

The hydrophobic effect:

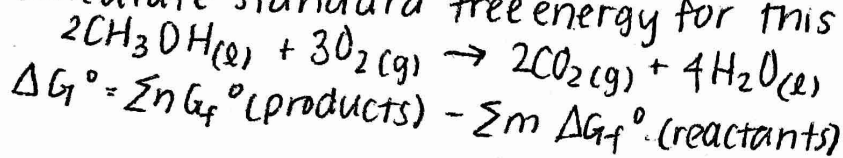
- water molecules are ordered, entropy is unfavorable
- surface area that H_2O has to solvate is minimized
- Protein folding: puts nonpolar in the middle, polar on outside

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

$$\Delta G = \Delta H - T\Delta S$$

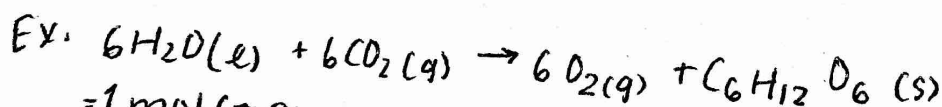
- Indicates if rxns are spontaneous,
- If ΔG is negative, the forward rxn is spontaneous bc free energy has been released, meaning that it is exergonic + product-favored
- If ΔG is positive, the rxn is spontaneous in the reverse direction - Endergonic:
- If ΔG is 0, the rxn is at equilibrium and reversible

Ex. calculate standard free energy for this reaction



$$\Delta G^\circ = \sum n G_f^\circ(\text{products}) - \sum m G_f^\circ(\text{reactants})$$

species	ΔG_f° kJ/mol
$CH_3OH(l)$	-166.4
$O_2(g)$	0
$CO_2(g)$	-394.4
H_2O	-237.2



$$= 1 \text{ mol} (-910.6 \text{ kJ/mol}) + 6 \text{ mol} (0 \text{ kJ/mol}) - 6 \text{ mol} (-237.2) - 6(-394.4)$$

$$= -6 \text{ mol} (-237.2 \text{ kJ}) = +2879 \text{ - cellular respiration is spontaneous}$$

Is the following reaction spontaneous? $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
 where $\Delta H = -120 \text{ kJ}$, and $\Delta S = -150 \text{ J/K}$

favorable: heat is released bc neg.

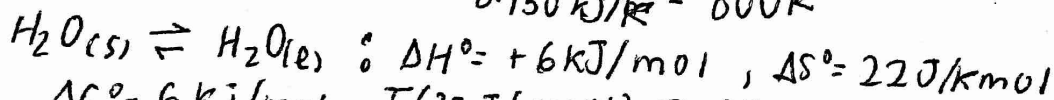
becoming more orderly, neg. value

makes sense given that rxn goes 3 mol $\rightarrow$ 2 mol

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

$$120 \text{ kJ} = T(0.150 \text{ kJ/K})$$

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



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

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