



Le Chatelier's Principle

- Regaining Equilibrium



Le Chatelier's Principle

- Le Chatelier's Principle states:
If something is changed in a system at equilibrium, the system shifts in equilibrium composition in order to counteract (or oppose) this change.



Le Chatelier's Principle

- A change imposed on an equilibrium system is called a **stress**.
- There are 3 types of stress:
 - 1) Changing concentration
 - 2) Changing temperature
 - 3) Changing pressure (for gases)
- The equilibrium always responds in such a way so as to counteract the stress.

Concentration Changes

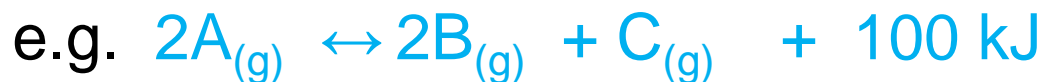
- If concentration is increased
 - shifts to consume some of the added reactant or product
- If concentration is decreased
 - shifts to replace some of the removed reactant or product



- If A is added, shifts right
- If B is added, shifts left
- If A is removed, shifts left

Temperature Changes

- If temperature is increased
 - shifts to consume some of the added thermal energy
- If temperature is decreased
 - shifts to replace some of the removed thermal energy
- Energy is treated as a reactant (endothermic) or product (exothermic)



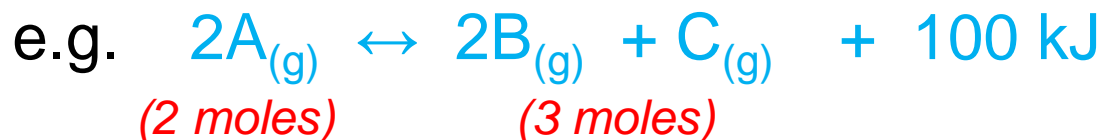
- If temperature is reduced, shifts right
- If temperature is increased, shifts left



- If temperature is increased, shifts right

Gas Volume Changes

- To predict whether a change in pressure will affect equilibrium, consider total moles of gas reactants and total moles of gas products.



- If volume is increased (pressure is decreased)
 - shifts toward the side with the **larger** number of moles of gaseous entities i.e. **shifts right**
- If volume is decreased (pressure is increased)
 - shifts toward in the direction that has the **smaller** number of moles i.e. **shifts left**

Note – In some cases there is no shift because

$$n_{\text{reactants}} = n_{\text{products}}$$



Other Effects?

Adding catalyst

- affects only how fast reaction reaches equilibrium
- no overall effect on equilibrium

Nature of Reactants

- Only affect how fast reaction reaches equilibrium
- no effect overall

Adding inert gases (keeping volume constant)

- no effect on equilibrium
- See **Summary** Table p 456