

Introduction to Organic Chemistry Map

Edexcel A Level Chemistry · Topic 6A

1 Types of formula

6A.2

- Molecular:** the actual atoms, C_4H_{10}
- Empirical:** simplest ratio, C_2H_5
- General:** a whole series, C_nH_{2n+2}
- Structural:** $CH_3CH_2CH_2CH_3$
- Displayed:** every bond drawn
- Skeletal:** corners and ends are C; H on C not drawn



2 Homologous series

6A.3

- Same functional group and same general formula
- Neighbouring members differ by CH_2
- Similar chemical reactions (the functional group reacts)
- Gradual trend in physical properties: boiling point rises with chain length
- Cycloalkanes: C_nH_{2n}

3 Naming (IUPAC)

6A.4

- Stem:** the longest chain with the group (meth, eth, prop, but, pent, hex, hept, oct, non, dec)
- Number for the lowest numbers
- Branches in alphabetical order; di-, tri- for repeats
- Commas between numbers; dashes between numbers and letters



4 Structural isomers

6A.6

- Same molecular formula, different structural formula
- Chain:** a different skeleton (butane, 2-methylpropane)
- Position:** the group moves (propan-1-ol, propan-2-ol)
- Functional group:** a different group (propanal, propanone)
- Isomer counts: C_4H_{10} 2, C_5H_{12} 3, C_6H_{14} 5

5 Breaking bonds

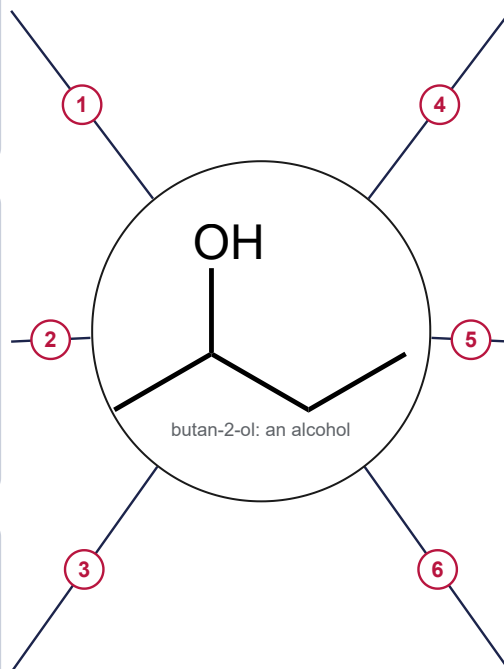
6B.15, 6C.23

- Homolytic:** one electron to each atom → free radicals (fish-hook arrows)
- Heterolytic:** both electrons to one atom → ions (full arrow)
- Free radical:** a species with an unpaired electron, e.g. $Cl\cdot$
- Electrophile:** an electron pair acceptor, e.g. H^+ , $Br^{\delta+}$

6 Types of reaction

6A.5

- Addition:** two molecules make one ($C_2H_4 + Br_2$)
- Substitution:** an atom or group is replaced ($CH_4 + Cl_2$)
- Oxidation:** gains O or loses H; **reduction:** the reverse
- Polymerisation:** monomers → polymer
- Elimination:** loses H_2O or HX ; **hydrolysis:** water splits it



Functional groups the group decides the family, the name and the reactions

Family	Functional group	Name ending / prefix	General formula	Example
alkane	$C-C$, $C-H$ only	-ane	C_nH_{2n+2}	propane, $CH_3CH_2CH_3$
alkene	$C=C$	-ene	C_nH_{2n}	propene, $CH_2=CHCH_3$
halogenoalkane	$C-X$ ($X = Cl, Br, I$)	chloro-, bromo-, iodo-	$C_nH_{2n+1}X$	1-bromopropane, $CH_3CH_2CH_2Br$
alcohol	$-OH$	-ol	$C_nH_{2n+1}OH$	propan-2-ol, $CH_3CH(OH)CH_3$
aldehyde	$-CHO$	-al	$C_nH_{2n}O$	propanal, CH_3CH_2CHO
ketone	$C=O$ inside the chain	-one	$C_nH_{2n}O$	propanone, CH_3COCH_3
carboxylic acid	$-COOH$	-oic acid	$C_nH_{2n}O_2$	propanoic acid, CH_3CH_2COOH
ester	$-COO-$	alkyl -oate	$C_nH_{2n}O_2$	methyl ethanoate, CH_3COOCH_3

Worked examples

Seven reaction types

- Addition, elimination, substitution, hydrolysis
- Oxidation (gains O, loses H); reduction (the reverse)
- Polymerisation; one reaction can have two labels (hydrogenation: addition and reduction)

Naming: a worked example

- $(CH_3)_2CHCH(CH_3)CH_2CH_3$: longest chain 5 (pentane)
- two methyls on C2 and C3
- **2,3-dimethylpentane**

Isomers of C_5H_{12}

- pentane (a chain of 5)
- 2-methylbutane (4 + one branch)
- 2,2-dimethylpropane (3 + two branches)
- cyclopentane is C_5H_{10} : not an isomer

Skeletal formulae: every line is a $C-C$ bond; each carbon has enough H atoms to make four bonds.



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