EQUILIBRIUM LECTURE 3
Le Chatelier's Principle

Schweitzer

Consider this reaction…

	A(g) ⇔	B(g)
I.	100	0
C.		
E.	50	50

Notice this reactions equilibrium

What would happen to the reaction we **removed** all of B?

	A(g) ⇔	B(g)
I.	100	0
C.		
E.	25	25

The reaction lost a substance so it shifted to counter act the stress
(consumed A and produced B) SHIFT ➔

What if we added B?

	A(g) ⇔	B(g)
I.	100	0
C.		
E.	50	50

Notice this reactions equilibrium

What would happen to the reaction we **Added** B?

	A(g) ⇔	B(g)
I.	100	0
C.		
E.	50	50

Which way will the reaction shift?

What is Le Chatelier's Principle

- Le Chatelier's Principle: Says that a reaction at equilibrium will shift against any stress that is applied.

We have already seen that if B is added the reaction will shift to consume it.

Or

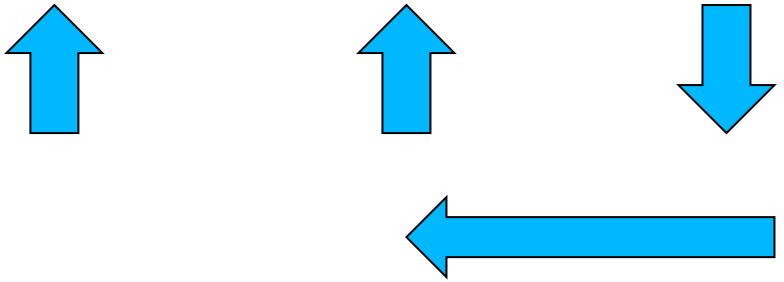
If B is removed it will shift to produced more B

Important: K is temperature dependant.
WILL NOT CHANGE UNLESS TEMP CHANGES

Practice Problem

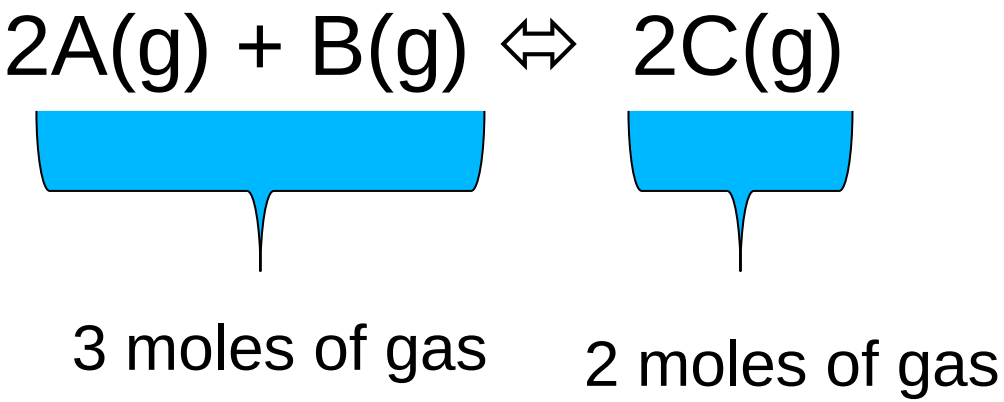
- Predict the direction of the reaction when H_2 is removed from a mixture of the following.

$$H_2\,(g) + I_2(g) \Leftrightarrow 2HI(g)$$



If you are going to remove H_2 then you will have to shift to Increase it. This will cause an increase in I_2 and a decrease in HI

Increase/Decrease Pressure?



This shift will cause a drop in pressure

This shift will cause an increase in pressure

Practice

$$2A(g) + B(g) \Leftrightarrow 2C(g)$$

If the reaction above is placed in a piston chamber and the pressure on the piston is increased causing the volume to decrease. How will the concentration of C be affected?

Practice Answer

$$2A(g) + B(g) \Leftrightarrow 2C(g)$$

If the reaction above is placed in a piston chamber and the pressure on the piston is increased causing the volume to decrease. How will the concentration of C be affected?

The increased pressure will cause this reaction to shift to reduce the pressure. The products have less particles which is therefore less pressure.

Practice

$$2A(g) + B(g) \Leftrightarrow 2C(g)$$

Gas A and B are in a rigid container. Gas D is added to the container doubling the pressure. Which way will the reaction shift?

Answer:

**They will not shift because the partial pressure of the gases did not change.

PV = nRT P = nRT/V Nothing changes

**D is also not a component in the reaction.

Add an inert substance?

- Anytime you add a substance that is not a specific part of the equation there will not be any shift of equilibrium.

What if we increase the Temperature?

- 1st the equilibrium constant is temperature dependent (K) and can ONLY change if the temperature changes.

Exothermic

$A \Leftrightarrow B + Energy \quad (-\Delta H)$

Shift: 

Endothermic

$Energy + A \Leftrightarrow B \quad (+\Delta H)$

Shift: 

Increasing temperature will cause a shift away from energy.

Practice

$$A(g) \Leftrightarrow B(g)$$

In the reaction above at 25C 1 mol of A produces .5 moles of B at equilibrium. At 50C 1 mol of a produces .75 moles of B. Is the reaction exothermic or endothermic?

Practice answer

- As the temperature was increased the reaction shifted to the products.
- As you increase temperature the reaction will shift away from energy.
- Endothermic

Energy + A ⇔ B

Use a catalyst?

- A catalyst will NOT change the net affect on a reaction. It will only reach equilibrium faster.