

14 Thermal equilibrium – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

*Write each word three times.***English****Write it 3 times** (English)

Heat

temperature

thermal equilib-
rium

thermal energy

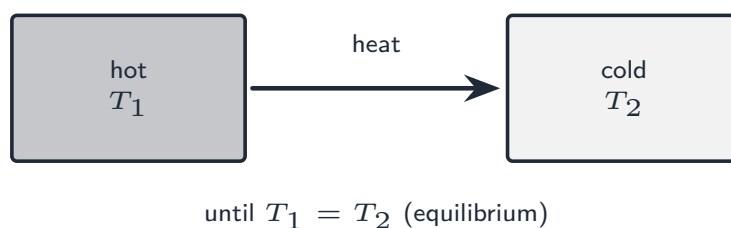
Recall

Heat (thermal energy) flows from hot to cold. It is temperature, not the amount of energy, that sets the direction – which is why an ice cube cools your drink rather than the drink warming the ice.

New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

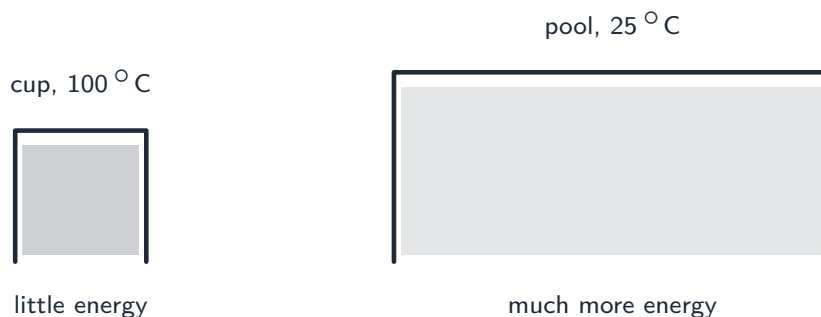
■ 1 Thermal equilibrium



When two bodies touch, heat flows from the higher **temperature** to the lower until they are equal – **thermal equilibrium**. Then there is no net flow.

Worked example. A hot metal block at $80\text{ }^{\circ}\text{C}$ is dropped into cool water at $20\text{ }^{\circ}\text{C}$. Heat flows from the block into the water: the block cools, the water warms, and they meet at one final temperature between 20 and $80\text{ }^{\circ}\text{C}$ (closer to 20 if there is a lot of water).

■ 2 Temperature is not energy



A small cup of boiling water ($100\text{ }^{\circ}\text{C}$) holds far less **thermal energy** than a warm swimming pool ($25\text{ }^{\circ}\text{C}$) – but heat still flows *from* the cup into anything cooler, because flow depends on temperature, not on total energy.

Worked example. A single spark from a sparkler can be over $1000\text{ }^{\circ}\text{C}$, yet it barely warms your skin: it is so tiny that it carries very little energy, even though its temperature is huge.

Watch out: temperature sets the *direction* of heat flow, but the *amount* of energy a body holds also depends on its mass and material.

Practice

Try these in order.

14.1 Which way does heat flow? [1]

14.2 What is *thermal equilibrium*? [1]

14.3 At equilibrium, what is the net flow of energy? [1]

14.4 A hot stone is dropped into a bucket of cool water. Describe what happens to the temperature of each until equilibrium is reached. [2]

14.5 Does a higher temperature always mean more thermal energy? Explain with an example. [2]

14.6 Challenge. A spark at over 1000 °C will not burn you, but bathwater at 50 °C can scald. Explain why, using the idea that thermal energy depends on more than temperature. [2]
