

Equilibrium and Thermodynamics Worksheet
CHEM 212

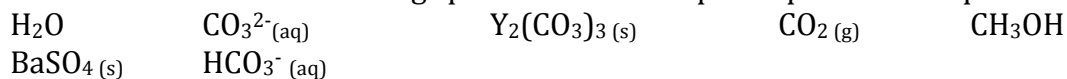
1. Write a generalized equilibrium expression for the following reaction.



2. State the units for each phase below necessary for the equilibrium expression. If a phase does not participate, explain why.

Phase	units
Gas	
Aqueous	
Liquid	
solid	

3. Circle each of the following species that do not participate in the equilibrium expression.



What do the circled answers have in common?

Manipulating Equilibrium constants

Forward and reverse reactions

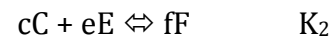
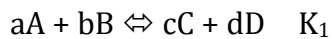


Write each equilibrium expression for each equation.

What is the relationship between equilibrium constants (Ks)?

Adding reactions

Write the final reaction and equilibrium expression for each reaction.



What is the relationship between the Ks?

Thermodynamics

Define the following terms in words and state if positive or negative is favorable:
enthalpy

entropy

Gibb's free energy

Spontaneous?

Spontaneity is predicted by: $\Delta G_r = \Delta H_r - T\Delta S_r$

Complete the table and predict if the reaction would be spontaneous.

ΔH_r	ΔS_r	ΔG_r	Spontaneous?
+	+		
+	-		
-	+		
-	-		

What is the equation relating the equilibrium constant and Free energy

What is Le Chatlier's principle in words?

When can heat be considered as a reactant or product?

In which direction is a reaction spontaneous?

Q is the reaction quotient and can be used in nonequilibrium situations to determine the direction in which a reaction will be spontaneous. K is Q at equilibrium.

Equilibrium is a lowest energy state predicted using thermodynamic data. However, it does not say if a reaction will happen or how fast. If a reaction will really happen also depends on kinetics, which is not discussed in this course.