

Thermodynamics Basics

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Laws of Thermodynamics

1. **Zeroth Law**: Thermal Equilibrium.
2. **First Law**: Conservation of Energy ($dQ = dU + dW$).
3. **Second Law**: Entropy always increases (Kelvin-Planck & Clausius statements).
4. **Third Law**: Entropy of a perfect crystal at absolute zero is zero.

Key Concepts

- **System**: Open, Closed, Isolated.
- **Process**: Isothermal ($T=\text{const}$), Adiabatic ($Q=0$), Isobaric ($P=\text{const}$), Isochoric ($V=\text{const}$).
- **Enthalpy (H)**: $H = U + PV$.
- **Entropy (S)**: Measure of disorder.

Carnot Cycle

- Two isothermal and two adiabatic processes.
- Efficiency = $1 - (T_{\text{cold}} / T_{\text{hot}})$.