

Why Sea Breeze Changes Direction

Have you ever noticed that the wind at the beach blows from the sea during the day, but reverses direction after the sun goes down?

The answer lies in the actual motion of matter.

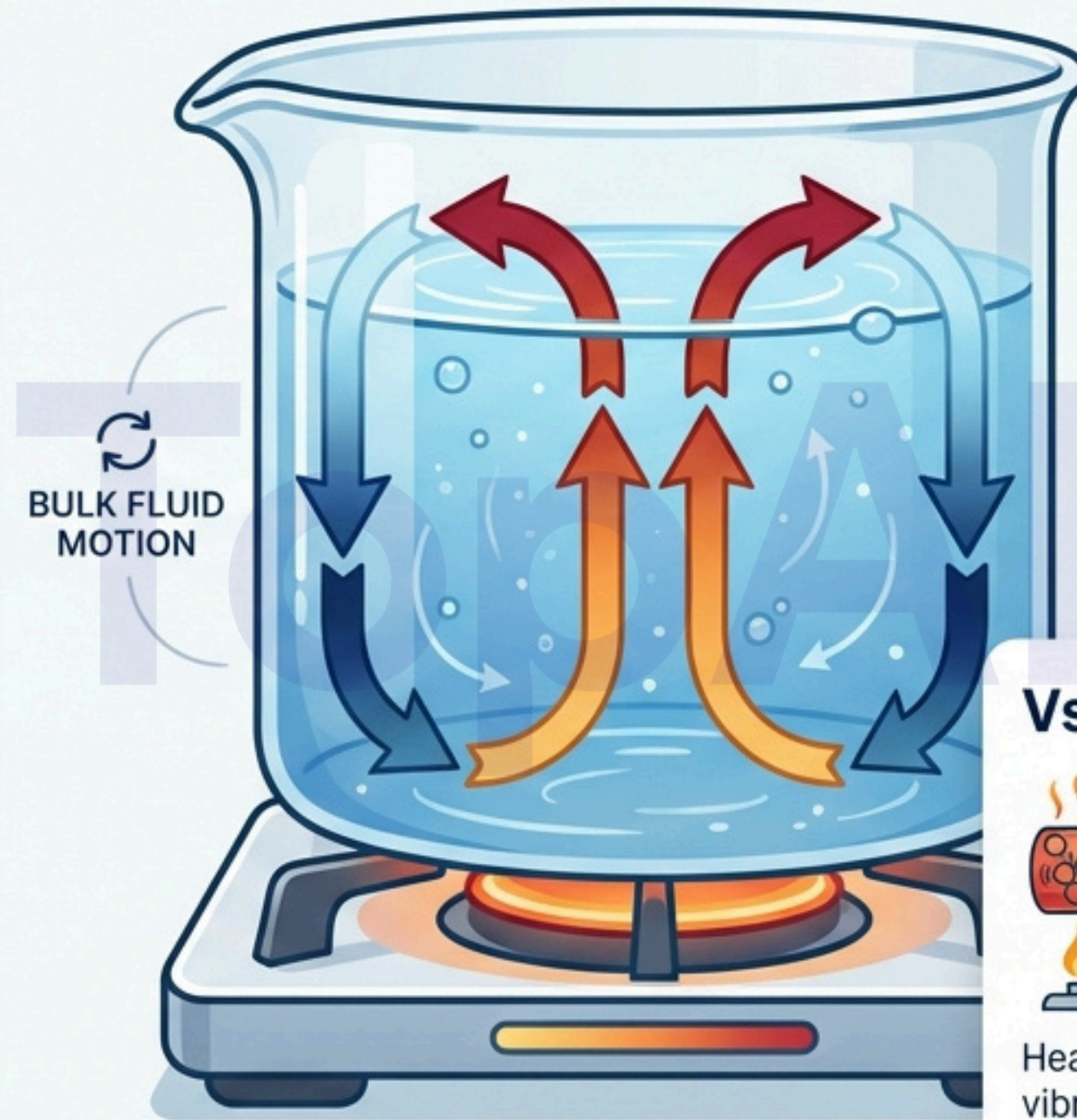


Convection: Heat Transfer by Fluid Motion

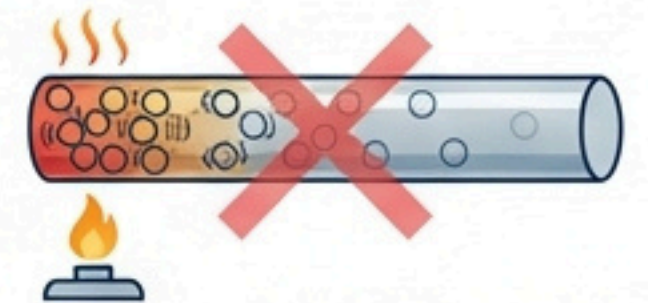
Convection is a mode of heat transfer by the actual motion of matter.

⚠ Possible ONLY in fluids (liquids and gases).

It involves the bulk transport of different parts of the fluid, unlike conduction where heat transfers between adjacent parts without bulk flow.



Vs. Conduction



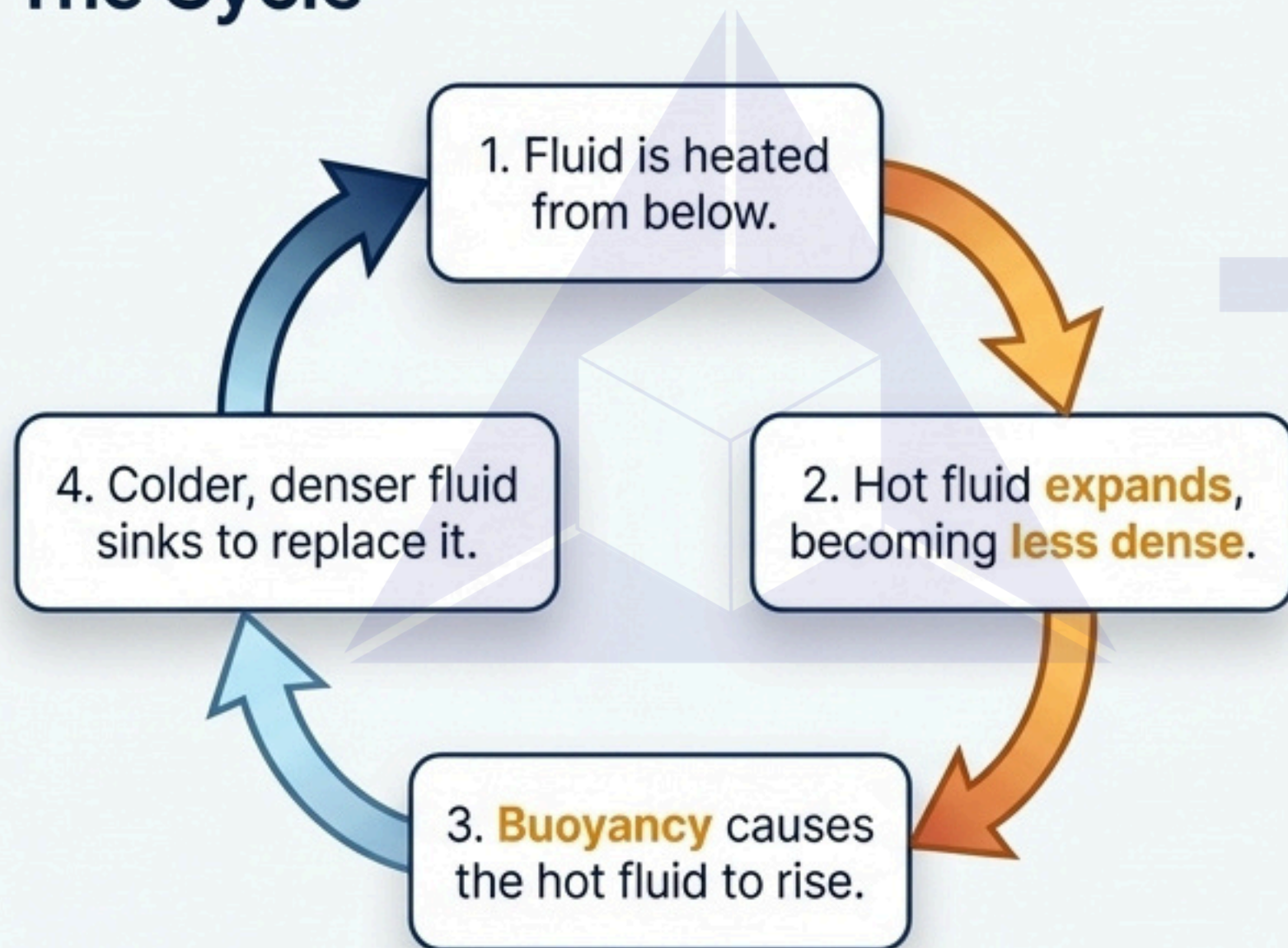
Heat transfer through particle vibration, no material flow.
Inter Regular, 14px, Navy

Practice more, score more

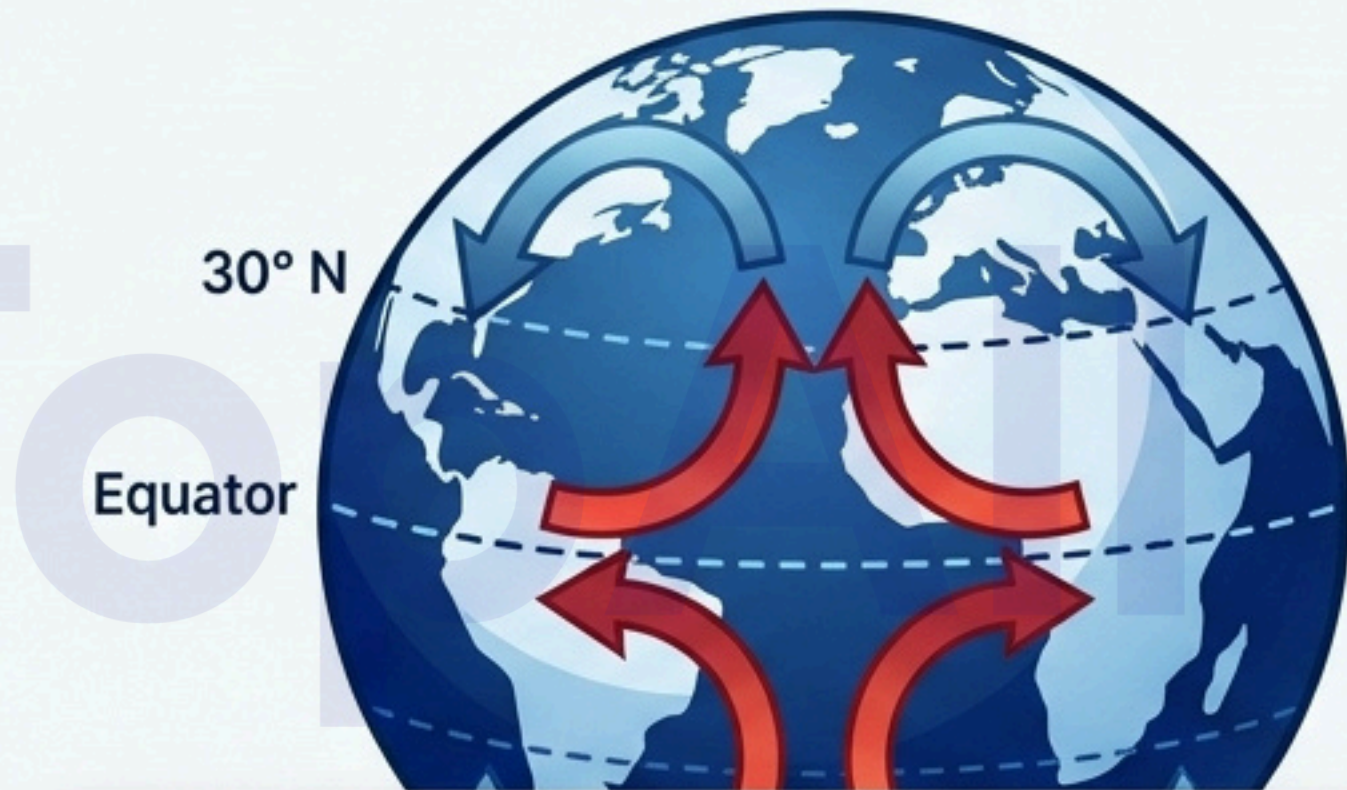
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Natural Convection: Driven by Gravity

The Cycle



Macro Example: Trade Winds



Equatorial air is hot; polar air is cool. Air rises at the equator, moves toward poles. Earth's rotation modifies the flow: air descends at 30° N latitude and returns to the equator, creating steady surface winds.

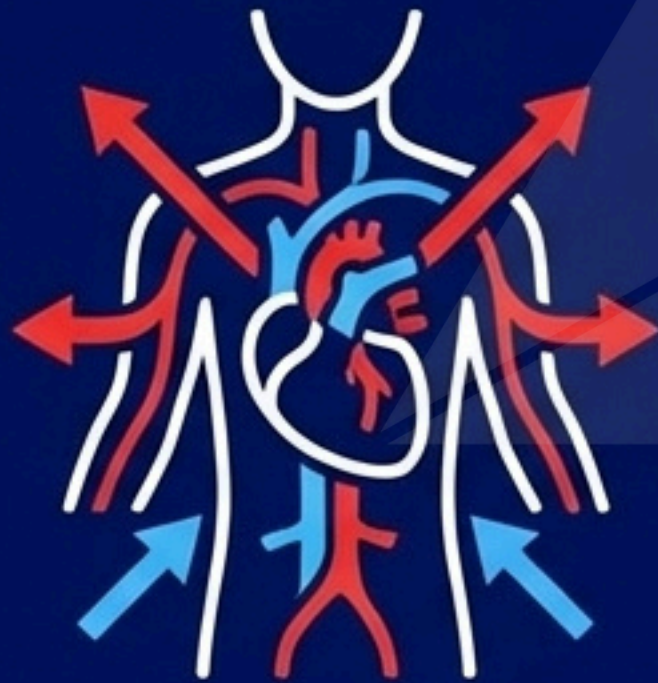
Practice more, score more

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Forced Convection: Pumping the Heat

Material is forced to move by a pump or by some other physical means, rather than relying on natural buoyancy.

Example 1: The Human Body



- The heart acts as a biological pump.
- Circulates blood through the body to transfer heat and maintain a uniform temperature.

Example 2: Automobile Engine

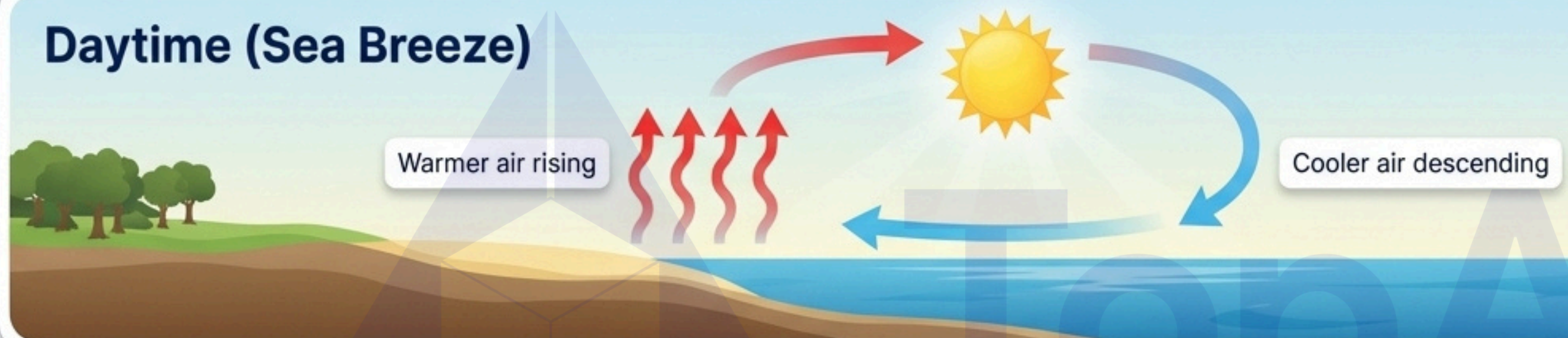


- A cooling system uses a mechanical water pump.
- Forces coolant through the engine to extract heat and move it to the radiator.

The Coastal Cycle: Sea & Land Breezes

The Catalyst: Water has a greater specific heat capacity than land. The ground heats up and cools down much faster than the ocean.

Daytime (Sea Breeze)



Land is hotter.
Air above land expands and rises.
Cooler air from the sea moves in to fill the space.

Nighttime (Land Breeze)



Land cools faster. Water is now relatively warmer.
Air above water rises.
Cooler air from the land moves out to sea.

Key Takeaways & Exam Trap

Key Takeaways

- ✓ **Convection:** Heat transfer via bulk fluid motion.
- ✓ **Medium:** ONLY occurs in liquids and gases.
- ✓ **Natural:** Driven by gravity, density differences, and buoyancy (e.g., Trade Winds, Sea/Land breeze).
- ✓ **Forced:** Driven by a physical pump (e.g., Heart, Car engine).



Exam Trap

Trap: Assuming convection can happen in solids or in zero-gravity environments.

Truth: Solids transfer heat via conduction (particle vibration). **Natural** convection **absolutely** requires **gravity** to pull denser fluids down!