This class will review basic thermodynamics and then see how the macroscopic properties of thermodynamics can be explained by applying the fundamental laws of physics, together with probability theory, on a microscopic scale.

What is the meaning of temperature?
What is heat?
Why do some processes happen spontaneously and others don't?

What is thermodynamics?

- Study of the transfer of energy between objects
- Temperature, pressure, and work

What is temperature?

"a measure of how hot or cold something is"

→ What does that mean?

Related to thermal energy

- insert mercury thermometer, some thermal energy is transferred to the mercury, which then expands

- insert room-temp thermometer into a freezer, thermal energy moves from the therm into the surroundings, & mercury contracts

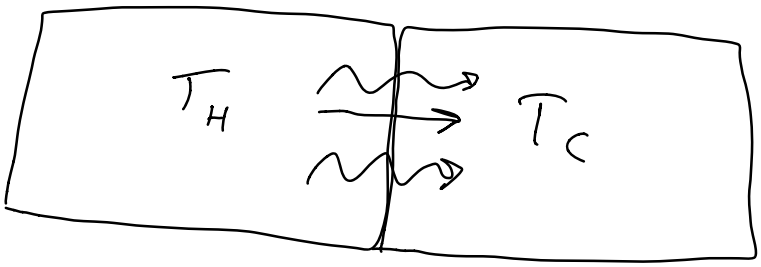
- Does expansion/contraction continue forever?

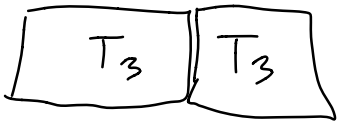
Energy transfer stops when the objects are at the same temp

Thermal Equilibrium

If two objects are in thermal eq:

- Same temp
- No transfer of energy





Temperature measures the tendency of an object to spontaneously give up energy to its surroundings

To make a thermometer, just use mercury
+
define arbitrary points

Celsius: 0 & 100 (water)

Farenheit: 0 & 100

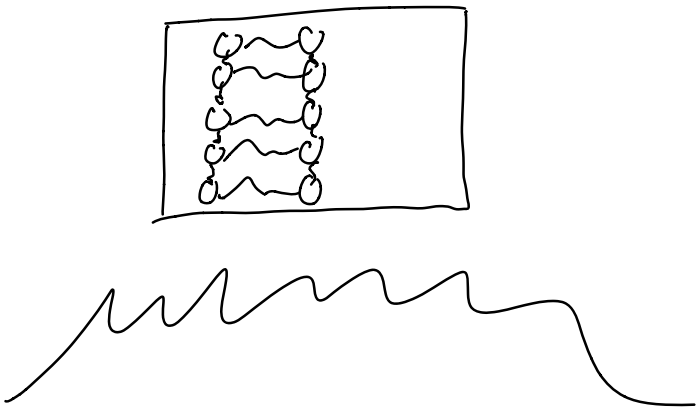
Gas thermometer:

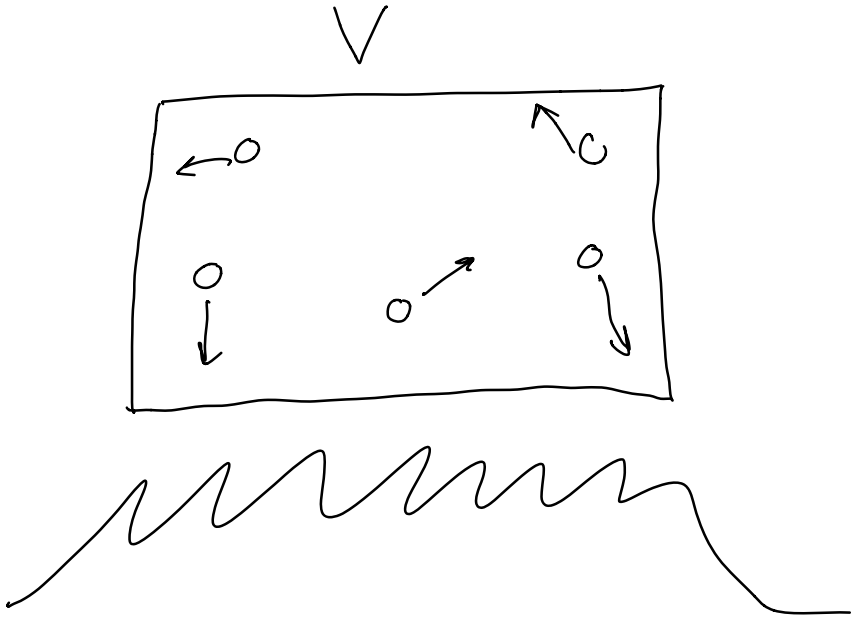
$V \rightarrow 0$ at $T = -273^\circ C$

↑

Lowest theoretical temp

0 K





Thermal energy $\Longrightarrow$ Kinetic energy

molecules collide w/ walls: Force

Avg F per area: Pressure P

$$PV = NkT$$

T: Kelvins

N: # of particles

k: Boltzmann's constant: $1.381 \times 10^{-23} \frac{J}{K}$

May have seen:

$PV = nRT$

n: # of moles $\quad (N_A = 6.02 \times 10^{23})$

R: $8.31 \frac{J}{mol \cdot K}$

$nR = NK$