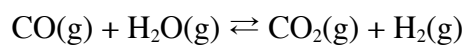


Chemical Equilibrium:

Chemical Reactions reach a state of dynamic equilibrium in which the rates of the forward and reverse reactions are equal and there is no net change in composition.



Rates:

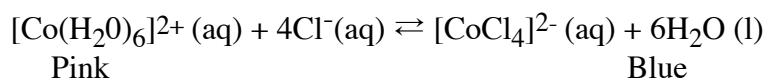
Concentrations:

Le Chatelier's Principle

When a system at equilibrium is subjected to a stress, the equilibrium will shift to relieve the stress.

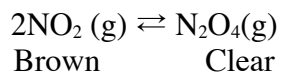
What is a stress?

Let's look at the following equilibrium:



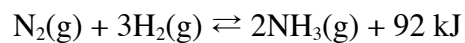
What happens if we put this into a hot bath?

Now let's look at the following equilibrium:



If we heat this puppy up what happens? Is it exothermic or endothermic?

Now consider the following equilibrium system:



What direction will the equilibrium shift to relieve the stress if we if we:

Add N_2

Remove NH_3

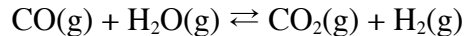
Remove H_2

Add a catalyst

Add heat

Decrease the volume

Now a different system:



What direction will the equilibrium shift to relieve the stress if we if we:

Add CO

Add water

Add carbon dioxide

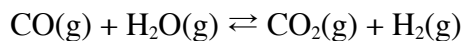
Remove Hydrogen gas

Remove CO

Add a catalyst

Increase the volume

Now consider a slightly different question



What happens to the concentration of H_2 if we:

Add CO

Add water

Add carbon dioxide

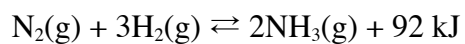
Remove Hydrogen gas

Remove CO

Add a catalyst

Increase the volume

Now let's reconsider this system:



Suggest ways to make the equilibrium shift to the left

Equilibrium Constants

What is an equilibrium constant?

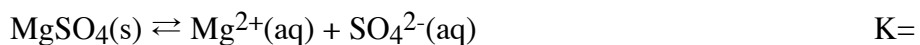
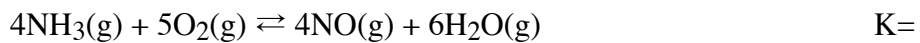
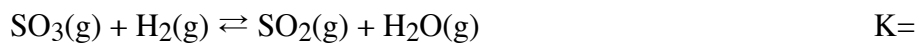
How do you write an equilibrium constant?

What is excluded and why?

What is included in an equilibrium constant?

What is the difference between K_c and K_p ?

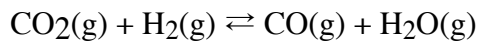
How do you write the equilibrium constant for these reactions:



What does the word constant mean? What is a constant in algebra?

What does the relative size of the equilibrium constant tell us?

Think of the following reaction:



Which describes a reaction that was carried out at 900 Celsius with the following results:

Trial	CO ₂	H ₂	CO	H ₂ O
1	0.648	0.148	0.352	0.352
2	0.234	0.234	0.266	0.266
3	0.314	0.314	0.186	0.685

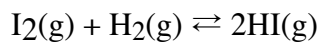
What is the equilibrium constant for the reaction:

K₁ =

K₂ =

K₃ =

Now think of this reaction which is not one to one:



Trial	H ₂	I ₂	HI
1	0.00647	0.000593	0.0137
2	0.00384	0.00152	0.0169
3	0.00143	0.00143	0.0100

Show work here

Show answers here

K₁ =

K₂ =

K₃ =

Solving Equilibrium Problems (Honors Only)

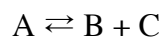
Steps to solving an equilibrium problem.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

The Quadratic Equation.

For an equation of the form: $ax^2+bx+c=0$

1. For the reaction:



the equilibrium constant is 3.0×10^{-6} . What is the concentration of B at equilibrium if A was originally 0.10 M?