11 Hydrocarbons and fuels – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
Organic chemistry	有机化学			
hydrocarbon	碳氢化合物			
Petroleum	石油			
homologous series	同系物			
alkanes	烷烃			
saturated	饱和			
alkenes	烯烃			
unsaturated	不饱和			
fractions	馏分			
fractional distillation	分馏			
volatility	挥发性			
Cracking	裂化			
catalyst	催化剂			
Combustion	燃烧			
bromine water	溴水			

Recall

Organic chemistry 有机化学 is the chemistry of carbon compounds. A **hydrocarbon** 碳氢化合物 is a compound made of hydrogen and carbon only.

- **Petroleum** 石油 (crude oil) is a mixture of many hydrocarbons.
- Carbon is special: it joins to other carbon atoms to make long chains.

Nothing here is hard — it just gives names to families of molecules.

New ideas

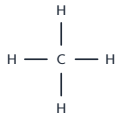
Read these first, then do the Practice.

1 Two families of hydrocarbon

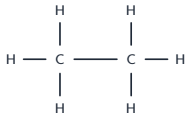
A **homologous series** 同系物 is a family of compounds with similar chemical properties and the same general formula. Two to know:

Family	Bonds	General formula
alkanes 烷烃	single C–C only (**saturated** 饱和)	C_nH_{2n+2}
alkenes 烯烃	one C=C double bond (**unsaturated** 不饱和)	C_nH_{2n}

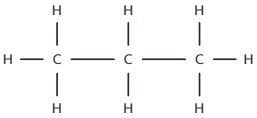
The start of the name gives the number of carbons (*meth-* = 1, *eth-* = 2, *prop-* = 3); the ending gives the family (*-ane* or *-ene*).



methane CH_4



ethane C_2H_6



propane C_3H_8

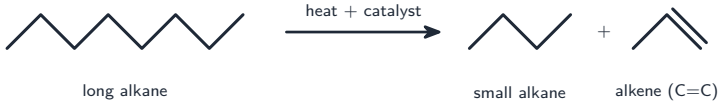
2 Fractional distillation

Petroleum is separated into useful **fractions** 馏分 by **fractional distillation** 分馏. The oil is heated; the gases rise up a tall column that is hot at the bottom and cool at the top, so each fraction turns back to liquid at a different height.

Going up the column the molecules get smaller, with lower boiling points and higher **volatility** 挥发性 (they turn to gas more easily).

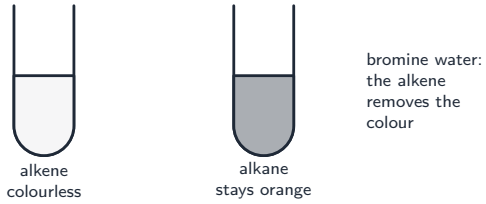
3 Cracking

Long alkane molecules are not very useful. **Cracking** 裂化 breaks them into smaller, more useful molecules — a smaller alkane plus an alkene — using a high temperature and a **catalyst** 催化剂.



4 Two reactions to know

- **Combustion** 燃烧: hydrocarbons burn in plenty of oxygen to give carbon dioxide and water.
- **Test for a C=C**: shake the compound with orange **bromine water** 溴水. An alkene turns it colourless; an alkane leaves it orange.



Watch out: alkanes are *saturated* (single bonds only, C_nH_{2n+2}); **alkenes** are *unsaturated* (one C=C, C_nH_{2n}). Only an **alkene** decolourises bromine water — that is the test for the C=C double bond.

Practice

Try these in order.

11.1 What is a *hydrocarbon*? [1]

11.2 Give the general formula of (a) the alkanes and (b) the alkenes. [2]

11.3 Name the process used to separate petroleum into fractions. [1]

11.4 What does *cracking* do, and why is it useful? [2]

11.5 Describe the test that tells an alkene from an alkane, and the result for each. [2]

11.6 Challenge. Propene is an alkene with 3 carbon atoms. Write its molecular formula, and state what you would see when it is shaken with bromine water. [3]