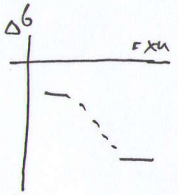
ΔG_{rxn}°

zero for pure elements in standard state → 1 atm pressure

$\Delta G_{rxn}^{\circ} = \sum \Delta G_f^{\circ}(\text{products}) - \sum \Delta G_f^{\circ}(\text{reactants})$

$\Delta G_{rxn}^{\circ} \leq 0$ spontaneous



usually measured in kJ/mol

and

$\Delta G_{rxn}^{\circ} = \Delta H_{rxn}^{\circ} - T\Delta S_{rxn}^{\circ}$

measured in K

	$\Delta H > 0$	$\Delta H < 0$
$\Delta S > 0$		
$\Delta S < 0$		

$S_{gas} > S_{liquid} > S_{solid}$?

$\Delta S_{rxn}^{\circ} = \sum S^{\circ}(\text{products}) - \sum S^{\circ}(\text{reactants})$

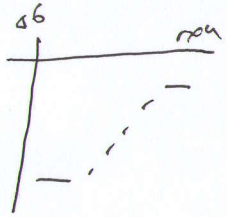
usually measured in J/mol K

$\Delta S_{universe} = \Delta S_{sys} + \Delta S_{surr}$

$\Delta S_{uni} > 0$ spontaneous (2^{nd} Law)

$\Delta S_{uni} < 0$ non-spontaneous

$\Delta G_{rxn}^{\circ} > 0$ non-spontaneous



zero for pure elements in standard state

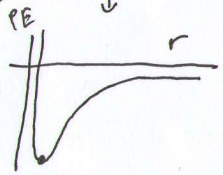
$\Delta H_{rxn}^{\circ} = \sum \Delta H_f^{\circ}(\text{products}) - \sum \Delta H_f^{\circ}(\text{reactants})$

usually measured in kJ/mol

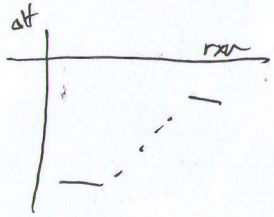
and

$\Delta H_{rxn}^{\circ} = \sum \Delta H(\text{bonds broken}) - \sum \Delta H(\text{bonds formed})$

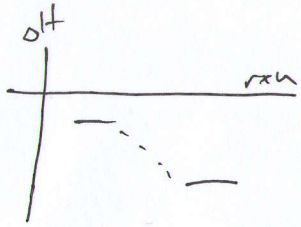
only use when all products and reactants in gas phase



$\Delta H_{rxn}^{\circ} > 0$ endothermic energy absorbed



$\Delta H_{rxn}^{\circ} < 0$ exothermic energy released



Hess's Law

~~First~~ Laws of Thermodynamics