11-21-13

Predict sign for the ΔS_{sys} for sugar dissolving in water

+

- mixed higher S than unmixed

- as volume increases, entropy increases

- Predict the sign for the ΔS_{sys} for iodine vapor condensing on a cold surface.

−

$\Delta S_{total} > 0$

$\Delta S_{sys} < 0$ $\Delta S_{surroundings} > 0$

Determining behavior of S

- volume change: V↑ S↑
- Mixed: high S, unmixed: low S
- Phase Change solid low S ⟶ gas high S
- Temp Chang: T↑ S↑
- Chemistry
  - generally, if more molecules are produced, entropy is going up Reactants → products

Knowing something about entropy ~~[illegible]~~ can help us figure out the other

Entropy of the Surroundings

$$\Delta S_{surroundings} = \frac{q_{surr}}{T} = \frac{-q_{sys}}{T}$$

Exothermic $\Delta S_{surrounding} > 0$

Endothermic $\Delta S_{surroundings} < 0$

(and vice versa) $\Delta S_{system} \uparrow \rightarrow \Delta S_{surroundings} \downarrow$

Physical Change — ΔT, phase change

Chemistry

units = $\frac{energy}{temp}$

$$\boxed{\Delta S = C \ln \frac{T_f}{T_i}}$$

depends on what you want to find (follow units to figure out)

$$\Delta H = C\Delta T$$

$$\Delta S_{trans} = \frac{q_{rev}}{T} = \frac{\Delta H_{trans}}{T_{trans}} \rightarrow \frac{\Delta H}{\Delta S} = T$$

often tabulated

can be calculated

Chemistry

Reactants $\rightarrow$ Products

$$\Delta S = S_{final} - S_{initial} = S_{products} - S_{reactants}$$

- we need to be able to find entropy of a substance!

Third law of Thermodynamics

- The entropies of all perfect crystals approach zero when absolute temp. approaches zero!

$$S = k \ln \Omega = k \ln 1 = k(0) = 0$$

$$\Omega = 1$$

We can use entropy change from temp. change & phase change to find the entropy of any substance at any temp.

tables for ΔS in J and ΔH in kJ

$$\Delta S_r^{\circ} = \sum n S^{\circ}_{products} - \sum n S^{\circ}_{reactants}$$

standard state comparison

- entropy is Ø at zero K
  - entropy is absolute

Volume change - only qualitative

LECTURE ~NOV 21

QUANTIFY ENTROPY CHANGE

ENTROPY

$V \uparrow$ $S \uparrow$

mixed $\uparrow S$, unmixed $\downarrow S$

solids $\downarrow S$ → gas $\uparrow S$

Temp $\uparrow S$

chemistry ??? (more molecules $\uparrow S$)

ENTROPY OF SURROUNDINGS

$\Delta S_{surroundings} = \frac{q_{surr}}{T} = \frac{-q_{sys}}{T} = \frac{-\Delta H_{sys}}{T}$ for constant pressure

exothermic $\Delta S_{surr} > 0$ $\Delta H < 0$

Endothermic $\Delta S_{surr} < 0$ $\Delta H > 0$

→ $\Delta S_{sys} \uparrow$ ⇒ $\Delta S_{surr} \downarrow$ ~have to balance

- Honey ex

PHYSICAL CHANGE

ΔT

PHASE CHANGE

$\Delta S_{trans} = \frac{q_{rev}}{T} = \frac{\Delta H_{trans}}{T_{trans}}$

$\Delta H / \Delta S = T$

CHEMISTRY

$\Delta H = C\Delta T$

$\Delta S = C \ln T_f/T_i$ $\Delta H = C\Delta T$ units are energy/temp

CHEMISTRY

Reactants → Products $\Delta S = S_{final} - S_{initial} = S_{products} - S_{reactants}$

THIRD LAW OF THERMO

→ the entropies of all perfect crystals approach zero when the absolute temp approaches zero

$S = k \ln \Omega = k \ln 1 = k(0) = 0$

all molecules in one specific place

* standard entropy (ΔS) in J, and enthalpy (ΔH) in kJ

>100K at phases of reactants, solids → liquids → gas

*entropy is zer[o] at 0K entr[opy] is absolute

$$\Delta S_r^\circ = \sum n S^\circ_{prod} - \sum n S^\circ_{reactants}$$

pure · pure · standard state comparison

ENTROPY CALCULATIONS

Phase change, temp change,