29.1 Formulas, functional groups and naming

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

KEY WORDS benzene 苯 • functional group 官能团 • benzene ring 苯环 • aromatic 芳香 • systematic nomenclatur

Objective

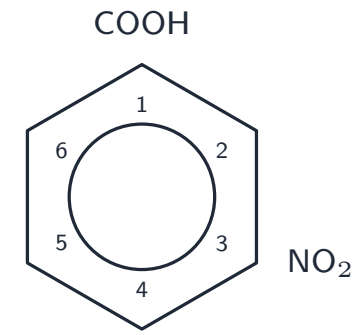
Build the skills to answer exam questions on **naming organic compounds** 有机化合物命名 — functional groups, the four kinds of formula, and **systematic nomenclature** 系统命名法 of aliphatic and **aromatic** 芳香 molecules.

You must be able to:

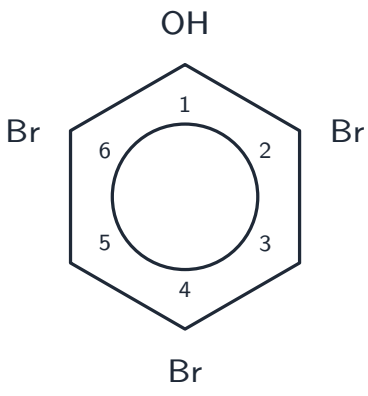
- identify the functional group that dictates a compound's properties
- interpret general, structural, displayed and skeletal formulas
- name aliphatic molecules (up to six carbons, incl. single rings)
- name simple aromatic molecules with one benzene ring (e.g. 3-nitrobenzoic acid)

1 Worked examples

■ Naming an aromatic compound

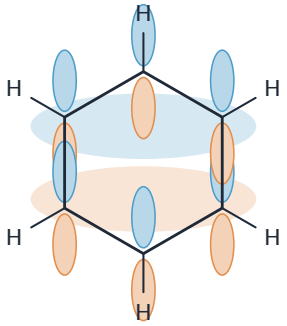


3-nitrobenzoic acid



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 → parent is **benzoic acid**, its carbon is **C1**
- the $–NO_2$ is on **C3** → 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** 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** 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, CH_3CH_2CN

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

Solutions

2.1 an atom or group of atoms that gives a molecule its characteristic chemical (and physical) properties.

2.2 2,4,6-tribromophenol.

3.1 C. A skeletal formula omits the hydrogen atoms bonded to carbon (and the carbons are shown only as line-ends/bends).

3.2 A. 2-aminobutanoic acid — the –COOH is C1, the $–NH_2$ is on C2.

3.3 (a) 2-methylnitrobenzene / 1-methyl-2-nitrobenzene
(b) cyclohexanol
(c) propanenitrile.

3.4 a benzene hexagon with –COOH drawn at C1 and $–NO_2$ at C3.