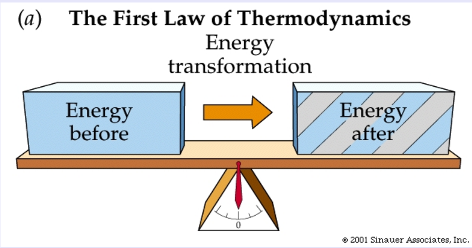
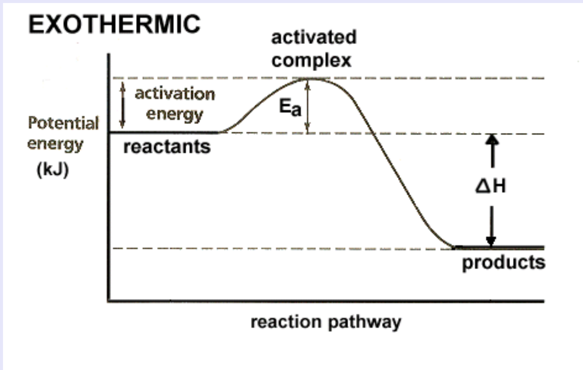
Gibbs Free Energy
and Entropy

May 22-12:12 PM

1st law of Thermodynamics: Conservation of energy

Energy can be changed from one form to another, but it cannot be created or destroyed.

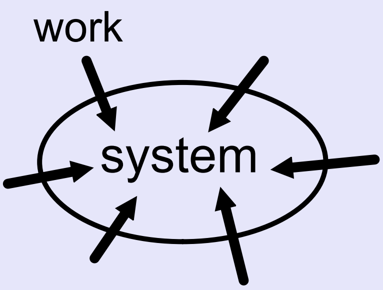




chem energy → heat, ΔH
↘ work

analogy:

$$$ → to do stuff
energy → work

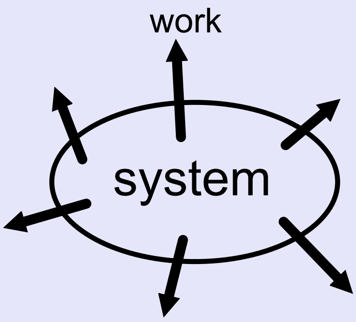


endergonic

(enter work)

+ΔG Gibbs Free E

non spontaneous

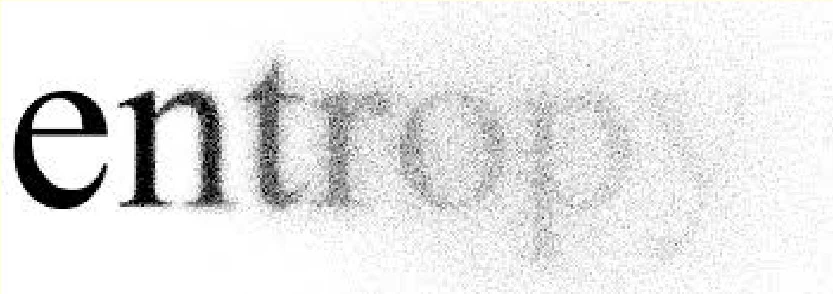


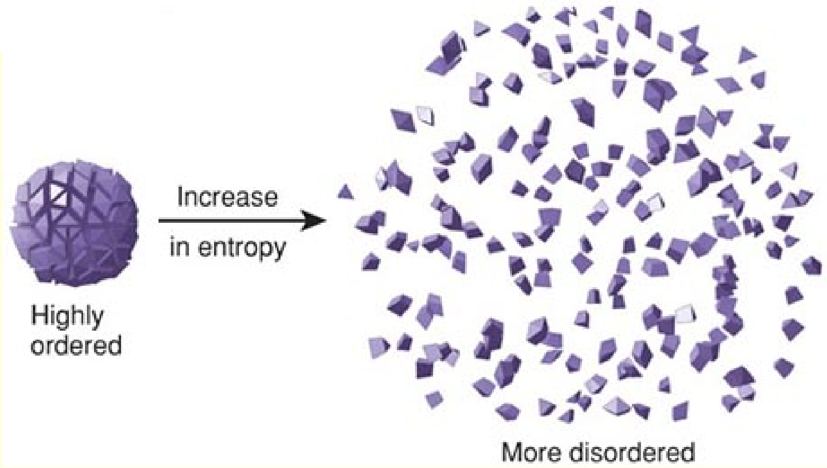
exergonic

(exit work)

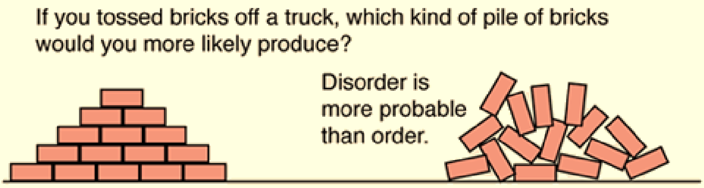
- ΔG

spontaneous





What happens to your room if you put no energy into cleaning it?



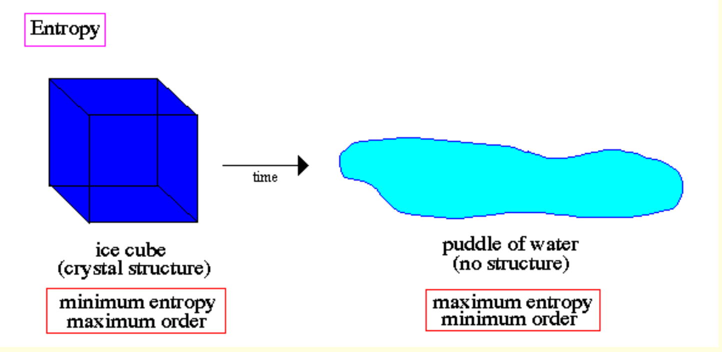
$\uparrow$ movement $\uparrow$ entropy $+\Delta S$

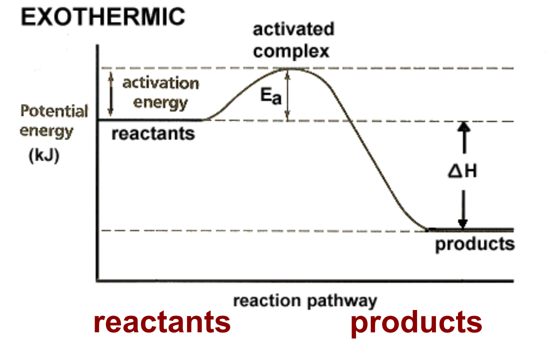
$\downarrow$ movement $\downarrow$ entropy $-\Delta S$

2nd law of Thermodyanmics:

Randomness will increase without added energy to a system

The disorder (entropy, S) of an isolated system will tend to increase over time.





reactants	products
more order	less order
more PE	less PE
less entropy	more entropy

low entropy (high order)	high entropy(low order)
solid	gas
reactants in exothermic rxn	products in exoth. rxn
gallons of gas	carbon dioxide and water
prepared food	unprepared food
sunlight	

↑ movement ↑ entropy $+\Delta S$

↓ movement ↓ entropy $-\Delta S$

May 26-3:50 PM

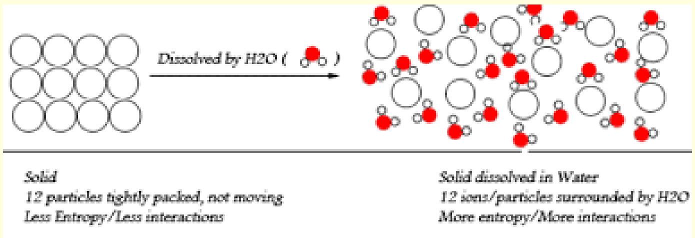
Entropy --disorder/dispersal

qualitatively, what is happening?

matter

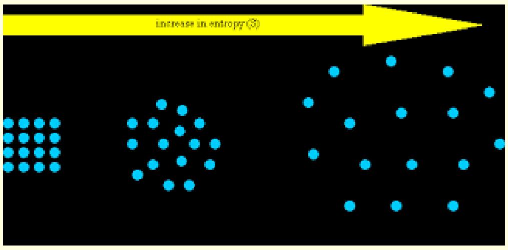
- 0 entropy, S is perfect crystal at 0K
  no movement

-dispersal



dissolving salt

-phase changes
s<l<g



-stoichiometry

increase # of mole from reactant to product

$$N_2O_{4(g)} \rightarrow 2NO_{2(g)}$$

1 mole 2 moles

$$2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$$

energy

increased movement

$\uparrow$ movement	$\uparrow$ entropy	$+\Delta S$
$\downarrow$ movement	$\downarrow$ entropy	$-\Delta S$

May 26-8:23 PM

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

ΔG	ΔH	ΔS	T	$\Delta G = \Delta H - T\Delta S$
−	−	+	all	− = − − (+)
+	+	−	all	+ = + − (−)
−/+	+	+	depends	+ = + − (low T +) − = + − (high T +)
−/+	−	−	depends	− = − − (low T −) + = − − (high T −)