

Spontaneity | Does Negative ΔH Guarantee a Reaction?



$\neq$



SPONTANEOUS $\neq$ FAST

Thermodynamics dictates the direction, not the speed.

What is a Spontaneous Process?

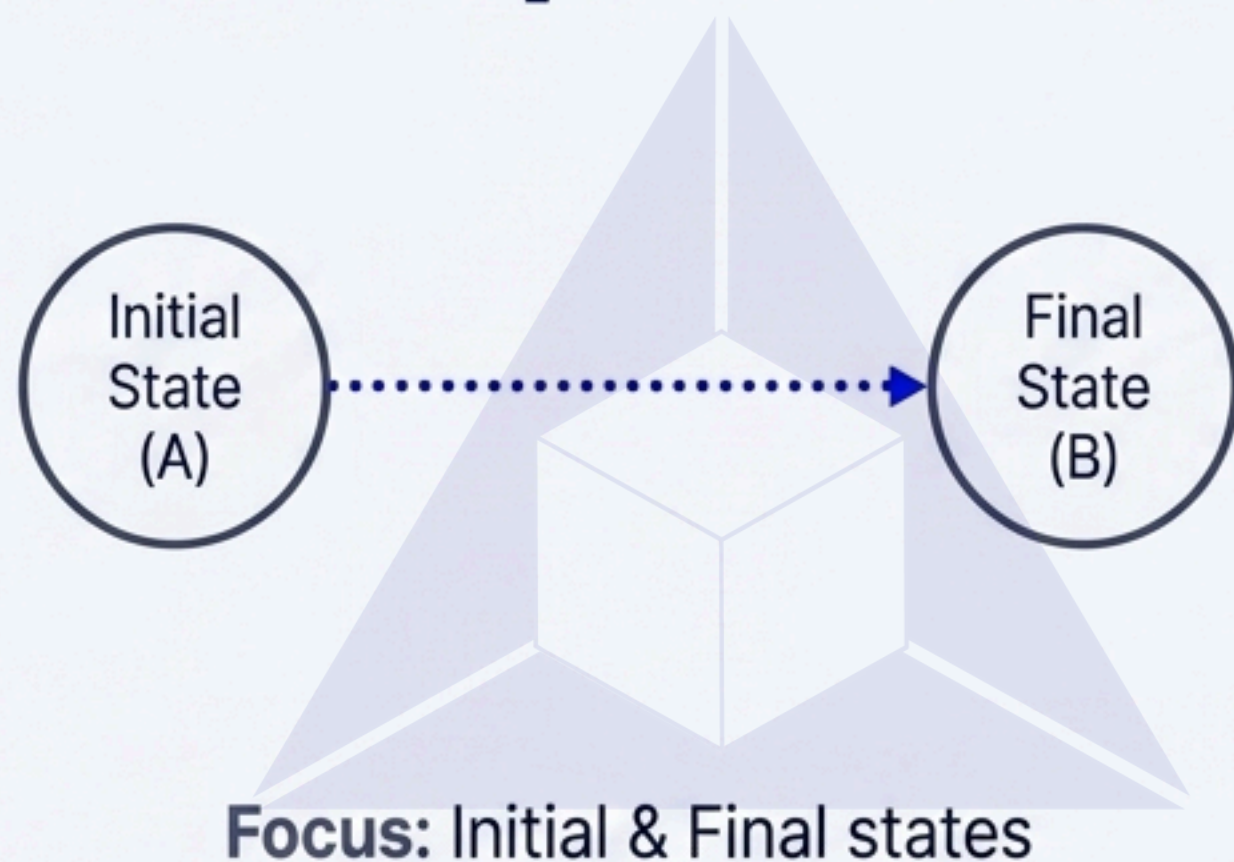
A spontaneous process has the thermodynamic tendency to proceed without continuous external assistance.



Note: The reaction between H_2 and O_2 to form water can sit at room temperature for years without perceptible change. It is extremely slow, but completely spontaneous.

Thermodynamics

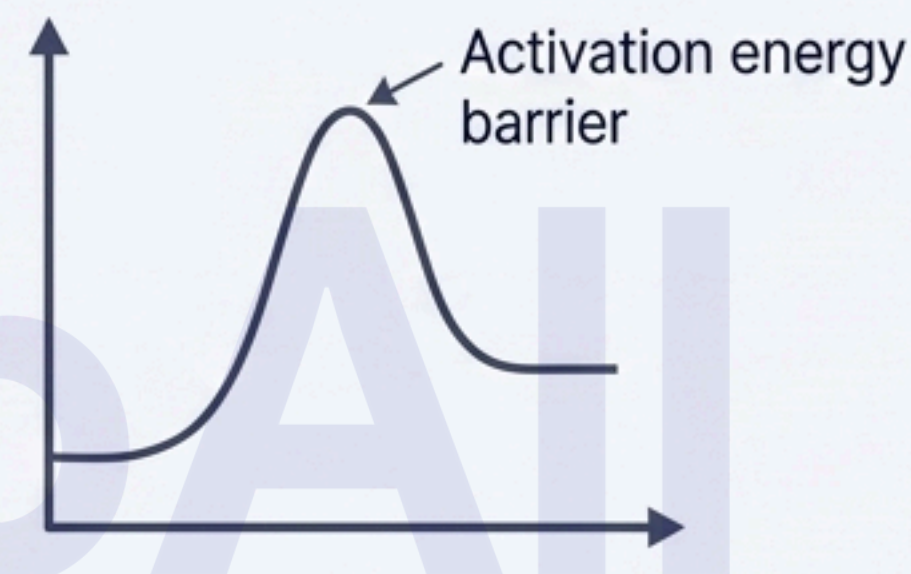
Can it proceed?



Output: Determines direction and feasibility.

Kinetics

How fast?



Focus: The Path taken

Output: Determines rate and time.

Thermodynamics is NOT concerned about how or at what rate energy transformations are carried out.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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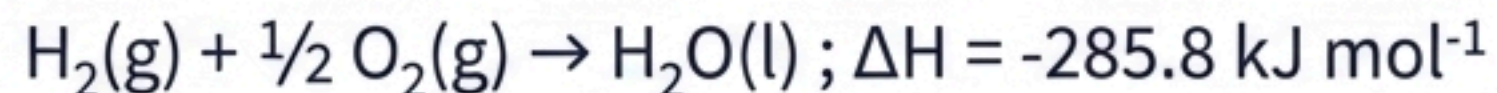
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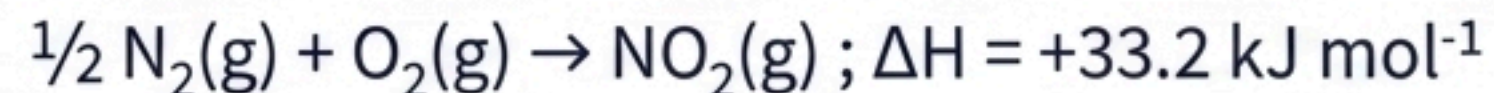
Exothermic & Spontaneous

$$\Delta H < 0$$



Endothermic & Spontaneous

$$\Delta H > 0$$



Both proceed naturally without external assistance. Therefore, decreasing energy cannot be the only driving force.

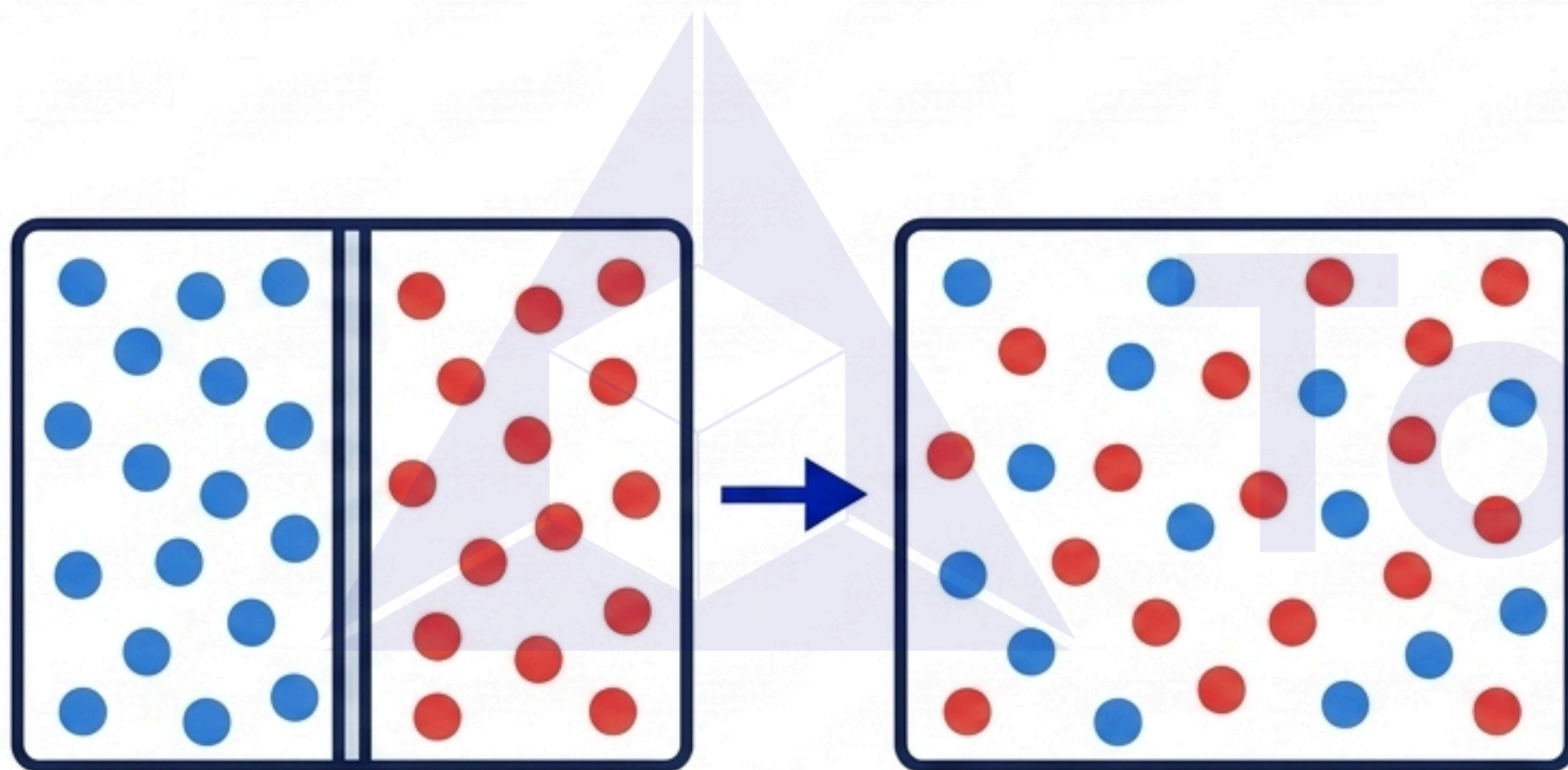
MAJOR JEE TRAP

$[\Delta H < 0 \text{ alone is NOT the}]$
 $[\text{criterion for spontaneity}]$

- ✗ Assuming all exothermic reactions are always spontaneous.
- ✗ Assuming all endothermic reactions are always non-spontaneous.

Decrease in enthalpy is a contributing factor, but not the absolute rule. We are missing a crucial variable.

Enthalpy is only half the story.



Why do endothermic reactions happen? Why do isolated gases spontaneously mix even when $\Delta H = 0$?

We need a measure of randomness.

NEXT: ENTROPY (S) →



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