

11.4 Alkanes

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS ultraviolet light 紫外线 • substitution 取代 • alkanes 烷烃 • combustion 燃烧
• hydrogen 氢气

Objective

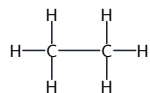
Build the skills to answer exam questions on **alkanes** 烷烃 — saturated hydrocarbons, **combustion** 燃烧, and **substitution** 取代 with chlorine.

You must be able to:

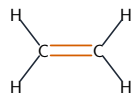
- describe alkanes as saturated and generally unreactive
- write combustion equations (complete/incomplete)
- describe the photochemical substitution with chlorine

1 Worked examples

■ Alkane reactions



ethane C₂H₆
saturated: single C–C bond

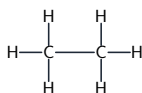


ethene C₂H₄
unsaturated: C=C double bond

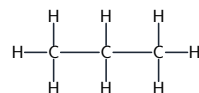
Alkanes are saturated (single bonds only), so they are generally unreactive



methane
CH₄



ethane
C₂H₆



propane
C₃H₈

each step adds a CH₂ unit general formula C_nH_{2n+2}

Alkanes form a homologous series

- combustion (complete):** alkane + O₂ → CO₂ + H₂O.
- substitution:** CH₄ + Cl₂ $\xrightarrow{\text{UV}}$ CH₃Cl + 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	B
C	D

- 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, C₂H₆. [2]

3.4 Methane, CH_4 , is the first member of the alkanes.

(a) State what is meant by a *saturated hydrocarbon*, and give the general formula of the alkanes. [3]

(b) Write the balanced equation for the complete combustion of methane, and state one danger of **in**complete combustion. [3]

(c) Methane reacts with chlorine in ultraviolet light. Name the type of reaction, write the equation for the first step, and state why light is needed. [3]

(d) Draw the displayed formula of ethane, and explain why alkanes are generally unreactive. [3]