

# 5 Energetics – 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) |       |       |
|-------------------|-----|----------------------------|-------|-------|
| energy            | 能量  | _____                      | _____ | _____ |
| exothermic        | 放热  | _____                      | _____ | _____ |
| endothermic       | 吸热  | _____                      | _____ | _____ |
| thermal energy    | 热能  | _____                      | _____ | _____ |
| combustion        | 燃烧  | _____                      | _____ | _____ |
| neutralisation    | 中和  | _____                      | _____ | _____ |
| decomposition     | 分解  | _____                      | _____ | _____ |
| enthalpy change   | 焓变  | _____                      | _____ | _____ |
| activation energy | 活化能 | _____                      | _____ | _____ |

## Recall

Every chemical reaction transfers **energy** 能量. The reaction is either **exothermic** 放热 or **endothermic** 吸热, depending on which way the heat moves.

- An exothermic reaction **gives out** heat (warms the surroundings).
- An endothermic reaction **takes in** heat (cools the surroundings).

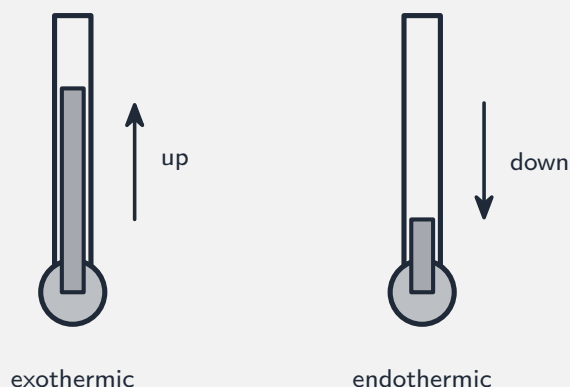
Nothing here is hard —it just adds a symbol and a diagram.

## New ideas

Read these first, then do the Practice.

### ■ 1 Exothermic and endothermic

- **exothermic** 放热反应—gives out **thermal energy** 热能, so the surroundings warm **up**. Examples: **combustion** 燃烧, **neutralisation** 中和.
- **endothermic** 吸热反应—takes in thermal energy, so the surroundings cool **down**. Example: thermal **decomposition** 分解.



### ■ 2 Enthalpy change, $\Delta H$

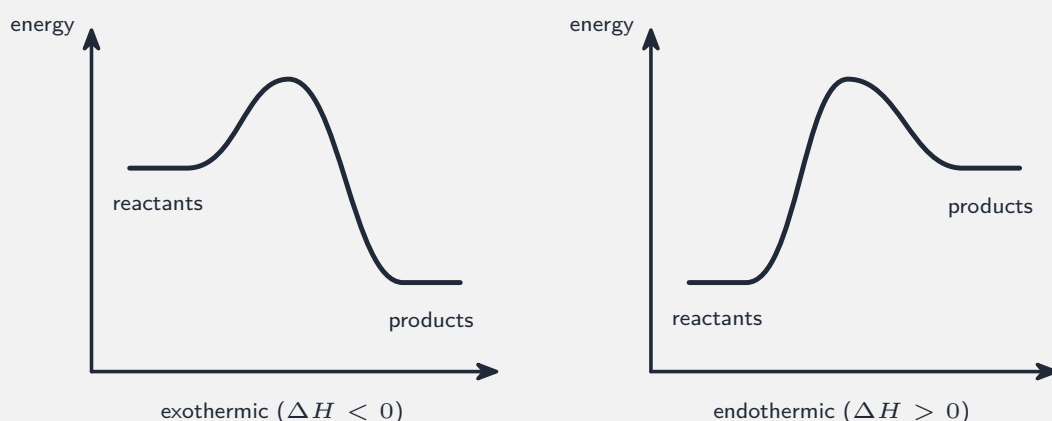
The thermal energy transferred is the **enthalpy change** 焓变,  $\Delta H$ :

- $\Delta H$  is **negative** for exothermic (energy leaves the chemicals).
- $\Delta H$  is **positive** for endothermic (energy is taken in).

### ■ 3 Reaction pathway diagrams

The **activation energy** 活化能 ( $E_a$ ) is the least energy colliding particles need to react—a "hill" they must get over.

- **exothermic** —products **lower** than reactants ( $\Delta H < 0$ ).
- **endothermic** —products **higher** than reactants ( $\Delta H > 0$ ).



**Watch out:** match the sign to the direction —exothermic **gives out** heat so  $\Delta H$  is **negative** (products lower); endothermic **takes in** heat so  $\Delta H$  is **positive** (products higher). The activation energy is a *hill* every reaction must climb, exo or endo.

## Practice

Try these in order.

**5.1** What happens to the temperature of the surroundings in (a) an exothermic, (b) an endothermic reaction? [2]

**5.2** Give the sign of  $\Delta H$  for (a) an exothermic, (b) an endothermic reaction. [2]

**5.3** Give one example of an exothermic reaction. [1]

**5.4** What is meant by the *activation energy*? [1]

**5.5** On a reaction pathway diagram, where are the products (compared with the reactants) for an exothermic reaction? [1]

**5.6 Challenge.** On a pathway diagram the products lie **above** the reactants. State (a) whether the reaction is exothermic or endothermic, (b) the sign of  $\Delta H$ , and (c) what the

surroundings do.

[3]

