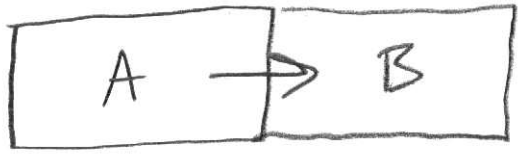
Temperature: what is it?

→ read off a thermometer

→ your intuitively understand hot + cold



hot block $T_{Ai} = 110°C$

cold $T_{Bi} = 0°C$

touch

just a form of energy → Heat flows from A to B (not temperature).

Due to the heat transfer, A cools off, B heats up

Heat flow stops when

$$\underbrace{T_{Af} = T_{Bf}}_{\text{between } 110° + 0°}$$

When $T_{Af} = T_{Bf}$, two systems are said to be in <u>thermal equilibrium</u>

↑

"transitive" A in eq with B
A in eq with C

then.. B in eq with C

Temperature Scales

① °F water freezes 32°F
boils 212°F

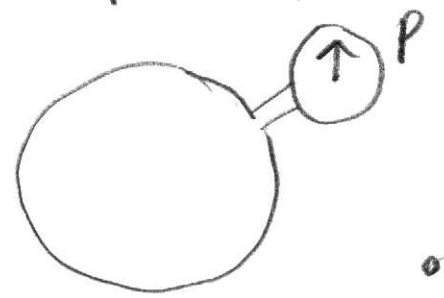
② °C freeze 0°C
boils 100°C

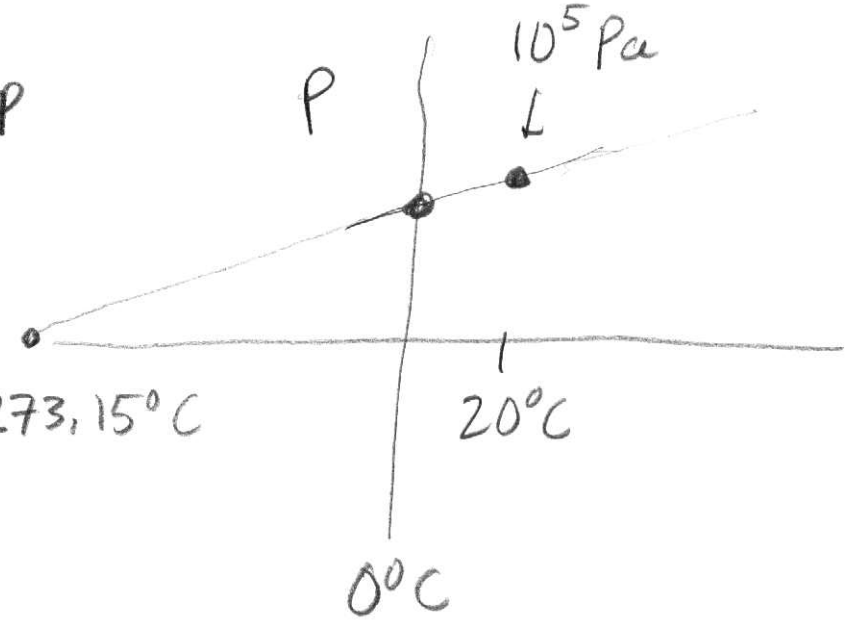
③ K... 0K = −273.15 °C

$\Delta T(K) = \Delta T(°C)$

<u>What?</u> Meaning of 0K...
where a volume of gas has 0 pressure...

Empirically





volume of gas V_0 put at a temperature T, vary

$$PV_0 = nRT \leftarrow K$$

$$P = \left(\frac{nR}{V_0}\right) \cdot T$$

P... gas could suck?

What really is temperature?

→ random motion of molecules (heat = energy = random directions, velocities)

→ randomness ↔ mathematically defined by entropy.

Example: all air molecules could suddenly collect on left side of room, just probability is unbelievably small

$$\rightarrow \quad T \propto \frac{1}{\left(\frac{\partial(\text{entropy})}{\partial(\text{energy})}\right)} \leftarrow \boxed{\text{never infinite}}$$

absolute

$\therefore$ T never 0

$\therefore$ T can be negative (very weird, but possible)

Thermal Expansion

Linear "rules"

$\Delta L \propto L_0$ (initial length)

$\propto \Delta T$ (K or °C)

$$\Delta L = \alpha L_0 \Delta T$$

α depends on material