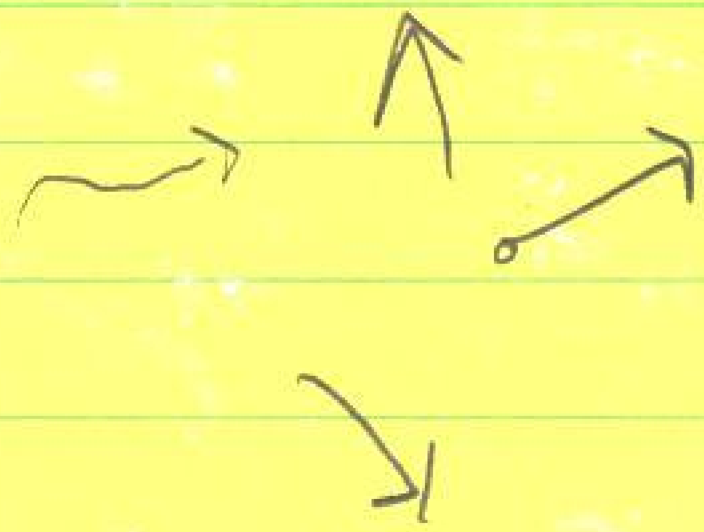
Temperature

~> Loosely energy per degree of freedom



KE increase s withe temperatur

~> Two bodies are in equilbrium wheul their temperatures are equl

~> Measure with Celsius or better kelvin

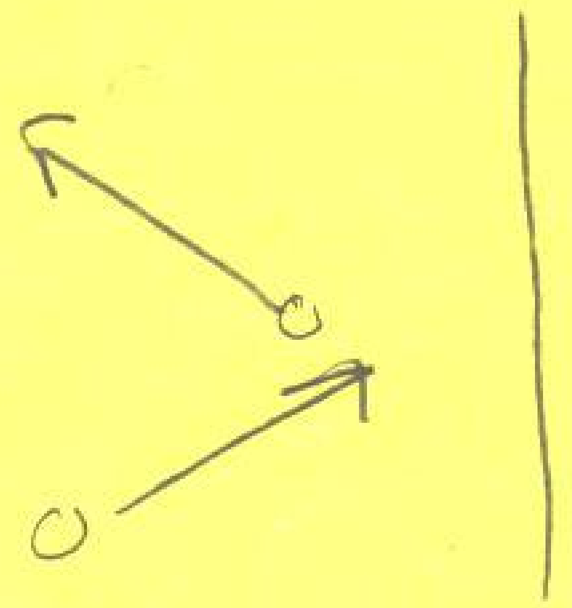
$$T \text{ in Kelvin} = T_C \cdot \frac{°K}{°C} + 273°K$$

Pressure

P = Force per unit area

$$P = \frac{F}{A} = \frac{1N}{m^2} = 1\,Pa$$

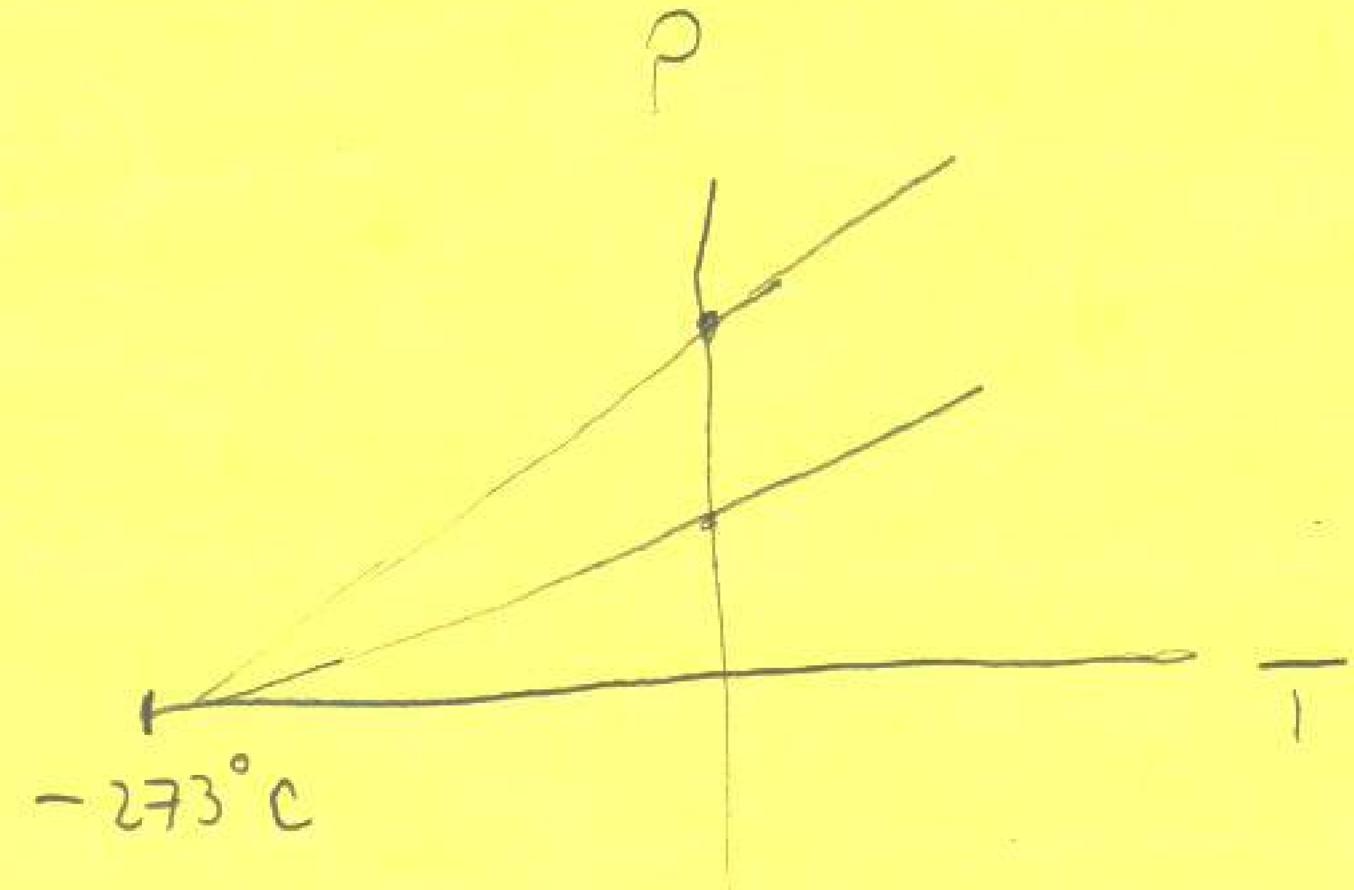
$P = \frac{F}{A}$



$1 \text{ Atmosphere} \approx 10^5 \frac{N}{m^2} = 10^5 Pa = 1$

- increasing T increases speed, increases momentum trasfer, increases pressure

- increasing the density, increases the number of molecule wall collisions increase pressure



- There is a temperature $T_c = -273°C$ where molecules seem to exert no pressure "no motion" loosely

Abs Zero

number Avagadro

$18g \rightarrow 1\, N_A$ number of H_2O

So $\frac{2000}{18} \cdot 18g \longrightarrow \frac{2000}{18} \cdot 1$ Avagadro #

$2000g \rightarrow 111 \cdot$ Avagaro # of H_2O

$= 111$ moles

Ideal Gas Law

$$PV = nRT$$

n ← number of moles

R ← units

T ← T in units of k_B

$R = 8.31 \frac{J}{Mol \cdot K}$

Suppose

$P \propto \frac{1}{V}$ for constant

$P \propto T$ constant V

number of moles

$n \propto$ Total number of molecules $\equiv N$

$PN \propto NT$

$PV = N k_B T$ $\qquad nR = N k_B$

$\hookrightarrow k_B = 1.38 \times 10^{-23}\ J/^\circ K$

Heating a Spray Can

A spray can at 2atm has a volume of 1.25L at 22°C is thrown into a fire, When the temp is 195°C what is the pressure inside the can? assume V_{const}

$$PV = nRT \quad V \text{ const}, \; n \text{ const}$$

$$P \propto T$$

$$\frac{P_f}{P_i} = \frac{T_f}{T_i} \Rightarrow P_f = P_i \frac{T_f}{T_i} =$$

$$P_f = 2 \times 10^5 Pa \left(\frac{468°K}{295°K} \right) = 3.2 \times 10^5 Pa$$

What is the number of moles?

$$\frac{P_i \cdot 125 \times 10^{-6} m^3}{RT} = n$$

$$P_o V_o = 25 J$$

$$\frac{2 \times 10^5 \, N/m^2 \cdot 125 \times 10^{-6} m^3}{8.31 \frac{J}{mol °K} \cdot 295°K} = n$$

$$0.011 = n$$

Energy

E → sum of all the potential and kinetic energies of all the components

Heat

Flow of Energy into or out of the system

→ cal

Specific Heat

The inflow of Energy increases the average energy / degree of freedom

$Q \propto \Delta T$

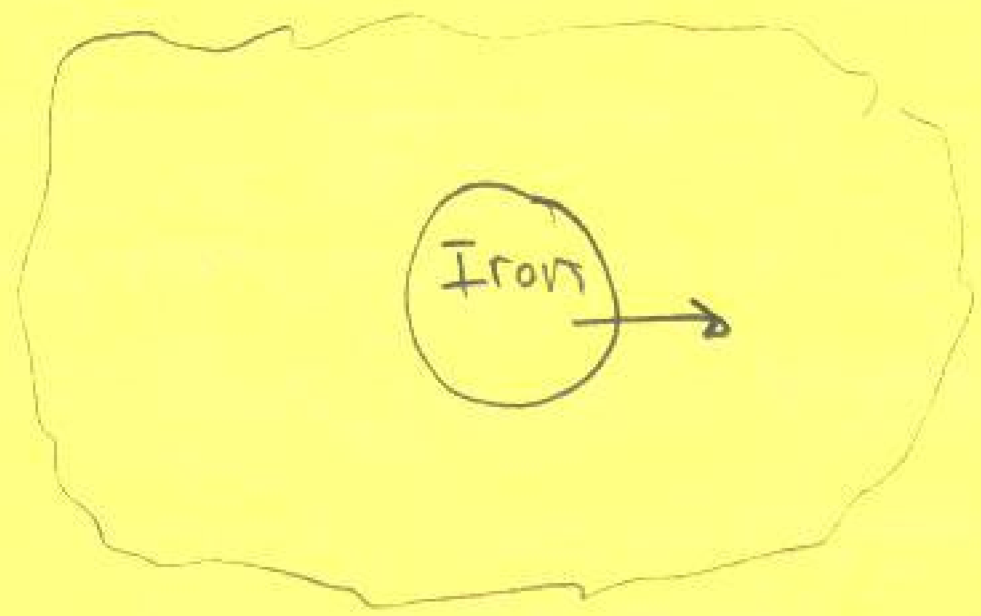
$Q \propto m \Delta T$

$Q = m c_w \Delta T$ ← specific heat in $\frac{J}{kg\,°C}$

$c_w = 4.18 \frac{J}{kg\,°C}$ $\quad 1 \frac{cal}{g\,°C}$

Example

A hot slab of iron 0.05 kg is heated to 200° C and dropped in 0.4 kg of water. Determine the final temp



Q flows out

$$-|Q| = m_I c_I \cdot -|\Delta T_I| \qquad |Q| = m_w c_w \Delta T_w$$

$$+Q = m_I c_I [+1 (T_I - T_f)] \qquad Q = m_w c_w (T_f - T_w)$$

$$m_I c_I (T_I - T_f) = m_w c_w (T_f - T_w)$$

$$\frac{m_I c_I T_I + m_w c_w T_w}{m_I c_I + m_w c_w} = T_f$$

$$c_I = 453 \text{ J/kg °K} \qquad c_w = 4.186 \text{ J/kg °C}$$

$$T_f = 22.4°$$

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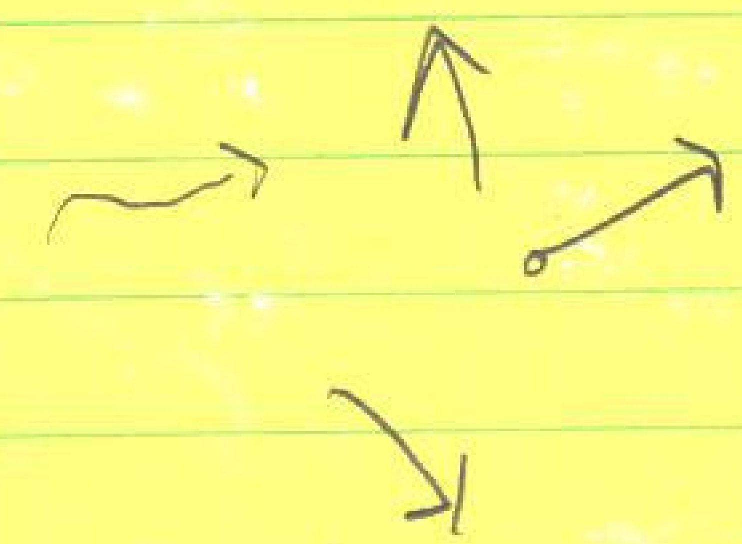

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