

THERMODYNAMICS LAWS

OVERVIEW

LAW	CORE CONCEPT	MATHEMATICAL EXPRESSION
Zeroth Law	If two systems are in thermal equilibrium with a third system, they are in thermal equilibrium with each other. Establishes the basis for temperature measurement.	<i>If $T_A = T_C$ and $T_B = T_C$, then $T_A = T_B$</i>
First Law	Energy cannot be created or destroyed, only transformed. The change in internal energy is equal to heat added minus work done.	$\hat{U} = Q - W$
Second Law	The total entropy of an isolated system can never decrease over time; systems spontaneously evolve toward thermodynamic equilibrium.	$\hat{S}_{total} \geq 0$
Third Law	As the temperature of a system approaches absolute zero, the entropy of a system approaches a constant minimum.	$S \rightarrow S_0$ as $T \rightarrow 0 \text{ K}$