

The 3 Ways Heat Travels

Heat is energy transferred by virtue of of a temperature difference.

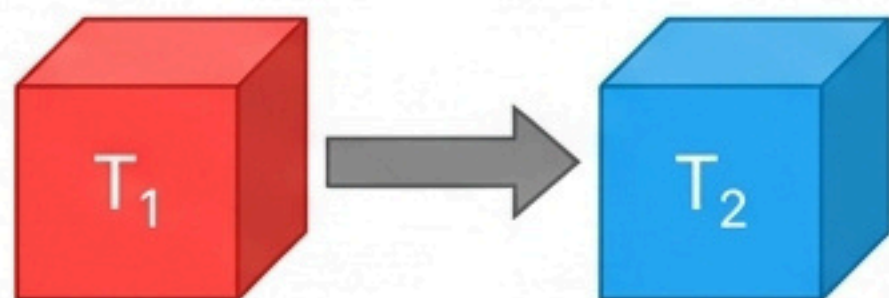


What Drives Heat Transfer?

Golden Rule: Heat is the form of energy transferred between systems (or a system and its surroundings) purely by virtue of **temperature difference**.

The Requirement

Heat only flows when
 $T_1 \neq T_2$



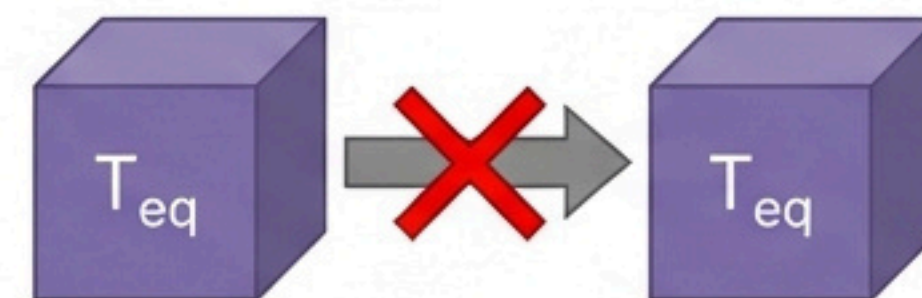
The Direction

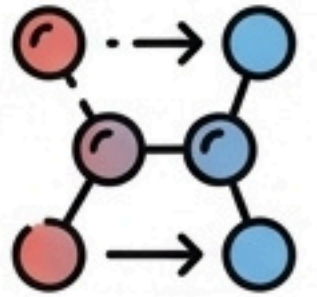
Heat always flows from
Higher Temperature to
Lower Temperature.



The End State

Transfer continues until
thermal equilibrium is
reached ($T_1 = T_2$).





Conduction: Transfer Through Contact

Definition:

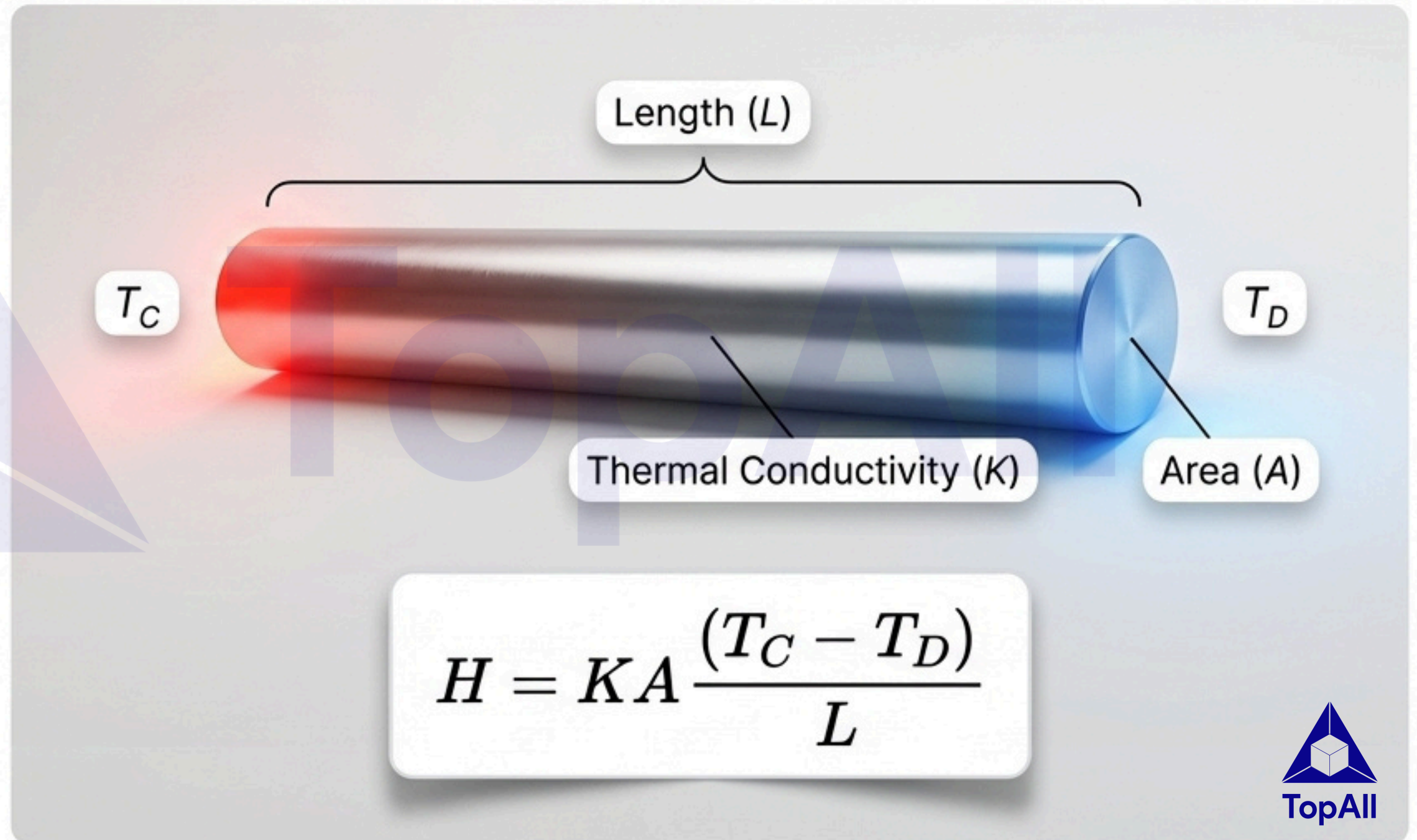
Mechanism of transfer between two adjacent parts of a body due to temperature difference.

Key Characteristic:

Heat flows through molecular collisions without any bulk flow of matter.

**Exam Trap:

Gases are poor thermal conductors. Metals are excellent conductors.





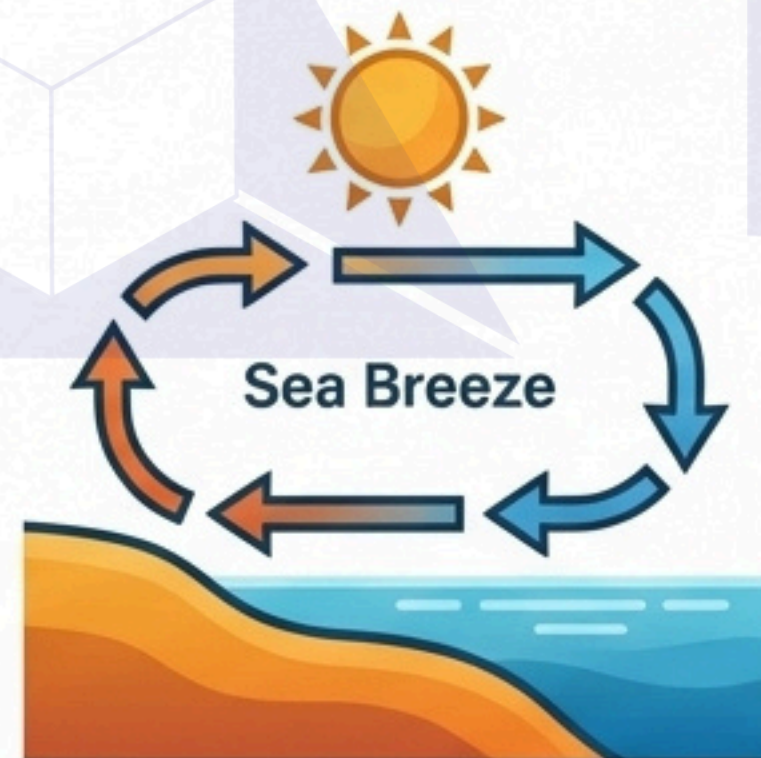
Convection: Transfer by Bulk Motion

Definition: Mode of heat transfer by the **actual motion of matter**.

Key Characteristic: Possible only in fluids (liquids and gases).

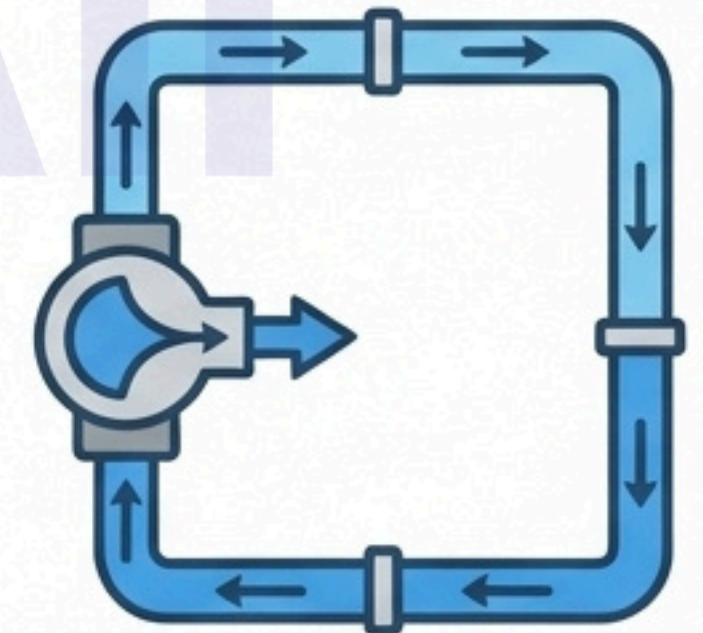
Natural Convection

Driven by gravity/buoyancy. Hot fluid expands, becomes less dense, and rises. Cold fluid replaces it.

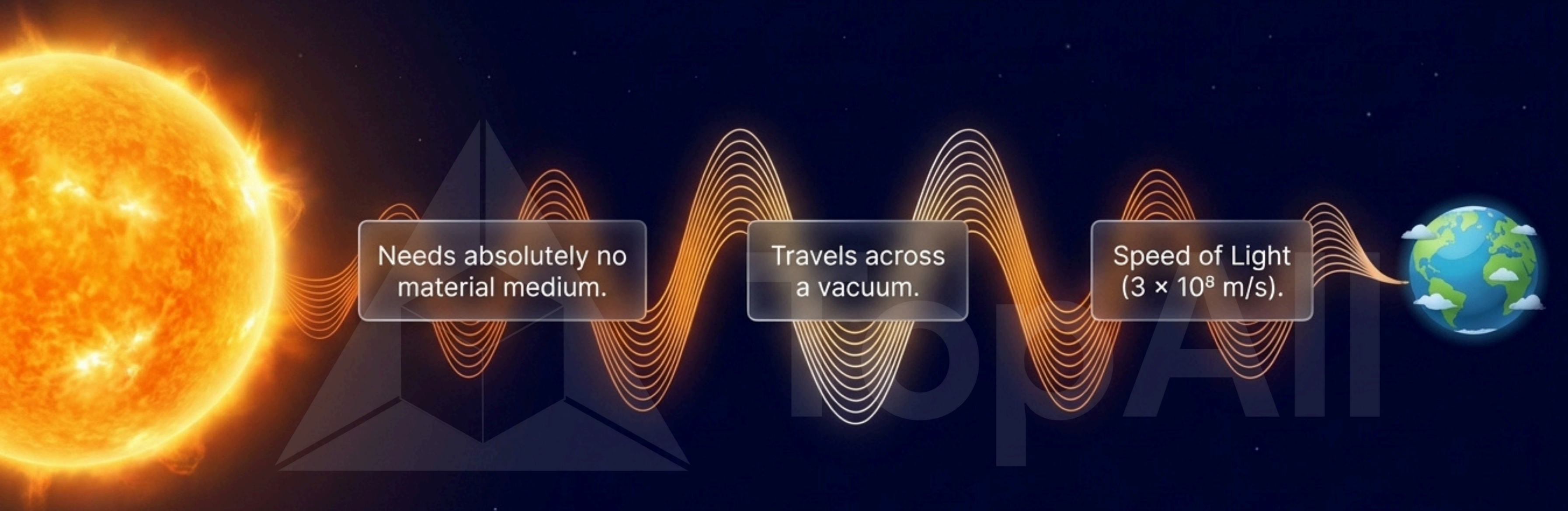
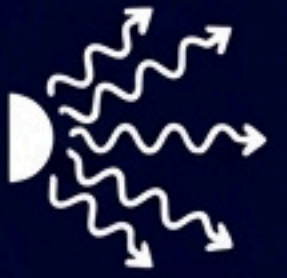


Forced Convection

Material is forced to move by a pump or physical means (e.g., human circulatory system, car engine cooling).



Radiation: Transfer via EM Waves



Definition: Energy transferred by electromagnetic waves.

Fact: All bodies emit radiant energy by virtue of their temperature (Thermal Radiation).

Key Takeaways: Heat Transfer Modes

	 Conduction	 Convection	 Radiation
Medium	Solids (mostly)	Fluids only	No medium (Vacuum)
Mechanism	Molecular collisions	Actual bulk motion	Electromagnetic waves
Speed	Slow	Moderate	Speed of Light

Exam Recap: Heat transfer fundamentally arises from temperature differences. The path it takes depends entirely on the medium available.