

29.1 Formulas, functional groups and naming

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS benzene 苯 • functional group 官能团 • aromatic 芳香 • benzene ring 苯环
 • systematic nomenclature 系统命名法

Objective

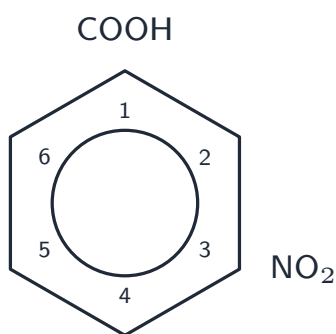
Build the skills to answer exam questions on **naming organic compounds** 有机化合物命名 — functional groups, the four kinds of formula, and **systematic nomenclature** 系统命名法 of aliphatic and **aromatic** 芳香 molecules.

You must be able to:

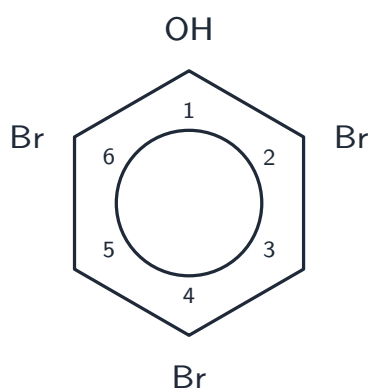
- identify the functional group that dictates a compound's properties
- interpret general, structural, displayed and skeletal formulas
- name aliphatic molecules (up to six carbons, incl. single rings)
- name simple aromatic molecules with one benzene ring (e.g. 3-nitrobenzoic acid)

1 Worked examples

■ Naming an aromatic compound

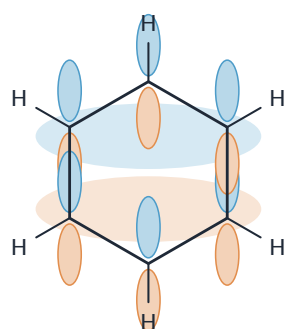


3-nitrobenzoic acid



2,4,6-tribromophenol

Number the ring from the principal group (carbon 1); the substituent positions give the name



one **delocalised** π system
above and below the ring

sp^2 σ framework;
all six C–C bonds equal

The delocalised benzene ring

Name $C_6H_4(NO_2)(COOH)$ with the groups on carbons 1 and 3.

- the $-COOH$ is the principal group $\rightarrow$ parent is **benzoic acid**, its carbon is **C1**
- the $-NO_2$ is on **C3** $\rightarrow$ prefix **3-nitro**
- name: **3-nitrobenzoic acid**

Skeletal vs displayed. A skeletal formula shows each bond as a line, with carbons at the ends/bends and hydrogens on carbon left out; a displayed formula shows every atom and bond.

2 Practice

2.1 State what is meant by a **functional group**.

[1]

2.2 Name the compound: a benzene ring with an $-OH$ on C1 and $-Br$ on C2, C4 and C6.

[1]

3 Exam-style questions

3.1 The skeletal formula of a compound has 5 line-ends and bends in a chain with a terminal $-COOH$. Which feature does a skeletal formula leave out?

[1]

A	B
C	D

- A** the functional group
- B** carbon atoms
- C** hydrogen atoms bonded to carbon
- D** the longest chain

3.2 Which is the correct systematic name for the molecule with an -NH_2 on C2 of a 4-carbon carboxylic acid? [1]

A	B
C	D

A 2-aminobutanoic acid

B butan-2-amine

C 2-aminobutanal

D aminobutanoic acid

3.3 Give the systematic name of: [3]

(a) a benzene ring carrying one -CH_3 and one -NO_2 on adjacent carbons (methyl on C1)

(b) the cyclic alcohol cyclohexanol

(c) propanenitrile, $\text{CH}_3\text{CH}_2\text{CN}$

3.4 Draw the **skeletal** formula of 3-nitrobenzoic acid. [2]

3.5 A compound **W** has the skeletal structure of a five-carbon chain with a methyl branch on carbon 2, a C=C between carbons 3 and 4, and an OH on carbon 1. Its molecular formula is C₆H₁₂O.

(a) Give the systematic name of **W**, and explain how the position numbers are chosen. [3]

(b) Give the empirical formula and the general formula of the homologous series to which **W**'s alcohol group belongs. [2]

(c) Draw the displayed formula of **W**. [3]

(d) Name **two** functional groups present in **W**, and for each state one reagent that would react with it. [4]
