The hydrophobic effect:
- water molecules are ordered, entropy is unfavorable
- surface area that H_2O has to solvate is minimized
- Protein folding: puts nonpolar in the middle, polar on outside

Gibbs Free Energy, ΔG : $\Delta S_{universe} = \Delta S_{system} + \Delta S_{surroundings}$
- substitute for entropy of the surroundings $\Delta S_{universe} = \Delta S_{system} - \Delta H_{rxn}/T$

$$\boxed{\Delta G = \Delta H - T\Delta S}$$

- Indicates if rxns are spontaneous,
- If ΔG is negative, the forward rxn is spontaneous bc free energy has been released, meaning that it is exergonic + product-favored
- If ΔG is positive, the rxn is spontaneous in the reverse direction
  - endergonic:
- If ΔG is 0, the rxn is at equilibrium and reversible

Ex. calculate standard free energy for this reaction

$2CH_3OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(l)}$

$\Delta G^\circ = \Sigma n G_f^\circ (products) - \Sigma m \Delta G_f^\circ (reactants)$

species	ΔG°_f kJ/mol
$CH_3OH_{(l)}$	-166.4
$O_{2(g)}$	0
$CO_{2(g)}$	-394.4
H_2O	-237.2

Ex. $6H_2O(l) + 6CO_2(g) \rightarrow 6O_{2(g)} + C_6H_{12}O_6(s)$

$= 1 mol (-910.6 kJ/mol) + 6 mol (0 kJ/mol) - 6 mol (-237.2) - 6(-394.4)$
~~$= -6 mol (-237.2 kJ$~~
$= +2879$ - cellular respiration is spontaneous

Is the following reaction spontaneous? $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ where $\Delta H = -120 kJ$, and $\Delta S = -150 J/K$

favorable: heat is released bc neg.

becoming more orderly, neg. value makes sense given that rxn goes 3 mol → 2 mol

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \rightarrow = -120kJ - T(-0.150 kJ/K)$

$120 kJ = T(0.150 kJ/K)$

$T = \frac{120 kJ}{0.150 kJ/K} = 800K$

$H_2O_{(s)} \rightleftharpoons H_2O_{(l)}$: $\Delta H^\circ = +6 kJ/mol$, $\Delta S^\circ = 22 J/K mol$

$\Delta G^\circ = 6 kJ/mol - T(22 J/K mol)$, $T = 273K$

Rxn is spontaneous if $\Delta G < 0$, so optimally $\Delta H < 0$ and $\Delta S > 0$, but temperature matters