

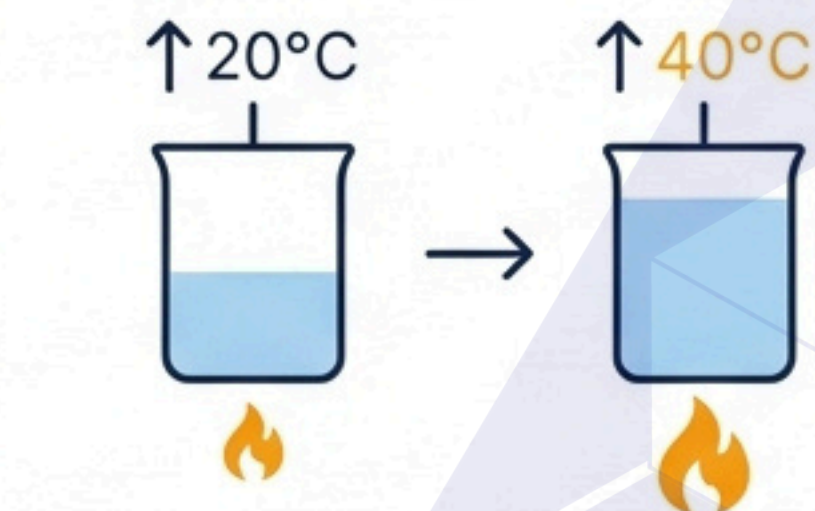
Why Water Heats More Slowly Than Oil

The invisible property that determines how substances absorb energy.



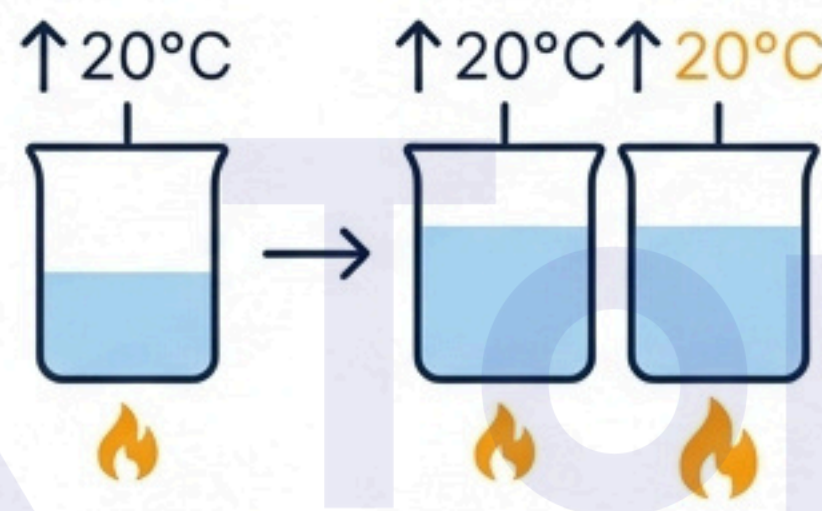
The 3 Rules of Heating

Step 1: Temp Change



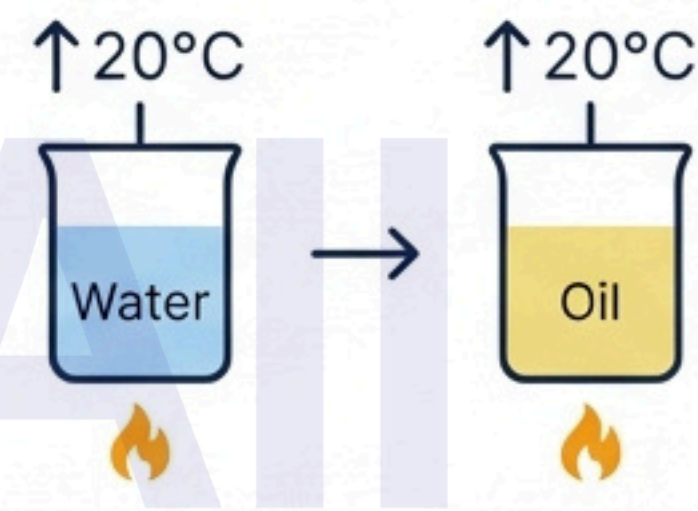
 Requires 2x the time/heat

Step 2: Mass



 Requires 2x the time/heat

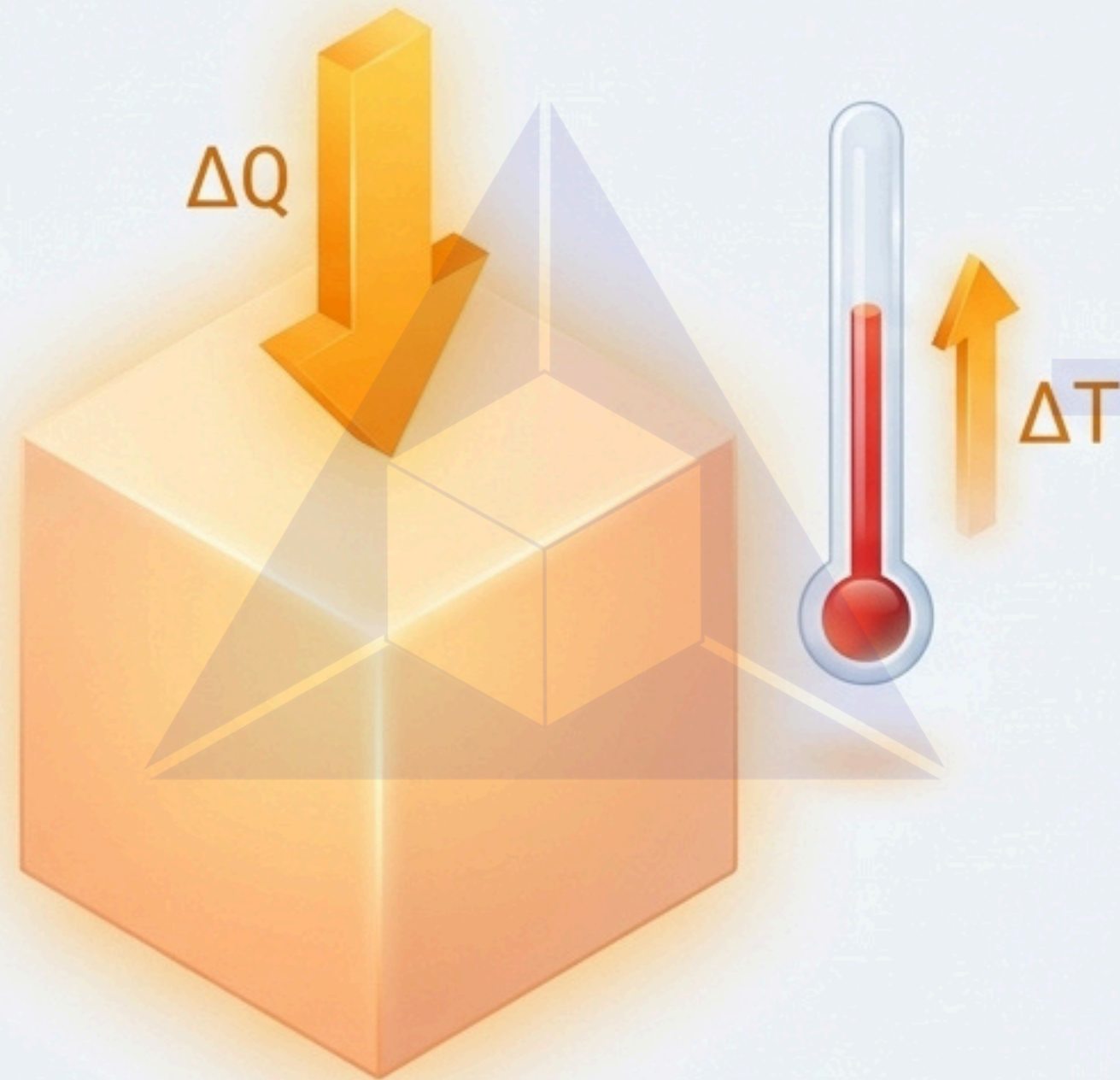
Step 3: Material



 Oil takes less time/heat

Heat Required (ΔQ) depends on: **Mass (m)** **Temp Change (ΔT)** Nature of **Material**

Heat Capacity (S): The Whole Object



The change in temperature of a substance when a given quantity of heat is absorbed or rejected.

Eq. (10.10)

$$S = \frac{\Delta Q}{\Delta T}$$

Variable Key

ΔQ = Heat supplied

ΔT = Change in temperature (T to T + ΔT)

Specific Heat Capacity (s): The Unit Mass

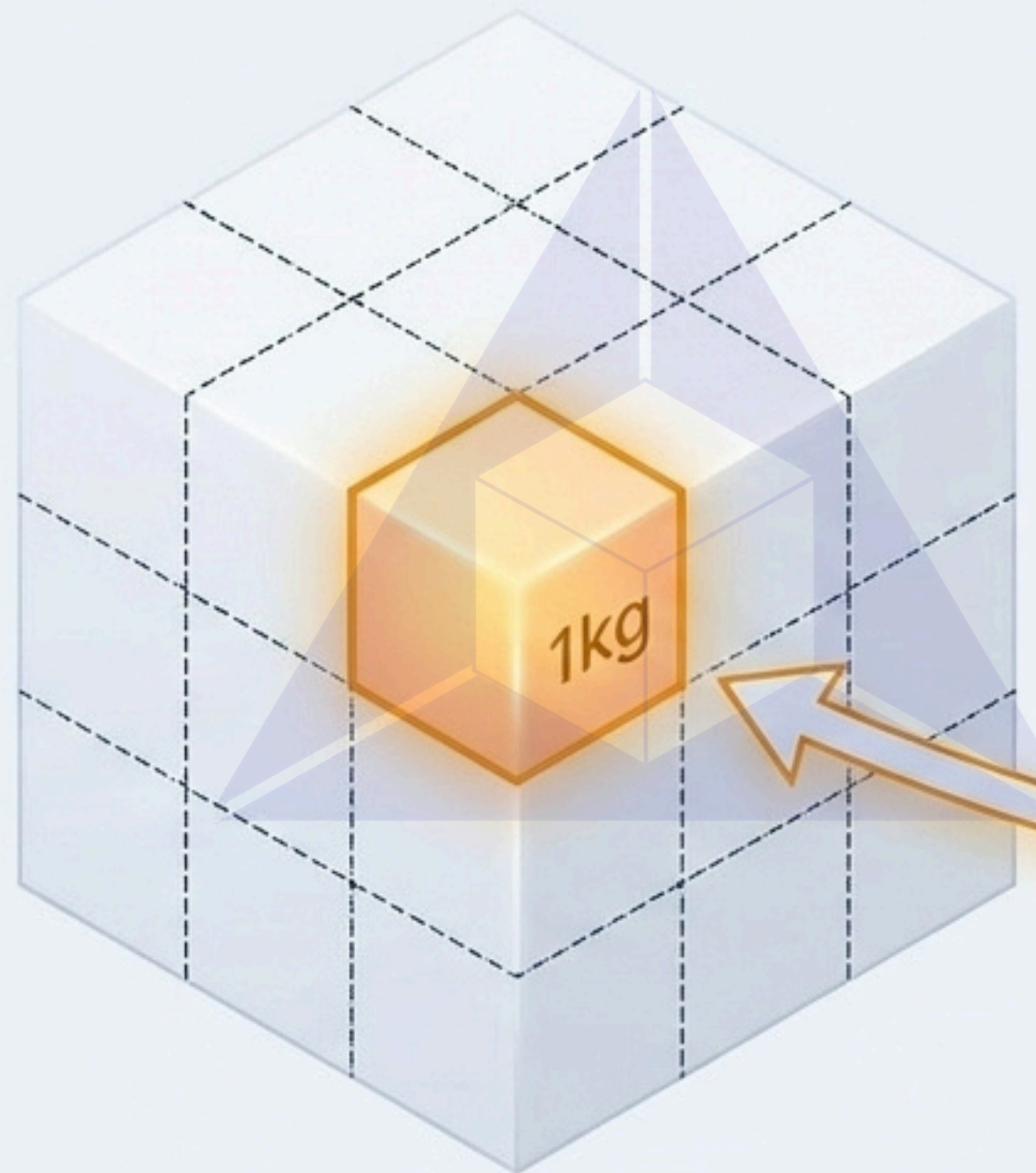


Every substance has a unique value for the heat required to change the temperature of a unit mass by one unit.

Eq. (10.11)

$$s = \frac{S}{m} = \frac{1}{m} \frac{\Delta Q}{\Delta T}$$

SI Unit: J kg⁻¹ K⁻¹



Molar Specific Heat Capacity (C)

For gases, we specify the amount of substance in moles (μ) instead of mass in kg.

Eq. (10.12)

$$C = \frac{S}{\mu} = \frac{1}{\mu} \frac{\Delta Q}{\Delta T}$$

SI Unit: J mol⁻¹ K⁻¹

Conditions Matter:



C_p : Molar specific heat at constant pressure

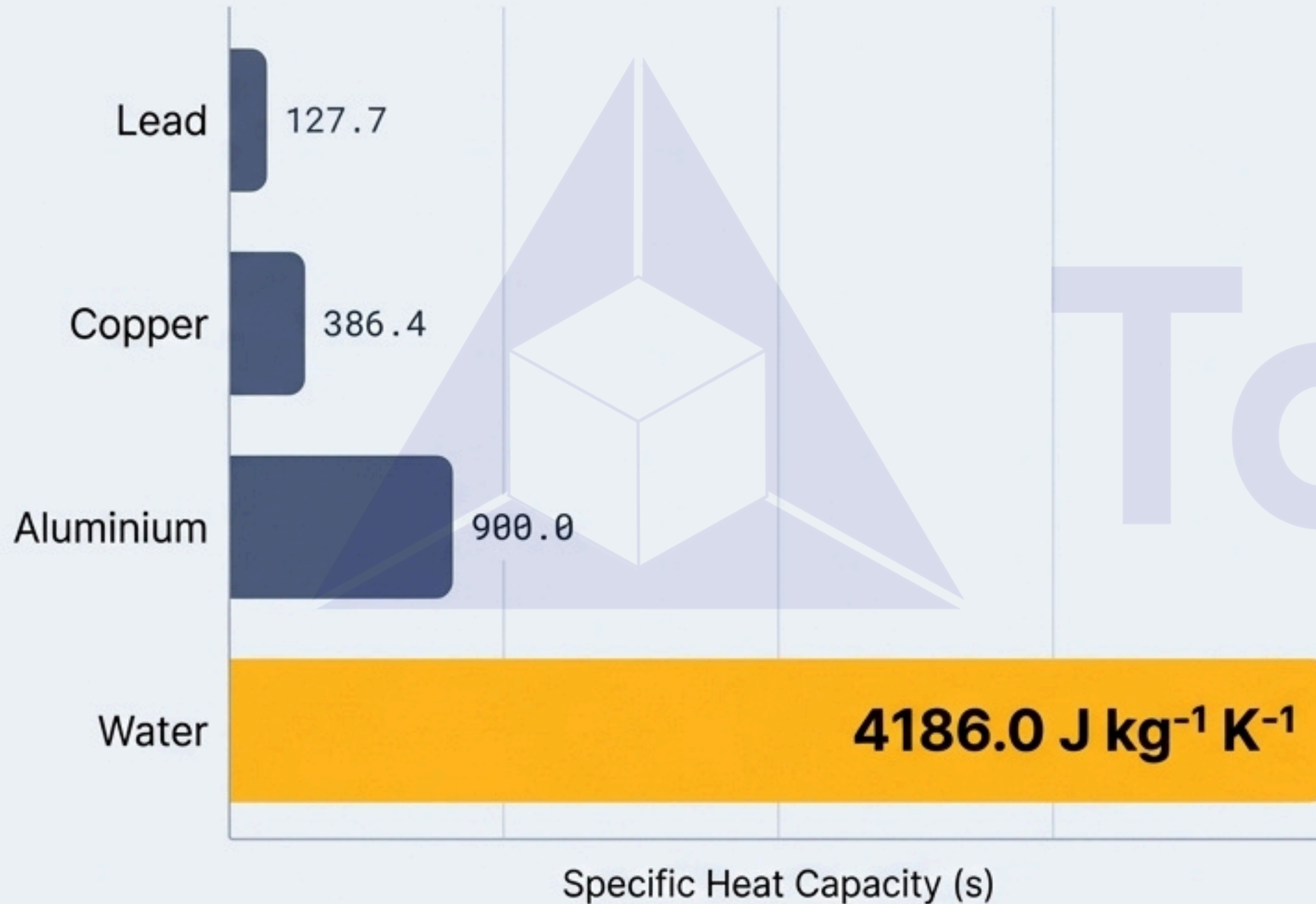


C_v : Molar specific heat at constant volume

Table 10.4 Excerpt

Gas	C_p	C_v
He	20.8	12.5
N ₂	29.1	20.8

The Astonishing Specific Heat of Water



Coolants: Auto radiators and hot water bags rely on water absorbing massive heat without boiling.

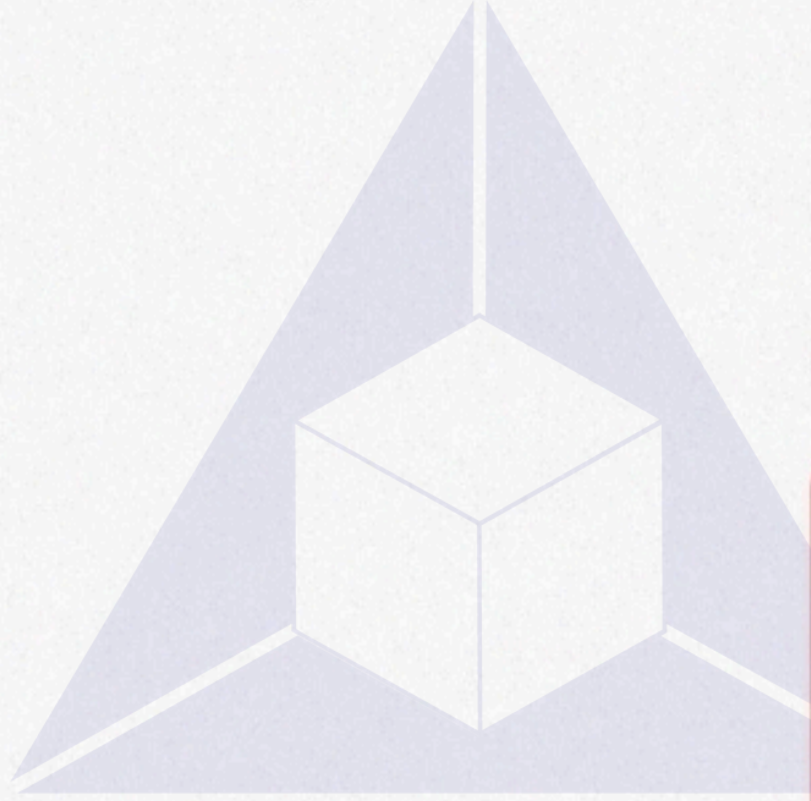


Climate Control: Sea breeze effect.



Desert areas heat rapidly by day and cool rapidly by night due to lack of water.

Key Takeaways & Exam Trap



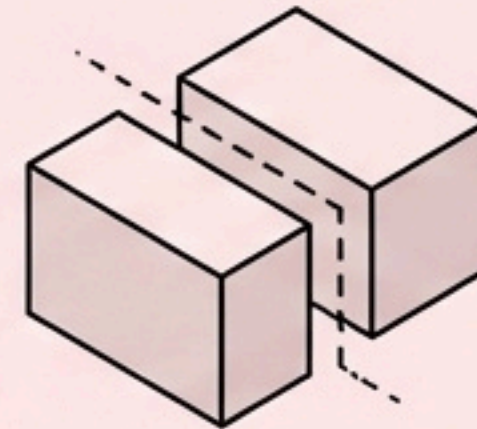
1	2	3
Heat Capacity (S)	Specific Heat (s)	Molar Heat (C)
Heat for the whole object	Heat per 1 kg	Heat per 1 mole
$\frac{\Delta Q}{\Delta T}$	$(\frac{1}{m})(\frac{\Delta Q}{\Delta T})$	$(\frac{1}{\mu})(\frac{\Delta Q}{\Delta T})$



The Exam Trap

Trap: Thinking Specific Heat (s) changes when you cut an object in half.

Truth: Heat capacity (S) halves, but Specific Heat (s) remains identical. It is an intrinsic property of the material!



$$S \rightarrow \frac{1}{2} S \quad \checkmark$$

$$s \rightarrow \frac{1}{2} s \quad \times$$