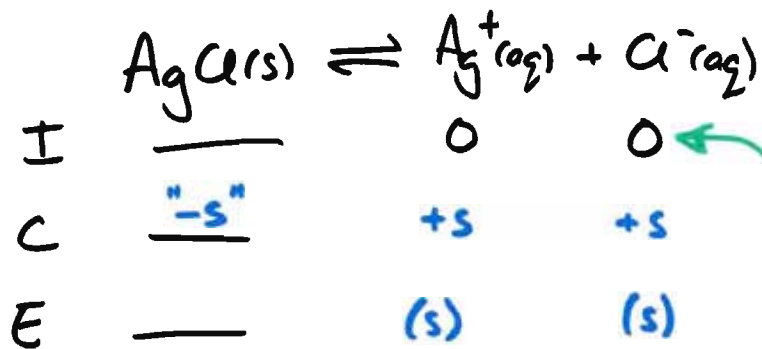


The common ion effect.

let's dissolve $\text{AgCl}(s)$ in H_2O .

$$K_{sp} = 1.6 \times 10^{-10}$$

molar sol?

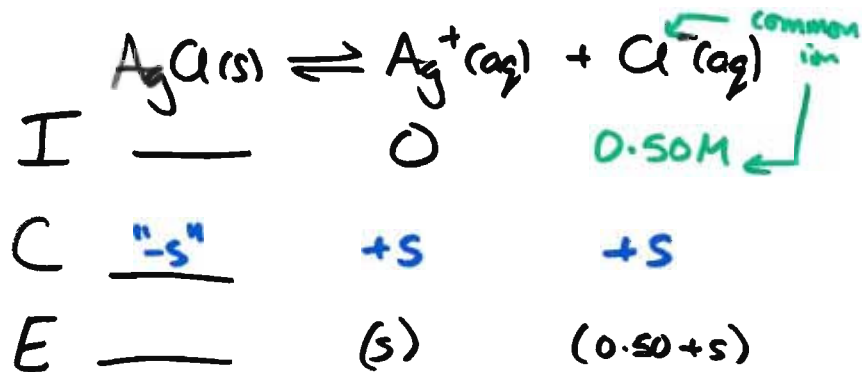


$$K_{sp} = [\text{Ag}^+][\text{Cl}^-]_{eq}$$

$$1.6 \times 10^{-10} = (s)(s) = s^2 \Rightarrow s = \sqrt{1.6 \times 10^{-10}} = 1.3 \times 10^{-5} \frac{\text{mol}}{\text{L}}$$

What would molar sol of AgCl be in, say 0.25M $\text{MgCl}_2(aq)$?

$\text{MgCl}_2(aq) \rightarrow \text{Mg}^{2+}(aq) + 2\text{Cl}^-(aq)$
 0.25M 0.25M 0.50M



So... $K_{sp} = [\text{Ag}^+][\text{Cl}^-]_{eq}$

$$1.6 \times 10^{-10} = (s)(0.50+s)$$

assume $s \ll 0.50$

$$\text{so: } 1.6 \times 10^{-10} \approx (s)(0.50)$$

$$\Rightarrow s = 3.2 \times 10^{-10} \frac{\text{mol AgCl}}{1 \text{ L sol}^n}$$

compare that to sol in pure H_2O of $1.3 \times 10^{-5}\text{M}$

Ch 18 - Thermodynamics

Ch 6 - thermochemistry

heat absorbed/released in chem rxns

(9) endo- / exothermic rxn

$$\Delta H_{rxn}^{\circ} = +ve / \Delta H_{rxn}^{\circ} = -ve$$

1st Law of Thermo.

Energy can neither be created or destroyed

$$E_{universe} = \text{constant.}$$

$$\Delta E_{univ} = 0$$

2nd Law of thermo.

- tell us if things can happen!

"The entropy ^S of the Universe is always increasing."



What is entropy?

Hmm...

an analogy is "Disorder" of "Messiness"

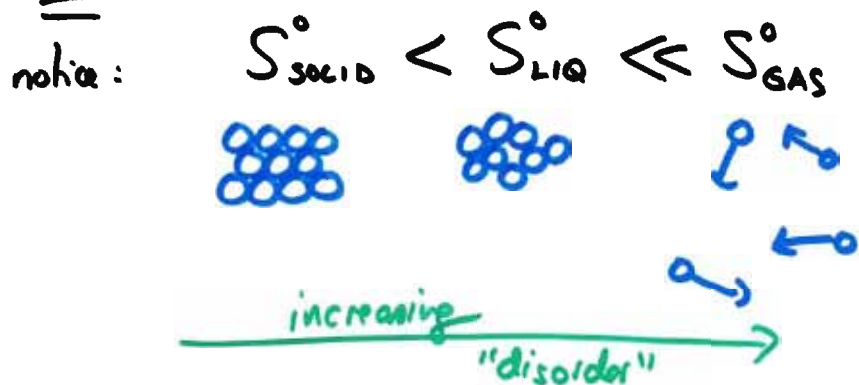
It turns out that we can both measure (+ calculate) entropy for chemical substances!

tabulate these (3rd Law) entropies: S°

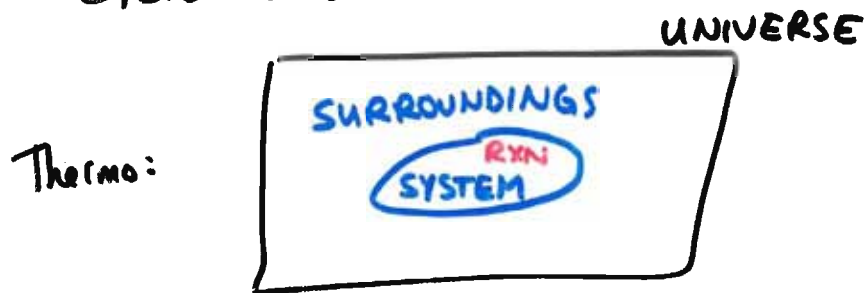
ex:

$S^\circ \left(\frac{\text{J}}{\text{mol}\cdot\text{K}} \right)$	44.6	69.9	188.7
Substance	H ₂ O(s)	H ₂ O(l)	H ₂ O(g)

@25°C



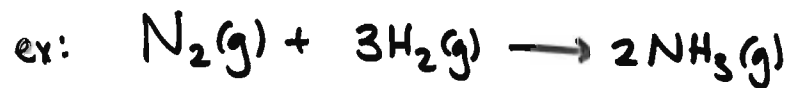
Calculating entropy changes in the SYSTEM (rxn)



$$\underbrace{\Delta S_{\text{UNIV}}}_{\geq 0} = \Delta S_{\text{sys}} + \Delta S_{\text{surr}}$$

aside: can ΔS_{sys} be -ve
as long as ΔS_{surr} is more +ve!

How do we calculate $\Delta S^\circ_{\text{rxn}}$ ← Latin pure solids 1M solids



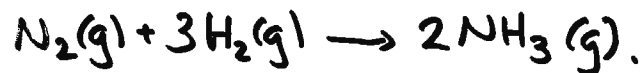
Appendix 2

Substance	$S^\circ (\text{J/mol}\cdot\text{K})$
N ₂ (g)	191.5
H ₂ (g)	131.0
NH ₃ (g)	193.0

Can calc $\Delta S^\circ_{\text{rxn}} = \sum m \cdot S^\circ(\text{prod}) - \sum n \cdot S^\circ(\text{react})$

$$\Rightarrow \Delta S_{\text{rxn}}^{\circ} = [2 \times S^{\circ}(\text{NH}_3(\text{g}))] \ominus [1 \times S^{\circ}(\text{N}_2(\text{g})) + 3 \times S^{\circ}(\text{H}_2(\text{g}))]$$
$$= [2 \times 193.0 \frac{\text{J}}{\text{mol}\cdot\text{K}}] \ominus [1 \times 191.5 \frac{\text{J}}{\text{mol}\cdot\text{K}} + 3 \times 131.0 \frac{\text{J}}{\text{mol}\cdot\text{K}}]$$

$$\Delta S_{\text{rxn}}^{\circ} = -198.5 \frac{\text{J}}{\text{mol}\cdot\text{K}}$$



note: we are decreasing # gas molecules... in general, this leads to -ve $\Delta S_{\text{rxn}}^{\circ}$.