Acid/Base Interactions

Name_____ Lab Section_____

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

http://cheminfo.chem.ou.edu/~mra/CCLI2004/ACIDS+BM.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.

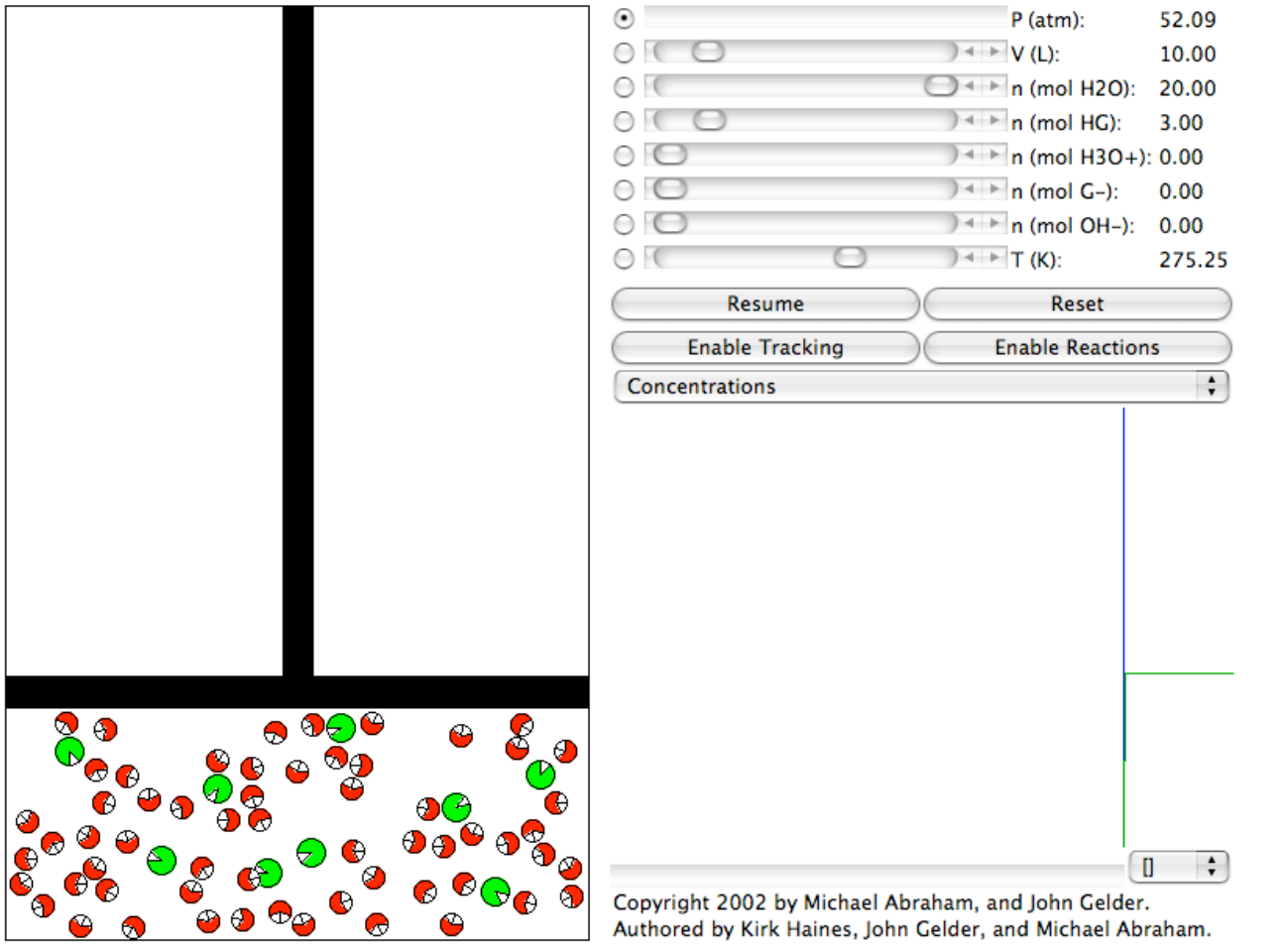

Figure 1.

Problem Statement: How do acids and bases interact?

I. Data Collection:

A. The simulation represents the strong acid HG when it is added to water. Allow the acid and water to interact by clicking on the Resume and Enable Reactions buttons. Describe what happen when the acid dissolves in the water. Use the Replay function in the drop down menu and the tracking button to aid your observations. Write a balanced equation to represent the interaction. What chemical species are present when the interaction is complete.

B. Pause the simulation. Add 1.00 mole of OH^- to the reaction container. Based on what you observe in the sample region and control bar region of the screen, calculate and record the initial concentration of each substance present in the following table. Click on the Resume button. Allow the simulation to run until no more changes occur. Click on the Pause button and calculate and record the ending concentration of each substance present in the following table. Calculate and record the change in concentration for each of the substances .

	$[H_2O]$	[HG]	$[H_3O^+]$	$[G^-]$	$[OH^-]$
Initial - I	--				
Change - C	--				
Ending - E	--				

C. Add an additional 1.0 mole of OH^- to the reaction container. Click on the Resume button and observe the interactions between the reactant particles. Use the Replay function in the drop down menu to aid your observations. Describe what happened when the reactant particles interacted with each other. What interactions cause changes to occur and what interaction don't cause changes to occur?

II. Data Analysis and Interpretation:

A. Write a balanced chemical equation for the reaction you observed in section I. B. and C. of this simulation.

B. How did you decide when the reaction was complete in section I. A.?

C. How did you decide when the reaction was complete in section I. B. and C.?

III. Data Collection:

A. Type the following address into the location-input line of your browser:

http://cheminfo.chem.ou.edu/~mra/CCLI2004/ACIDS+BN.htm

This will load the Graphic Simulation for the reaction you studied in the previous sections of this activity. If you haven't already done so, read the Numeric Simulation section of the Introduction to MoLEs Activities to learn how to use the simulation.

B. The simulation represents the strong acid HG when it is added to water. Allow the acid and water to interact by clicking on the Resume and Enable Reactions buttons. Describe what happen when the acid dissolves in the water. Write a balanced equation to represent the interaction. What chemical species are present when the interaction is complete.

C. Pause the simulation. Add 1.50 mole of OH^- to the reaction container. Based on what you observe in the control bar region of the screen, calculate and record the initial concentration of each substance present in the following table. Click on the Resume button. Allow the simulation to run until no more changes occur. Click on the Pause button and calculate and record the ending concentration of each substance present in the following table. Calculate and record the change in concentration for each substance.

	$[H_2O]$	[HG]	$[H_3O^+]$	$[G^-]$	$[OH^-]$
I					
C					
E					

IV. Data Analysis and Interpretation:

A. Using the data from section III. C. write a chemical equation representing the reaction you are studying.

B. What is the reacting capacity of this acid? (i.e. How much base is necessary to react with a specified amount of acid.)

C. What role does the water in the reaction container play? (What does the water do in the reaction?)

D. Discuss the change in concentration for each of the substances in the reaction. (Why does the change happen the way it does?)

V. Data Collection:

Open the molecular simulation ACIDW+BM:

http://cheminfo.chem.ou.edu/~mra/CCLI2004/ACIDW+BM.htm

This will load a Particulate Simulation.

A. The simulation represents the weak acid HB when it is added to water. Allow the acid and water to interact by clicking on the Resume and Enable Reactions buttons. Describe what happens when the acid dissolves in the water. Use the Replay function in the drop down menu, the strip chart, and the tracking button to aid your observations. Write a balanced equation to represent the interaction. What chemical species are present when the interaction is complete.

B. Pause the simulation. Add 1.00 mole of OH^- to the reaction container. Based on what you observe in the sample region and control bar region of the screen, calculate and record the initial concentration of each substance present in the following table. Click on the Resume button. Allow the simulation to run until the reaction is complete. Click on the Pause button and calculate and record the ending concentration of each substance present in the following table. Calculate and record the change in concentration for each substance.

	$[H_2O]$	[HB]	$[H_3O^+]$	$[B^-]$	$[OH^-]$
I	--				
C	--				
E	--				

C. Add an additional 1.00 mole of OH^- to the reaction container. Click on the Resume button and observe the interactions between the reactant particles. Use the Replay function in the drop down menu, the values in the Slide Bar region, the tracking function, and the strip chart to aid your observations. Describe what happens when the reactant particles interact with each other. What interactions cause changes to occur and what interaction don't cause changes to occur?

VI. Interpretation and Conclusions:

A. Why was water not included in the table in section V. B.?

B. Write balanced chemical equations that represent all of your observations in both sections V. B. and C.

VII. Data Collection:

Type the following address into the location-input line of your browser:

http://cheminfo.chem.ou.edu/~mra/CCLI2004/ACIDW+BN.htm

This will load the Graphic Simulation for the reaction you studied in the previous sections of this activity.

A. Using the data from the Control Bar Region, enter the initial concentrations of each substance in the equation into the table (called an ICE table) below.

$$HB + H_2O \leftrightarrows H_3O^+ + B^-$$

Initial Concentration – I	___	___	___	___
Concentration Change – C	___		___	___
Ending Concentration – E	___	___	___	___

B. Click on the Resume and then the Enable Reactions buttons 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 A. Calculate and record the change in concentration of each of the substances in the reaction.

C. Pause the simulation. Add 0.128 mole of OH^- to the reaction container. Based on what you observe in the control bar region of the screen, calculate and record the concentration of each substance present initially in the following table. Click on the Resume button. Allow the simulation to run until no more changes occur. Click on the Pause button and calculate and record the ending concentration of each substance present in the following table. Calculate the change in concentration for each substance.

	$[H_2O]$	$[HB]$	$[H_3O^+]$	$[B^-]$	$[OH^-]$
I					
C					
E					

D. Reset the simulation. Click on the Resume and then the Enable Reactions buttons to generate the initial conditions for the acid base interaction. Pause the simulation. Add 1.50 mole of OH^- to the reaction container. Based on what you observe in the control bar region of the screen, calculate and record the concentration of each substance present initially in the following table. Click on the Resume button. Allow the simulation to run until no more changes occur. Click on the Pause button and calculate and record the ending concentration of each substance present in the following table. Calculate the change in concentration for each substance.

	$[H_2O]$	[HB]	$[H_3O^+]$	$[B^-]$	$[OH^-]$
I					
C					
E					

VIII. Interpretation and Conclusions:

A Compare the concentration of the weak acid HB before the reaction has occurred in section VII. A. with the concentration of H_3O^+ after the reaction in section VII. D. What percentage of the HB was converted to H_3O^+?

B. What is the reacting capacity of this acid? (i.e. How much base is necessary to react with a specified amount of the weak acid.) Compare the reacting capacity of the weak acid HB (section VII.) with the strong acid HG you studied in section III. (also see section IV. B.)

C. Write balanced chemical equations that represent all of your observations in section VII.

D. Discuss the change in concentration for each of the substances in the reaction in VII. D. (Why does the change happen the way it does?)

E. How would you explain to another student the difference between a strong acid and a weak acid with respect to:

a) the pH of a 0.100 M solution;

b) the $[H^+]$ compared to the initial concentration of the acid;

c) the magnitude of K_a;

d) the reacting capacity of the acid.