

CHAPTER 18 S, ΔG, K

Laws of Thermodynamics

① Conservation of Energy \Rightarrow E not created or destroyed

$$\Delta E = \Delta H = \frac{q}{n} \text{ @ const } P$$

$$\Delta E = q + w \quad \Delta P, \Delta V$$

SPONTANEOUS REACTION \rightarrow a reaction that occurs by itself (as written) under a given set of circumstances
"thermodynamically favorable"

- phase change @ proper T
- expansion of gas
- heat flow $\uparrow T \Rightarrow \downarrow T$
- "one way" reactions

EXOTHERMIC REACTIONS ($-\Delta H$)
tend to be spontaneous
 \rightarrow overall decrease in the E of the system

EXERGONIC

$$PE_{\text{SYSTEM}} \Rightarrow KE_{\text{SURR}}$$

$$\Delta E = \Delta H \text{ @ } P \text{ const, } \Delta E \approx \Delta H \text{ if } \Delta P, \Delta V$$

ENTROPY (S) \rightarrow a measure of the "distribution of micro states in a system"
"disorder"

less "distributed" \Rightarrow lower the entropy
"freedom of movement"

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$$S_{\text{SOLID}} < S_{\text{LIQUID}} \quad \text{crystalline solids} \downarrow S$$

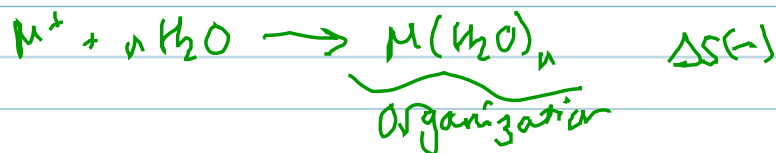
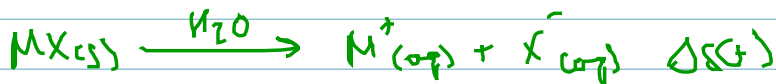
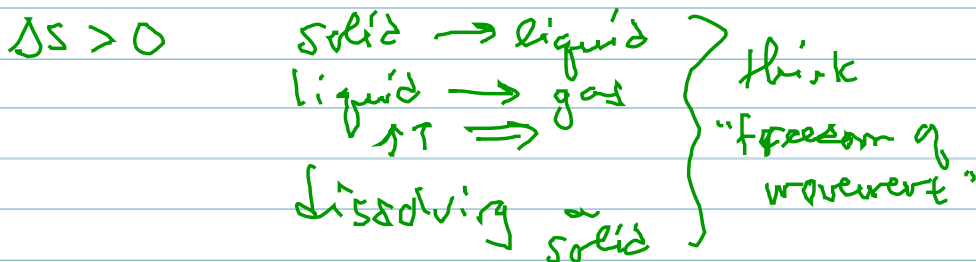
$$S_{\text{LIQUID}} < S_{\text{GAS}}$$

$$S_{\text{DIAMOND}} < S_{\text{GRAPHITE}} \quad (\text{ALLOTROPES})$$

$$S_{\text{He}} < S_{\text{Ne}} \quad M_{\text{m Ne}} \uparrow \quad S_{\text{CH}_4} < S_{\text{C}_2\text{H}_6} < S_{\text{C}_3\text{H}_8}$$

$$S \text{ units} \quad \frac{\text{J}}{\text{K-mole}} \quad S^\circ \leftarrow \text{standard} \quad [] = 1 \text{ M} \quad (T = 298 \text{ K})$$

$$P = 1 \text{ atm}$$



heat a solid

$$\uparrow S \Rightarrow \uparrow T \Rightarrow \uparrow \text{KE} = \frac{1}{2} m v^2$$

velocity

motion

- translational
- rotational
- vibrational

$$\Delta S^{\circ}_{\text{rxn}} = \sum S^{\circ}_{\text{products}} - \sum S^{\circ}_{\text{reactants}}$$

predict the sign ΔS

$\Delta S (+)$ if

→ reaction produces more moles
of gas than it consumes
[COEFFICIENTS!]

→ $\Delta n_{\text{gas}} = 0$ → ΔS could be (+)
or (-) but will be
small

look @ physical states