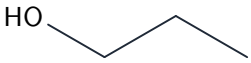
chain



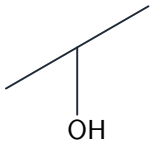
butane

2-methylpropane

positional

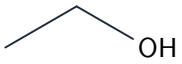


propan-1-ol

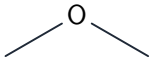


propan-2-ol

functional



ethanol (alcohol)



methoxymethane (ether)

Naming distinguishes structural isomers

- **general** (family pattern, e.g. alkanes C_nH_{2n+2}); **molecular** (C_4H_{10}); **structural** ($CH_3CH_2CH_2CH_3$); **displayed** (every bond drawn); **skeletal** (lines; C at corners).

Naming

Stem for carbons (meth/eth/prop/but/pent/hex = 1–6); ending for the functional group; numbers for positions. E.g. $CH_3CH(OH)CH_3$ = propan-2-ol.

2 Practice

2.1 Define the term **hydrocarbon**. [1]

2.2 Give the molecular formula of the alkane with 5 carbons (using C_nH_{2n+2}). [1]

3 Exam-style questions

3.1 Which formula shows the simplest whole-number ratio of atoms? [1]

- **A** molecular
- **B** empirical
- **C** displayed
- **D** skeletal

3.2 What is the name of $CH_3CH_2CH_2OH$? [1]

- **A** propan-1-ol
- **B** propan-2-ol
- **C** propanal
- **D** propanoic acid

3.3 (a) Draw the skeletal formula of 2-methylbutane. [2]

(b) Give the structural formula of butan-2-ol. [1]

3.4 Explain why all members of a homologous series have similar chemical properties. [2]

Solutions

2.1 a compound made up of only carbon and hydrogen atoms.

2.2 C_5H_{12}.

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

3.2 A. $CH_3CH_2CH_2OH$ is propan-1-ol.

3.3 (a) a four-carbon zigzag with a methyl branch on the second carbon.
(b) $CH_3CH(OH)CH_2CH_3$.

3.4 they all have the same functional group, which determines their chemical reactions.