

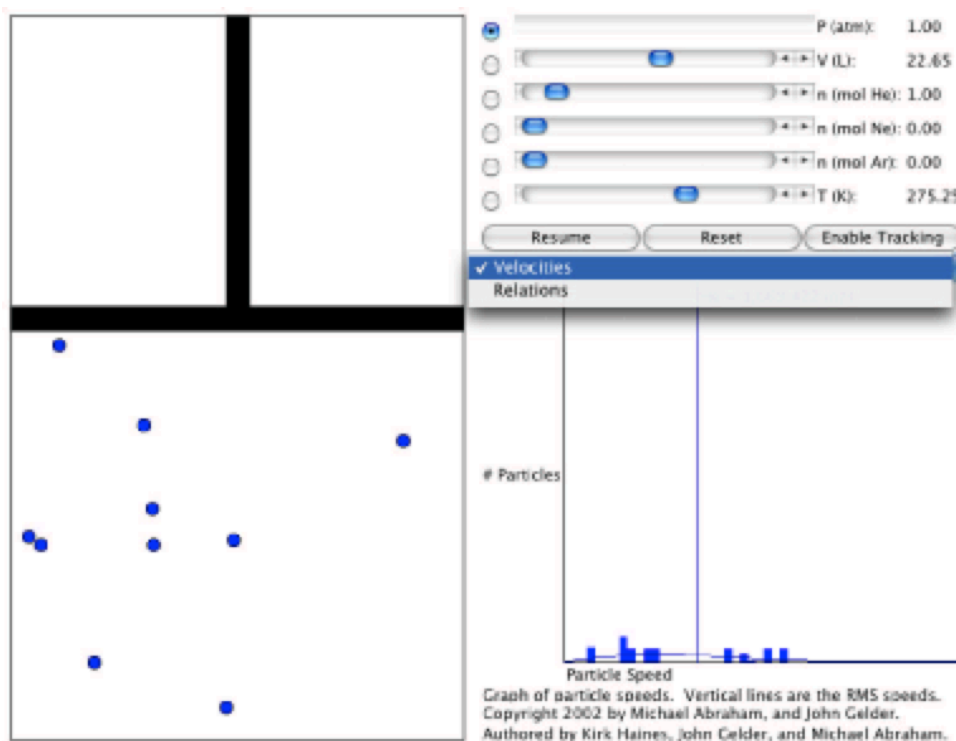
Shifting Reactions A

Name _____ Lab Section _____

Log on to the Internet. Type the following address into the location-input line of your browser:

<http://introchem.chem.okstate.edu/DCICLA/ERGBM.htm>

This will load a Particulate Simulation. Once you have the simulation running your screen will look like what is shown in Figure 1 below. If you haven't already done so, read the Particulate Simulation section of the Introduction to MoLEs Activities to learn how to use the simulation.



Problem Statement: What are the characteristics of a hypothetical chemical reaction?

I. Data Collection:

- A. Open the Particulate Simulation. Use the pause button in the Control Bar region to stop the action of the particles. In the diagram below record the conditions of your sample as shown in the simulation.

The screenshot shows the Particulate Simulation interface. The main window displays a collection of particles: red spheres, blue spheres, and green spheres. To the right is a Control Bar with sliders for P (atm), V (L), n (mol) for four different substances (RO, GB, RC, B), and T (K). Below the sliders are buttons for Resume, Reset, Enable Tracking, and Enable Reactions. At the bottom right is a Concentrations display. The copyright notice at the bottom reads: Copyright 2002 by Michael Abraham, and John Gelder. Authored by Kirk Haines, John Gelder, and Michael Abraham.

- B. Use the reset button to refresh the screen. Determine the concentration (mol liter^{-1}) of each substance in the control bar region. (Show your work.) Click on the pause button to stop the motion of the particles. In the Control Bar region, change the number of moles of one of the substances present by adding one half a mole to the amount already there. Resume motion and describe what you observe in the strip chart and the Sample Window.

- C. Use the reset button to refresh the screen. Click on the Enable Reactions button. After a short period of time has elapsed click the Pause button. In the space below draw a picture of the strip chart. Label the lines of the strip chart with their identity (R, GB, RG, and B).
- D. Resume the action. Observe how the concentrations of the particles in the sample change over time. How can you tell when the reaction is completed? What particles are present when the reaction is completed?
- E. Use the reset button to refresh the screen. Use the pull down menu to change the graphical representation to the replay function. Click the Enable Reaction button to begin the reaction. Allow the reaction to proceed for a short period of time (10 sec – 20 sec). Click the Pause button. Scroll the time index bar back to the point where only the reactant particles are present. Click on the forward arrow to roll the reaction forward in a step-wise manner to the point where the first new particle appears. Explain, in detail, the nature of that interaction. Include drawings and specify the orientation of all of the atoms in the interaction.

II. Data Analysis:

Write a chemical equation representing the chemical interaction you observed.

III. Data Collection:

- A. Use the reset button to refresh the screen and the pause button to stop the action. Using the controls in the Control Bar region, fix the amounts of R and GB at zero, of RG at 3, and B at 4. Set the graphics display to Concentrations, and resume the interaction. Calculate the concentrations of the particles. Calculate the initial concentrations of all the substances (R, GB, RG and B).
- B. Click on the Enable Reactions button. When the reaction is complete, click on the Pause button. Calculate and record the final concentrations of all of the substances.

- C. Use the reset button to refresh the screen. Using the controls in the Control Bar region, fix the amounts of R and GB at zero, of RG at 3, and B at 4. Use the pull down menu to change the graphical representation to the replay function. Click the Enable Reaction button to begin the reaction. Allow the reaction to proceed for a short period of time (10 sec – 20 sec). Click the Pause button. Scroll the time index bar back to the point where only the reactant particles are present. Click on the forward arrow to roll the reaction forward in a step-wise manner to the point where the first new particle appears. Explain, in detail, the nature of that interaction. Include drawings and specify the orientation of all of the atoms in the interaction.

IV. Data Analysis:

- A. Write a chemical equation representing the chemical interaction you observed

- B. Compare and contrast the two equations you wrote in sections II. and IV. A.

V. Interpretation and Conclusions:

A. Chemists refer to the type of reaction you have been investigating as a reversible reaction. Using the chemical system you investigated explain what is meant by reversible reaction.

B. An example of a non-reversible reaction is:



What is meant when the term non-reversible is used to describe this reaction?

C. When viewed at the macroscopic level in the laboratory, chemical reactions seem to stop after a period of time. How does this compare to your molecular observations in this activity? How do your observations at the molecular level explain what happens at the macroscopic level?

D. Mental Modeling: Using the Particulate Simulation program see if you can observe both chemical reactions studied in this activity to occur in the same window. Illustrate your observation by drawing a sequence of interactions that result in both reactions occurring sequentially.

E. Summarize in a few statements what are the characteristics of chemical reactions of the type studied in this activity.