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://cheminfo.chem.ou.edu/~mra/CCLI2004/EQERGBN.htm

1. Open the Graphic Simulation program for the R + BG reaction. Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

EXPERIMENT #1: \[ R + BG \rightarrow RG + B \]

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>2.0</th>
<th>2.0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration Change – C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ending Concentration – E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
2. Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

**EXPERIMENT #2:** \( R + BG \rightarrow RG + B \)

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>1.0</th>
<th>1.0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration Change – C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ending Concentration – E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

3. Predict the ending amount for these initial conditions;

\( R + BG \rightarrow RG + B \)

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>1.5</th>
<th>1.5</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Concentration Change – C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted Ending Concentration – E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

Comments:
4. Predict the ending amount for these initial conditions;

\[ \text{R + BG} \rightarrow \text{RG + B} \]

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>Predicted Concentration Change – C</th>
<th>Predicted Ending Concentration – E</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 1.0 1.0</td>
<td>___ ___ ___ ___</td>
<td>___ ___ ___ ___</td>
</tr>
</tbody>
</table>

Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

Comments:

5. Predict the ending amount for these initial conditions;

**EXPERIMENT #5:**  
\[ \text{R + BG} \rightarrow \text{RG + B} \]

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>Predicted Concentration Change – C</th>
<th>Predicted Ending Concentration – E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 2.0 0 0</td>
<td>___ ___ ___ ___</td>
<td>___ ___ ___ ___</td>
</tr>
</tbody>
</table>

Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

Comments:
6. Predict the ending amount for these initial conditions;

**EXPERIMENT #6:** \[ R + BG \rightarrow RG + B \]

<table>
<thead>
<tr>
<th>Initial Concentration – I</th>
<th>1.0</th>
<th>0.6</th>
<th>1.2</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Concentration Change – C</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Predicted Ending Concentration – E</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

Using the Control Bar region, adjust the initial conditions of the reaction being studied to those listed in the following table. Use the Resume and Enable Reaction buttons to begin the reaction. When the reaction is completed, pause to stop the action. Record the values of the ending concentrations in the following table. Then determine the entries for the Concentration Change – C row.

Comments:

7. Complete the following Table

\[ R + BG \rightarrow RG + B \]

Exp #1-Ending Conc –E ___ ___ ___ ___ __________ __________

Exp #2-Ending Conc –E ___ ___ ___ ___ __________ __________

Exp #3-Ending Conc –E ___ ___ ___ ___ __________ __________

Exp #4-Ending Conc –E ___ ___ ___ ___ __________ __________

Exp #5-Ending Conc –E ___ ___ ___ ___ __________ __________

Exp #6-Ending Conc –E ___ ___ ___ ___ __________ __________
8. What conclusions can be drawn from these data? Find an algebraic equation that relates the ending concentrations of the reactants and products of the reactions being studied. (Hint: Try all possible combinations of the four concentrations by multiplication and/or division. For example, multiply all four concentrations together, multiply two and divide by the other two, etc., looking for the combination that gives the most constant result.) Summarize your results for three possibilities in the table above. Label each column with how you combined the four concentrations in the box provided. Discuss your results below.

9. Define the term chemical equilibrium.

10. Write the equilibrium expression, given the following general equation.
    
    \[ aA(g) + bB(g) \rightleftharpoons cC(g) + dD(g) \]