# Le Chatelier's Principle

Name_____Lab Section_____

This DCI consists of a series of experiments that involve interaction between you (the student), your instructor, and a molecular level simulation. Log on to the Internet. Type the following address into the location-input line of your browser:

http://introchem.chem.okstate.edu/DCICLA/ERGBN.htm

Problem Statement: How can concentration changes affect a chemical reaction?

1.   Open the Graphics Simulation program. Using the data from the Control Bar Region, enter the initial concentration of each substance in the equation below.
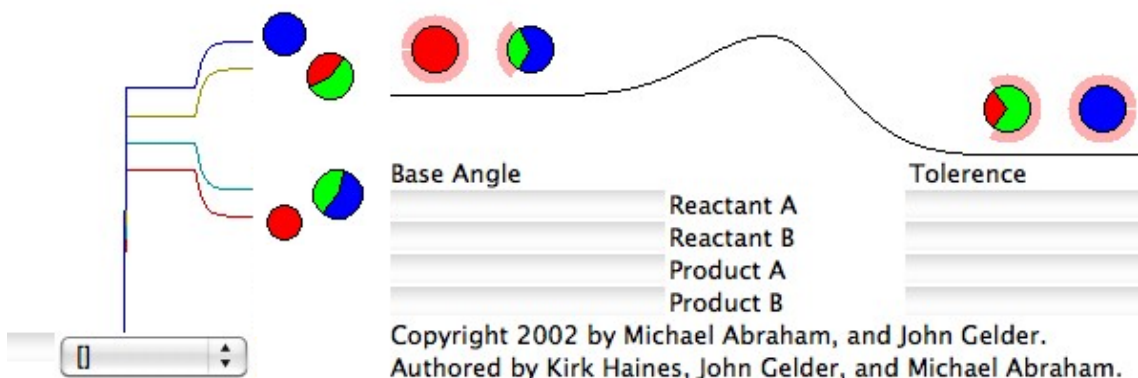
EXPERIMENT #1:
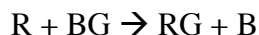
|	R + BG → RG + B
Initial Concentration – I	**0.60 0.70 0.80 0.90**
Concentration Change – C	**-0.17 -0.17 +0.17 +0.17**
Ending Concentration – E	**0.43 0.53 0.97 1.07 (after enabling Reactions**)

Click on the Resume and then the Enable Reactions button to begin the reaction. When the reaction appears to be complete, click Pause to stop the action. Record the values of the ending concentrations in the table in Section 1A. Calculate the change in concentration of each of the substances in the reaction. In the space below, draw the appearance of the strip chart and label the axes.
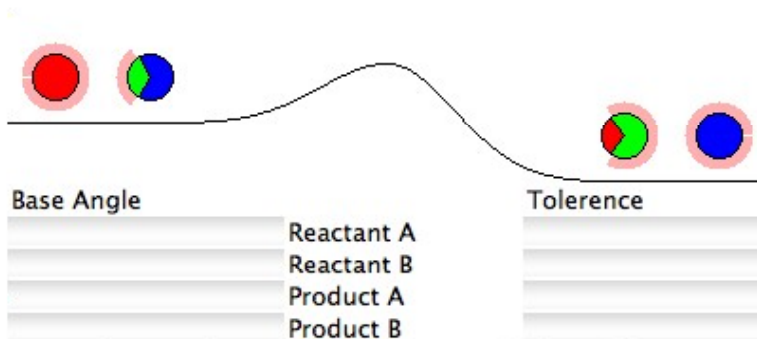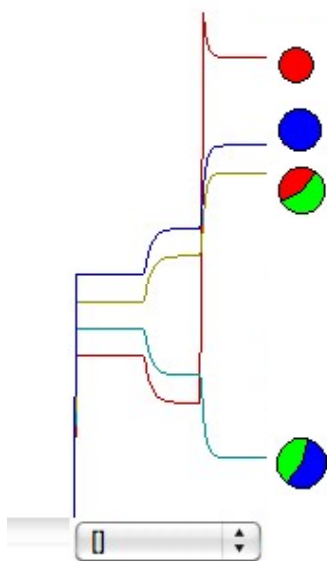

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III. Data Collection:

2. If necessary click Pause to stop the action. Use the ending concentrations of BG, RG and B from Experiment #1 as the initial concentrations in this experiment. Enter those values in the table below. In the Control Bar Region add R until its concentration is 2.0 M. Record this initial concentration of R in the table below. Click the Resume button. Observe how the concentrations of the substances change over time. When the reaction appears to be complete click the Pause button. Record the values of the ending concentrations in this table and calculate the change in concentration of each of the substances in the reaction. Draw and label the appearance of the portion of the strip chart for this reaction.

**EXPERIMENT #2: Increase reactant R to 2.0 M**

$$R + BG \rightarrow RG + B$$
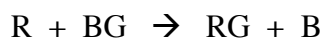
	R	BG	RG	B
Initial Concentration – I	**2.0**	**0.53**	**0.97**	**1.07**
Concentration Change – C	**-.304**	**-.304**	**+.304**	**+.304**
Ending Concentration – E	**1.696**	**.226**	**1.274**	**1.374**

Base Angle

Tolerence
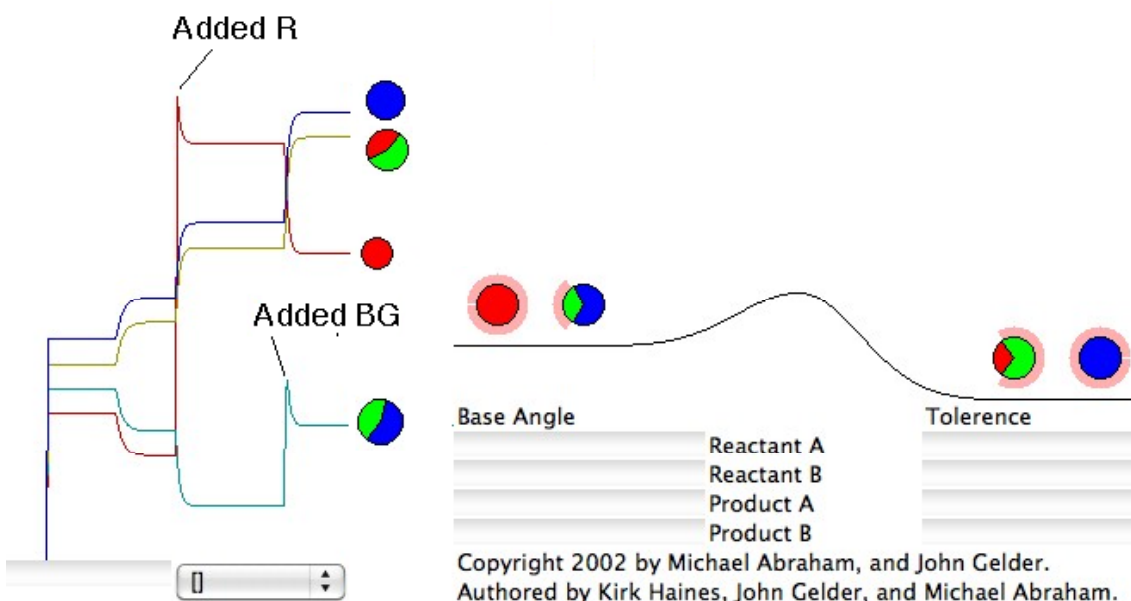
Reactant A
Reactant B
Product A
Product B

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3.   If you moved the strip chart scrollbar in the previous section, shift it back to as far to the right as it will go. Use the ending concentrations of R, RG and B from Experiment #2 as the initial concentrations in this experiment. Enter those values in the table below. In the Control Bar Region add BG until its concentration is 1.0 M. Record this initial concentration of BG in the table below. Click the Resume button. Observe how the concentrations of the substances change over time. When the reaction is appears to be complete click the Pause button. Record the values of the ending concentrations in this table and calculate the change in concentration of each of the substances in the reaction. Draw and label the appearance of the portion of the strip chart for this reaction. (NOTE: If necessary drag the Strip Chart scrollbar to the left.)

**EXPERIMENT #3: Increase reactant BG to 1.0 M**

$$R + BG \rightarrow RG + B$$
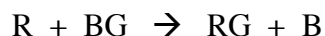
	R	BG	RG	B
Initial Concentration – I	1.696	1.00	1.274	1.374
Concentration Change – C	-.448	-.448	+.448	+.448
Ending Concentration – E	1.248	0.552	1.722	1.822

Added R

Added BG

Base Angle   Tolerence

Reactant A
Reactant B
Product A
Product B

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4. In a manner similar to the previous experiments remove R until its concentration equal 0.75 M. Record the new initial conditions of all substances in the table below. Click the Resume button. Observe how the concentrations of the particles in the sample change over time. When the reaction is appears to be complete click the Pause button. Record the values of the ending concentrations in the table and calculate the change in concentration of each of the substances in the reaction. Draw and label the appearance of the portion of the strip chart for this reaction.

EXPERIMENT #4: Decrease reactant R to 0.75 M

$$R + BG \rightarrow RG + B$$
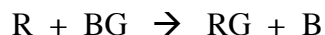
Initial Concentration – I	**0.750**	**0.552**	**1.722**	**1.822**
Concentration Change – C	**+.126**	**+.126**	**-.126**	**-.126**
Ending Concentration – E	**0.876**	**0.678**	**1.596**	**1.696**

Base Angle   Tolerence

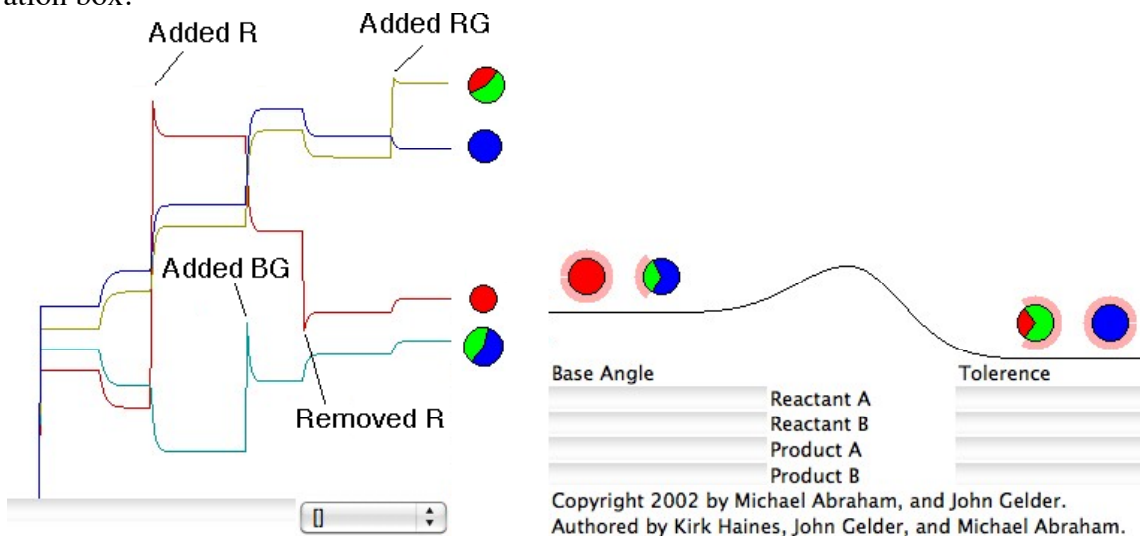Reactant A
Reactant B
Product A
Product B
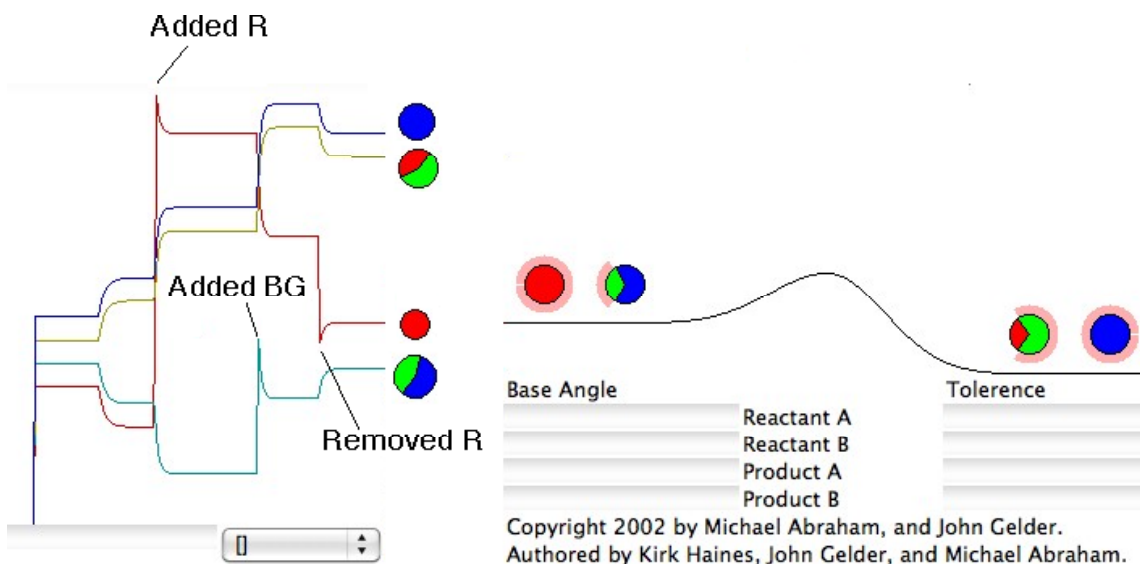
5.	In a manner similar to the previous experiments add RG until its concentration is 2.0 M. Record the new initial conditions of all substances in the table below.

EXPERIMENT #5: Increase product RG to 2.0 M

$$R + BG \rightarrow RG + B$$
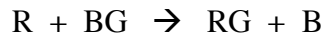
	R	BG	RG	B
Initial Concentration – I	0.876	0.678	2.00	1.696
Concentration Change – C	+.062	+.062	-.062	-.062
Ending Concentration – E	0.938	0.740	1.938	1.633

Click the Resume button. Observe how the concentrations of the particles in the sample change over time. When the reaction is appears to be complete click the Pause button. Record the values of the ending concentrations in the ICE table (above) and calculate the change in concentration of each of the substances in the reaction. Draw and label the appearance of the portion of the strip chart for this reaction in the Your Observation box.

Added R   Added RG

Added BG

Removed R

Base Angle   Tolerence

Reactant A
Reactant B
Product A
Product B

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6.   In a manner similar to the previous experiments remove RG until its concentration is 1.0 M. Record the new initial conditions of all substances in the table below.
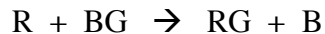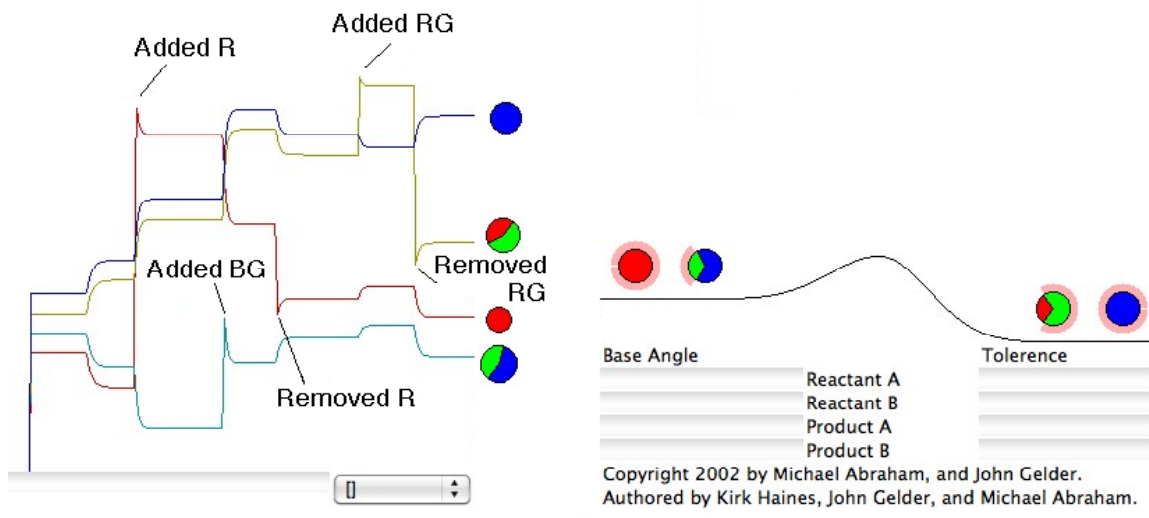
EXPERIMENT #6: Decrease product RG to 1.0 M

$$R + BG \rightarrow RG + B$$

Initial Concentration – I	0.938	0.740	1.00	1.633
Concentration Change – C	-.158	-.158	+.158	+.158
Ending Concentration – E	0.781	0.583	1.158	1.791

Click the Resume button. Observe how the concentrations of the particles in the sample change over time. When the reaction is appears to be complete click the Pause button. Record the values of the ending concentrations in the ICE table (above) and calculate the change in concentration of each of the substances in the reaction. Draw and label the appearance of the portion of the strip chart for this reaction in the Your Observation box.

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7. Summarize your observations of Experiments #3 - #6 by completing the table below. As an example, the entries for Experiment #2 have been done for you.

Experiment	Stress	Change in [Reactants]	Change in [Products]	Reaction shift
#2	Add reactant [R]	Concentrations decreased	Concentrations increased	Left to Right
#3	**Add reactant [BG]**	**Concentrations decreased**	**Concentrations increased**	**Left to Right**
#4	**Remove reactant [R]**	**Concentrations increased**	**Concentrations decreased**	**Right to Left**
#5	**Add product [RG]**	**Concentrations increased**	**Concentrations decreased**	**Right to Left**
#6	**Remove product [RG]**	**Concentrations decreased**	**Concentrations increased**	**Left to Right**

8. Review the summary of your experimental observations that you prepared in Section IVA. Write a statement(s) that generalizes how stressing a reaction by adding or removing a reactant or product shifts the chemical reaction.

Best Response: When a reaction is disturbed by imposing a stress the reaction will shift in a direction to relieve the stress.

Depending on where you are when you use this experiment, you may or may not have used the term *equilibrium*.

Other Response: When a reaction is disturbed by adding a reactant, or removing a product, the reaction will proceed left to right. When a reaction is disturbed by adding a product, or removing a reactant, the reaction will proceed right to left..