

11.4 Alkanes

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS alkanes 烷烃 • substitution 取代 • ultraviolet light 紫外线 • combustion 燃烧 • homologous series 同系列

Objective

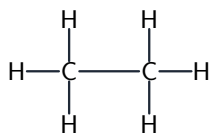
Build the skills to answer exam questions on **alkanes** 烷烃 — saturated hydrocarbons, **combustion** 燃烧, and **substitution** 取代 with chlorine.

You must be able to:

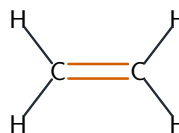
- describe alkanes as saturated and generally unreactive
- write combustion equations (complete/incomplete)
- describe the photochemical substitution with chlorine

1 Worked examples

■ Alkane reactions

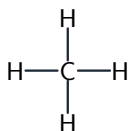


ethane C_2H_6
saturated: single C–C bond

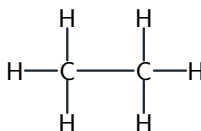


ethene C_2H_4
unsaturated: C=C double bond

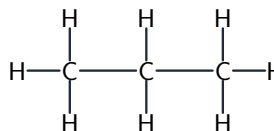
Alkanes are saturated (single bonds only), so they are generally unreactive



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

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

2 Practice

2.1 State why alkanes are described as saturated. [1]

2.2 Name the products of the complete combustion of an alkane. [2]

3 Exam-style questions

3.1 The reaction of methane with chlorine requires: [1]

- **A** a nickel catalyst
- **B** ultraviolet light
- **C** steam
- **D** high pressure only

3.2 Methane reacts with chlorine in ultraviolet light.

(a) Write the equation for the reaction. [2]

(b) Name this type of reaction. [1]

3.3 Write a balanced equation for the complete combustion of ethane, C_2H_6 . [2]

Solutions

2.1 they have only single carbon–carbon bonds.

2.2 carbon dioxide; water.

3.1 B. The substitution needs ultraviolet light.

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

(b) substitution.

3.3 $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$.