# Office Hours

Tu 12:30 – 1:30

Wed 12:30 – 1:30

Mon 11:10 – 12:00

CHEM LIBRARY

# Thermodynamics

## Classical Thermodynamics

pre-quantum

no need for
fundamental "structure" of matter

Quantum Mechanics → Statistical Thermo

Entropy

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$$A + B \rightleftharpoons C + D$$

↑ Equilibrium

$$K_{eq} = \frac{[D][C]}{[A][B]}$$

$$rate_{forward} = k_{forward} [A][B]$$

why? empirical

$$A + B \rightleftharpoons C$$

$$K_{eq} = \frac{[C]}{[A][B]}$$

$$\log K_{eq} = \log\left(\frac{[C]}{[A][B]}\right)$$

$pH = -\log([H^+])$

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# "Laws" of Thermodynamics

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0th "Law" → defines of Temperature ; "common" sense "Law"

T

1st "Law" → defines Energy, U ; Break even "Law"

2nd "Law" → Entropy ; Break Even at Absolute Zero T!

3rd "Law" → Value of Entropy ; You can Never Reach Absolute Zero!!!

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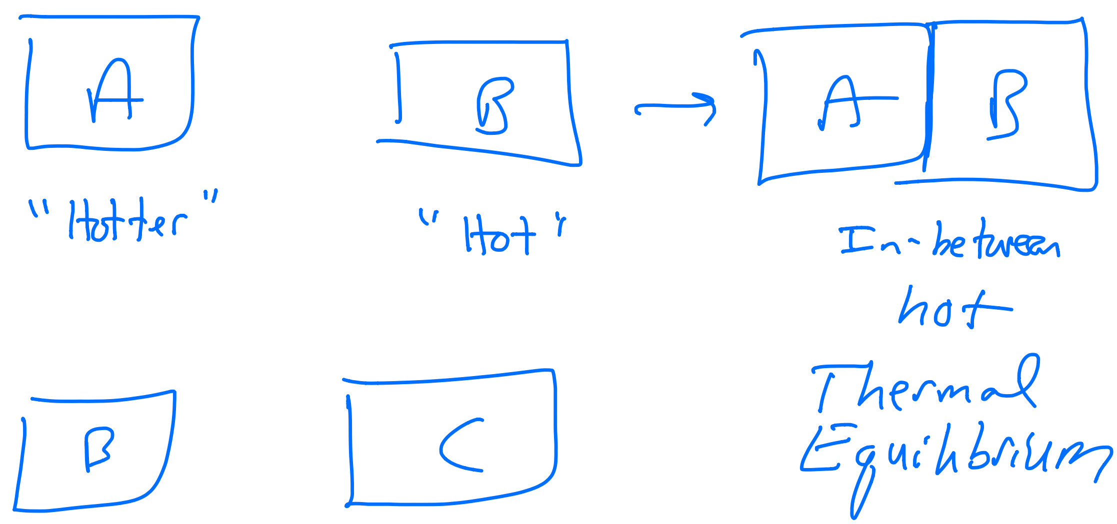
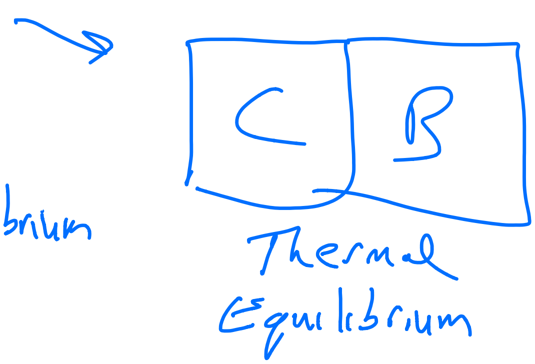
# Zeroth "Law"

Thermal Equilibrium

"Heat" Flow




∴ A in thermal Equilibrium with C

## Thermometer

Temperature Scale

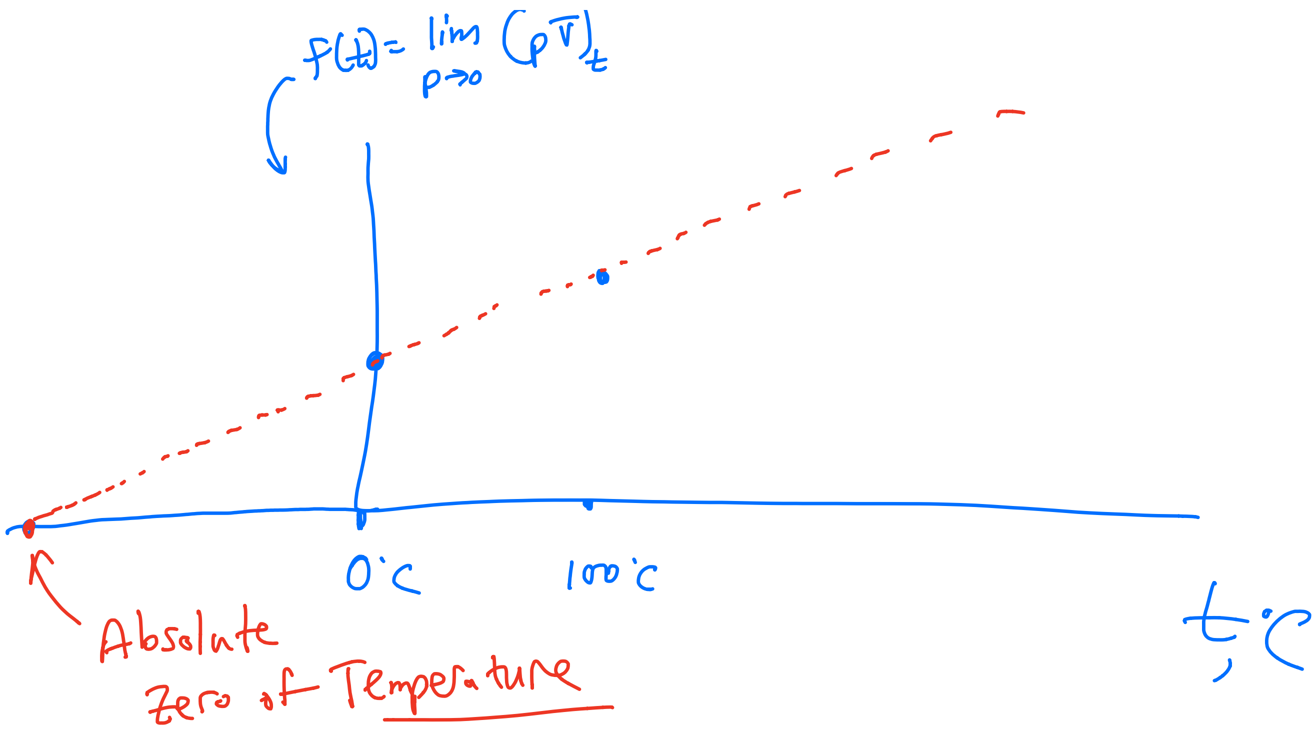
operational way to define T

Absolute Temperature Scale

- Fluid ( Hg, $H_2O$, alcohol, human blood )
  ↳ "Ideal" Gas
- Reference points → melting pt $H_2O$, boiling pt $H_2O$
- Property of Fluid
- Interpolation (linear)

Property: $\lim_{p \to 0} (p\bar{V})_t = f(t)$ Boyle's "law"

Holds for all gases in limit $p \to 0$




$$f(t) = mx + b$$

$$x \to t$$

$$f(t=0) \leftarrow b \to \lim_{p \to 0} (p\bar{V})_{t=0}$$

$$\frac{\Delta y}{\Delta x} \qquad m \to \frac{\lim_{p \to 0} (p\bar{V})_{t=0}}{\Delta}$$

$$f(t) = f(t=0) + \left[\frac{f(t=0)}{\Delta}\right] t$$

$$m \to \frac{f(t=0)}{\Delta}$$