

Hebden p43-49  
# 14-16

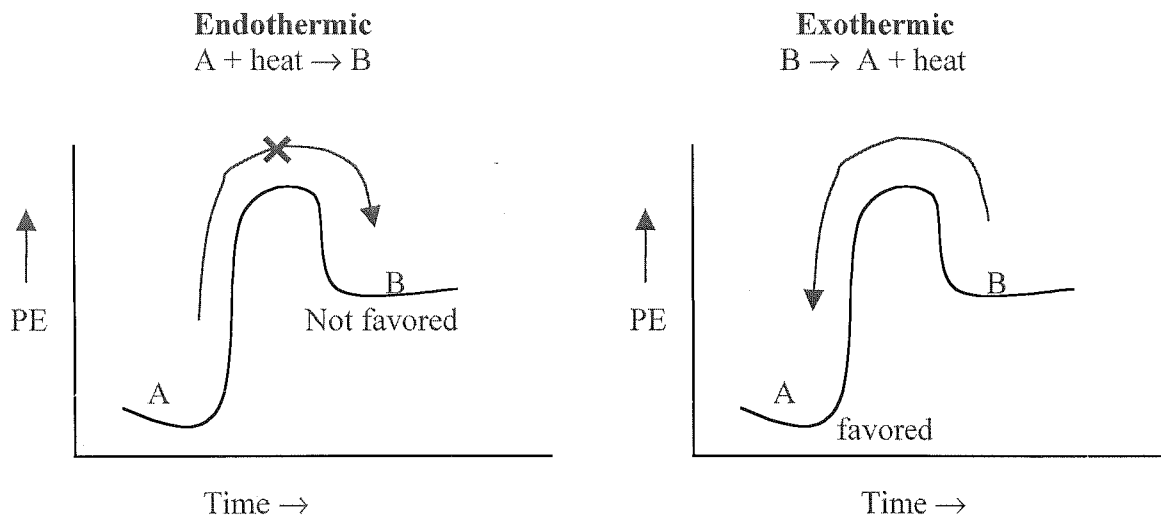
Heath p. 523-524  
# 1-2

## 2. What Causes an Equilibrium?

- A reaction will either:
1. proceed forward
  2. not proceed (proceed in reverse)
  3. form an equilibrium.

### a) Enthalpy

- i) The side of the reaction having the **least enthalpy** is favored.
- ii) In other words, the exothermic reaction path is more likely to occur than the endothermic reaction path.



- iii) Therefore, we should expect exothermic reactions to go to completion and not be reversible or at least in equilibrium!
- iv) We should also expect endothermic reaction to never occur spontaneously.  
(i.e.: without cranking up the temperature, or other outside forces)

**But both (iii) and (iv) occur!! Think "Cold Packs" for (iv)!!!**

**So there must be another factor that affects equilibrium!**

### b) Entropy

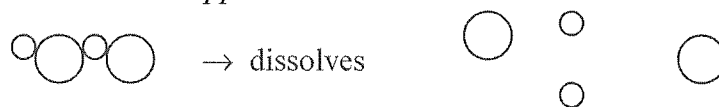
- i) What is "entropy"?  
disorder, randomness, unorganized
- ii) How is entropy related to our universe?

Probability is high that events occurring in life will lead to more disorder!

*Example: When you open a box of Smarties after shaking, are all the colours in order?!*

No! Probability of reorganizing low...

*Example: Why doesn't an ordered crystal of salt stay ordered when placed in water? What happens to the ions?!*



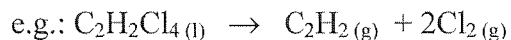
iii) How does entropy affect reaction equilibrium?

The side of the reaction having most entropy is favored

### ***c) How do we Decide which Side of a Reaction has the most Entropy?***

i) Phase    Most entropy   ←—————    Least entropy

Gases > Solutions(aq) > Liquids > Solids



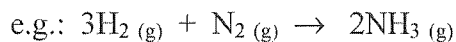
least  
entropy

most  
entropy

***But what if both reactant and product are the same phase??***

ii) Number of Molecules

The side of the reaction having the most molecules has most entropy



most  
entropy

least  
entropy

***But what if more than one phase is present in the reaction??***

iii) Combo of (i) and (ii)

Maximum entropy is the side that has the most particles of the most random phase!!