Solutions

Each answer shows the steps, then the **result**.

2.1

- from a region of **higher temperature** to a region of **lower temperature**

2.2

- two bodies are at the **same temperature**
- so there is **no net flow** of thermal energy between them

2.3

- **zero** (no net flow)

3.1

- they are at the **same temperature**
- so there is **no net transfer** of thermal energy between them

3.2

- temperature shows the **direction** of heat flow, not the amount of energy stored
- the pool has a far greater **mass**, so it can hold more total thermal energy despite its lower temperature

3.3 A

- A is at a higher temperature than B, so thermal energy flows **A** → **B**
- **B** would reverse the flow; **C** equal temperatures; **D** confuses energy stored with temperature

3.4

(a) from **P to Q**

- because P is at the higher **temperature**, and thermal energy always flows from the hotter body to the colder one

(b) their molecules collide at the boundary and transfer energy; on average energy passes from the block whose molecules have the greater mean kinetic energy

- at thermal equilibrium there is **no net** flow of energy either way
- the two blocks are at the **same temperature**

(c) energy lost by P = energy gained by Q

$$(0.50\ \text{kg})(390\ \text{J kg}^{-1}\ \text{K}^{-1})(80-\theta)\ ^\circ\text{C} = (1.5\ \text{kg})(390\ \text{J kg}^{-1}\ \text{K}^{-1})(\theta-20)\ ^\circ\text{C}$$

- c cancels: $0.50(80-\theta) = 1.5(\theta-20)$

$$40 - 0.5\theta = 1.5\theta - 30 \Rightarrow \theta = \frac{70}{2.0} = \mathbf{35}\ ^\circ\text{C}$$

(d) **no**

- they are at the same temperature, so their molecules have the same **mean** kinetic energy, but Q has three times the mass and therefore three times as many molecules, so it holds about three times the internal energy