Equilibriums

When the forward rate = the reverse rate

Conditions: a reversible process and a closed system

The rxn has NOT stopped.

The rxn is still taking place-its a dynamic ongoing process.

The concentrations (or P) remains constant due to the rates being equal.

Equilibrium constant Keq or Kc

Kc = kf/kr

$$Kc = \frac{[Prod]^{coeff}}{[React]^{coeff}}$$

Kc > l the products are preferred (you have more product) @ Equilibrium

Kc < 1 the reactants are preferred (you have more reactants)@ Equillibrium

Keq also known as Kc can change if Temperature is changed. The value (#) will go up or down depending on if the rxn is exothermic or endothermic. You should be able to tell if it will rise or fall when the temp is increased or decreased by looking at what side of the equation the heat is on.

Endothermic rxns, when heat is raised Kc rises

Exothermic rxns when heat is raised Kc drops.

Kc will also change if pressure is changed for gaseous rxns. The value (#) will go up or down depending on which way the rxn shifts.

If all of the reactants and products are gases the [concentration] is direcctly proportional to their partial pressures and the equilibrium can be expressed in terms of Kp

$$Kp = \frac{\text{Partial P of the products}^{coeff}}{\text{Partial P of the reactants}^{coeff}}$$

$Kp = Kc\,(RT)^{\Delta N}$ ˜ΔN = change in moles

A + B <--> C	Kc = 0.2	kp? at 25 C
C <--> A + B	Kc = 1/ 0.2	

1/2 D --> 1 X Kc = 9

1 D --> 2X Kc = $9^{\wedge 2}$

LeChatliers Principle. When a change in concentration, temp, or pressure occurs, the rxn will shift in such a way as to relieve the stress. Temp will change the Kc value.

The rxn will always **shift away from an increase** in Temp or concentration

The rxn will always **shift toward a decrease** in Temp or concentration

The rxn will always shift to the side with less gas molecule when P increases

The rxn will always shift toward the side with more gas molecules if P decreases

If both sides have the same amount of gas mlcs-P has no effect.

Adding/subtracting a solid, will not effect the rate of a rxn or the equilibrium concentrations.

Adding a catalyst does not change the equilibrium concentrations. It only reaches the state of equilbrium faster.

Adding additional water to the whole system will not alter the equilibrium concentrations as it dilutes both reactants and products equally..

Kc equations can be used to detemine if a reversible rxn is at a state of equilibrium. Plug in the concentrations of a rxn to see if they equal the constant.

- Q = Kc its at equilibrium
- Q > Kc too much products, needs to make more reactants or proceed Left
- Q < Kc too much reactant, needs to make more product or proceed right

Kc has many synonyms

Keq, Ka, Kb, Ksp, Kw etc

Equillibrium concentrations can be measure if the constant is known.
The following are all gases
A + C <-> D + 2X What is its mass action expression? Or Kc equations?

If the Kc = 7.5 @

@ equilibrium the concentration of
A = 2 Molar C = 3 Molar
D = 5 Molar X = ? Molar

You can find the Kc constant if you are given equilibrium concentrations.

	2D +	H	<-->	3 Z		Kc =
Initial [ ]	5.0 Molar	3.0 Molar		1.0 Molar		
Amt reac					t	
[ ] @ eq		1.0 Molar				

You can also find the equilibrium concentrations if you are given the Kc/Kp

	1D +	H	<-->	2Z		Kc = 6
Initial [ ]	5.0 Molar	3.0 Molar				
Amt reac	-x	-x		2x	t	
[ ] @ eq	5.0-x	3.0 –x		2x		