

Definitions

treat the system like a
black box.

Thermodynamics - phenomenological
description of equilibrium properties
of macroscopic systems.

→ do not change with time (scale dependent)

Statistical Mechanics - probabilistic
approach to equilibrium phenomena
with a large number of degrees of
freedom.

Heat - energy that flows spontaneously
from hot to cold.

Adiabatic

(walls) - insulating - do not permit heat flow. opposite is diathermal

(process) - maybe slow (scale dependent), maybe reversible.

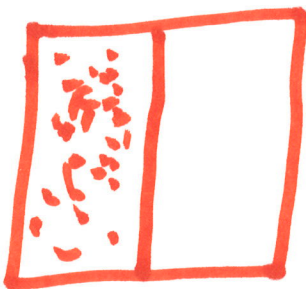
- sometimes "adiabatic" means no heat flow: $Q=0$

The system is always near an equilibrium state.

Non-adiabatic process

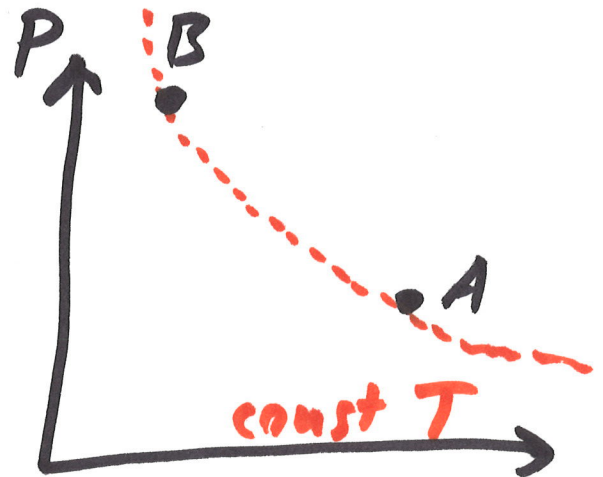
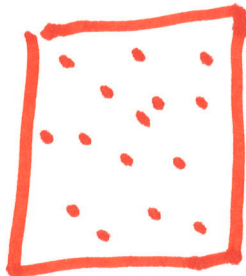
Joule-Kelvin (Thomson) Expansion

Before



same T

After



isotherm = hyperbola

Laws of Thermodynamics

Zeroth Law - If two systems A and B are each separately in thermal equilibrium with a third system C, then A is in thermal equilibrium with B ~~and the vice versa.~~

Equivalence relation

If $T_A = T_C$ and $T_B = T_C$, then $T_A = T_B$

transitive, symmetric, reflexive
 $T_B = T_A$ $T_A = T_A$

Non-transitive

Rock > Scissors > Paper

