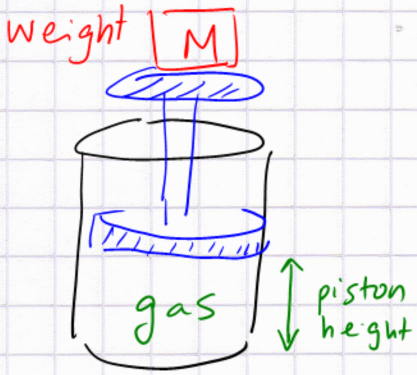
Thermodynamics → chemistry (physical) or physics ?

2 approaches ⟶ 1) <u>macroscopic view</u>



describe the system by state variables and establish relationships

a sample of gas in a cylinder with piston and some weight on top

→ gas occupies some volume, determined by piston height

→ change weight → piston height (volume) changes

gas exerts a pressure $\equiv \frac{\text{force}}{\text{area}}$ on the piston (and on the walls)

→ p = pressure V = volume

The pressure of the gas must equal $\frac{Mg}{A_{piston}}$, as they are in equilibrium

Another variable which controls the system = temperature

Heating the cylinder (gas) → piston rises ↳ V increases

to keep the piston in the same position ($V = const$)

we need to increase the outside mass M

∴ @ $V = const$ T increase ⇒ p increase

What is heat? ⇒ <u>Transfer of energy</u> from system 1 → system 2 if S1 is @ $T_1 > T_2$ temp.

(unit of energy ≙ Joule (or calorie unit)

food energy content: Calorie = kcal

If heat (= energy transfer) is related to T-difference:

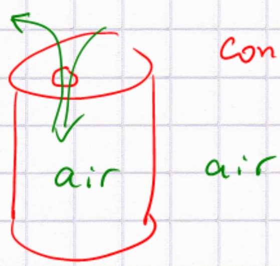
$$Q \sim \Delta T \quad (= T_2 - T_1)$$

energy storage?
- depends on mass m
- depends on material property ≙ specific heat c

$$\Rightarrow \quad Q = c\, m\, \Delta T$$

So much for approach 1. It is called macroscopic, since it doesn't look into what or who is responsible for the phenomena.

approach 2: Kinetic theory of gases; solid-state physics, ..



Consider a can which is open:
air is free to move in/out

air = molecules @ high speed

O_2, CO_2, H_2O, ...

Molecules bombard the walls of the can ⇒ pressure

→ evacuate the can → what happens?

Heating a cylinder of gas → what does it mean?
→ transfer of energy to molecules → they get faster, have higher KE. They bump into each other
→ their average KE changes quickly; ∴ pressure goes up!
$\Delta T \to 0$ ∴ no more energy transfer