5 Enthalpy changes – Part 2

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)		
Hess's law	盖斯定律			
specific heat capacity	比热容			
energy cycle	能量循环			

Recall

From Part 1 you know ΔH is the enthalpy change. Here we **measure** it in the lab and combine values using **Hess's law** 盖斯定律.

- A reaction that heats up water transfers a known amount of heat.
- Energy is conserved, so different routes give the same total.

New ideas

Read these first, then do the Practice.

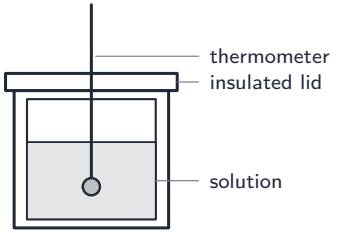
1 Measuring enthalpy change

When a reaction heats a known mass of water or solution, the heat transferred is:

$$q = mc\,\Delta T$$

where m = mass (g), c = **specific heat capacity** 比热容, ΔT = temperature change. Per mole:

$$\Delta H = -\frac{mc\,\Delta T}{n}$$

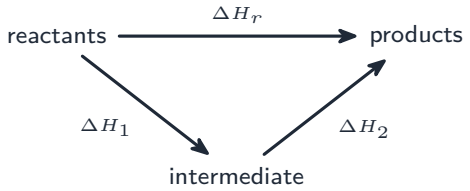


Worked example. Burning 0.50 g methanol ($M_r = 32$) heats 100 g water by 18 °C ($c = 4.18$): $q = 100 \times 4.18 \times 18 = 7520$ J; $n = 0.50/32 = 0.0156$ mol; $\Delta H_c = -7520/0.0156 \approx -480$ kJ mol^{-1}.

2 Hess's law

Hess's law 盖斯定律: the total enthalpy change is the **same** whichever route you take from reactants to products (because energy is conserved).

Draw an **energy cycle** 能量循环 with a direct route and an indirect route, then make both add up to the same total.



$$\Delta H_r = \Delta H_1 + \Delta H_2$$

It lets you find an enthalpy change you **cannot** measure directly, by using values you **can** measure.

Watch out: in $q = mc\,\Delta T$, the mass m is the mass of the *water (or solution) being heated*, not the mass of fuel. Then divide by the *moles of substance reacted* to get ΔH per mole.

Practice

Try these in order.

5.1 Write the equation that gives the heat transferred to a mass of water. [1]

5.2 A reaction releases 5000 J and uses 0.10 mol of fuel. Find ΔH in kJ mol^{-1}. [2]

5.3 200 g of water rises by 10 °C ($c = 4.18$). Calculate the heat transferred, q. [2]

5.4 State Hess's law. [1]

5.5 Give one reason Hess's law is useful. [1]

5.6 Challenge. Burning 0.32 g of methane ($M_r = 16$) heats 200 g of water by 20 °C ($c = 4.18$). Find the enthalpy change per mole of methane. [3]