

Exercise walk-through

Alkanes ■ 11.4

eXercise

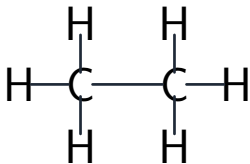
You must be able to

- describe alkanes as saturated and generally unreactive
- write combustion equations (complete/incomplete)
- describe the photochemical substitution with chlorine

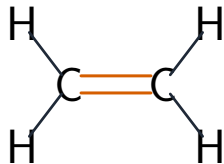
Method — Alkane reactions

- **combustion (complete):** $\text{alkane} + \text{O} \rightarrow \text{CO} + \text{H}_2\text{O}$.
- **substitution:** $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{UV}} \text{CH}_3\text{Cl} + \text{HCl}$ (needs UV light).

Method — Alkane reactions



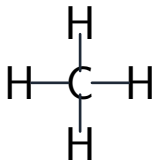
ethane C_2H_6
saturated: single C–C bond



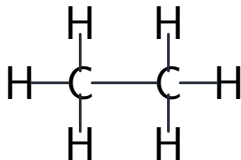
ethene C_2H_4
unsaturated: C=C double bond

Ethane (single C–C) vs ethene (C=C)

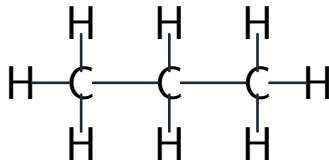
Method — Alkane reactions



methane
 CH_4



ethane
 C_2H_6



propane
 C_3H_8

each step adds a CH_2 unit

general formula $\text{C}_n\text{H}_{2n+2}$

Alkanes form a homologous series

Practice 2.1 ■ 1 mark

State why alkanes are described as saturated.

Solution 2.1

Method: Alkane reactions

Worked steps

they have only single carbon–carbon bonds **B1**.

Practice 2.2 ■ 2 marks

Name the products of the complete combustion of an alkane.

Solution 2.2

Method: Alkane reactions

Worked steps

carbon dioxide **B1**; water **B1**.

Exam-style 3.1 ■ 1 mark

The reaction of methane with chlorine requires:

A a nickel catalyst

B ultraviolet light

C steam

D high pressure only

Solution 3.1

A a nickel catalyst

B ultraviolet light 

C steam

D high pressure only

Worked steps

B. The substitution needs ultraviolet light.

Exam-style 3.2 ■ 2 marks

Methane reacts with chlorine in ultraviolet light.

- (a) Write the equation for the reaction.
- (b) Name this type of reaction.

Solution 3.2

Worked steps

(a) $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$ **M1** **A1**.

(b) substitution **B1**.

Exam-style 3.3 ■ 2 marks

Write a balanced equation for the complete combustion of ethane, C_2H_6 .

Solution 3.3

Method: Alkane reactions

Worked steps

$2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ **M1** **A1** *formulae, balanced.*