

Exercise walk-through

Formulas, functional groups and the naming of organic compounds ■ 29.1

eXercise

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)

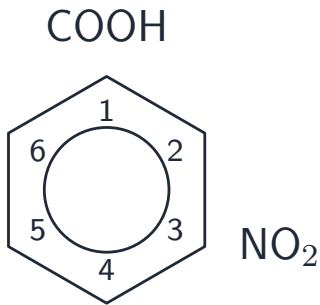
Method — Naming an aromatic compound

Name $\text{C}_6\text{H}_4(\text{NO}_2)(\text{COOH})$ with the groups on carbons 1 and 3.

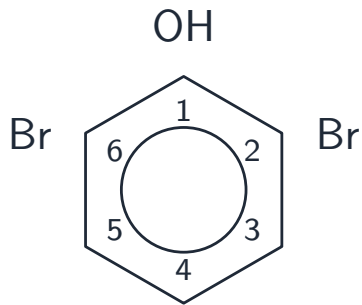
- the $-\text{COOH}$ is the principal group $\rightarrow$ parent is **benzoic acid**, its carbon is **C1**
- the $-\text{NO}_2$ is on **C3** $\rightarrow$ prefix **3-nitro**
- name: **3-nitrobenzoic acid**

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.

Method — Naming an aromatic compound



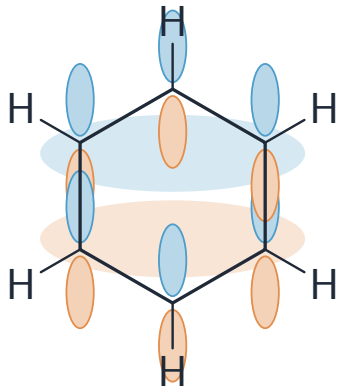
3-nitrobenzoic acid



Br

2,4,6-tribromophenol

Method — Naming an aromatic compound



one **delocalised** π system
above and below the ring
 sp^2 σ framework;
all six C–C bonds equal

The delocalised benzene ring

Practice 2.1 ■ 1 mark

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

Solution 2.1

Worked steps

an atom or group of atoms that gives a molecule its characteristic chemical (and physical) properties **B1**.

Practice 2.2 ■ 1 mark

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

Solution 2.2

Method: Naming an aromatic compound

Worked steps

2,4,6-tribromophenol **B1**.

Exam-style 3.1 ■ 1 mark

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?

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

Solution 3.1

Method: Naming an aromatic compound

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

Worked steps

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

Exam-style 3.2 ■ 1 mark

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

A 2-aminobutanoic acid

B butan-2-amine

C 2-aminobutanal

D aminobutanoic acid

Solution 3.2

Method: Naming an aromatic compound

A 2-aminobutanoic acid



B butan-2-amine

C 2-aminobutanal

D aminobutanoic acid

Worked steps

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

Exam-style 3.3 ■ 3 marks

Give the systematic name of:

- (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, $\text{CH}_3\text{CH}_2\text{CN}$

Solution 3.3

Method: Naming an aromatic compound

Worked steps

- (a) 2-methylnitrobenzene / 1-methyl-2-nitrobenzene **B1**
- (b) cyclohexanol **B1**
- (c) propanenitrile **B1**.

Exam-style 3.4 ■ 2 marks

Draw the **skeletal** formula of 3-nitrobenzoic acid.

Solution 3.4

Method: Naming an aromatic compound

Worked steps

a benzene hexagon **M1** with -COOH drawn at C1 and -NO_2 at C3 **A1**.