Speeds of a Chemical Reaction

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/K2RM.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.

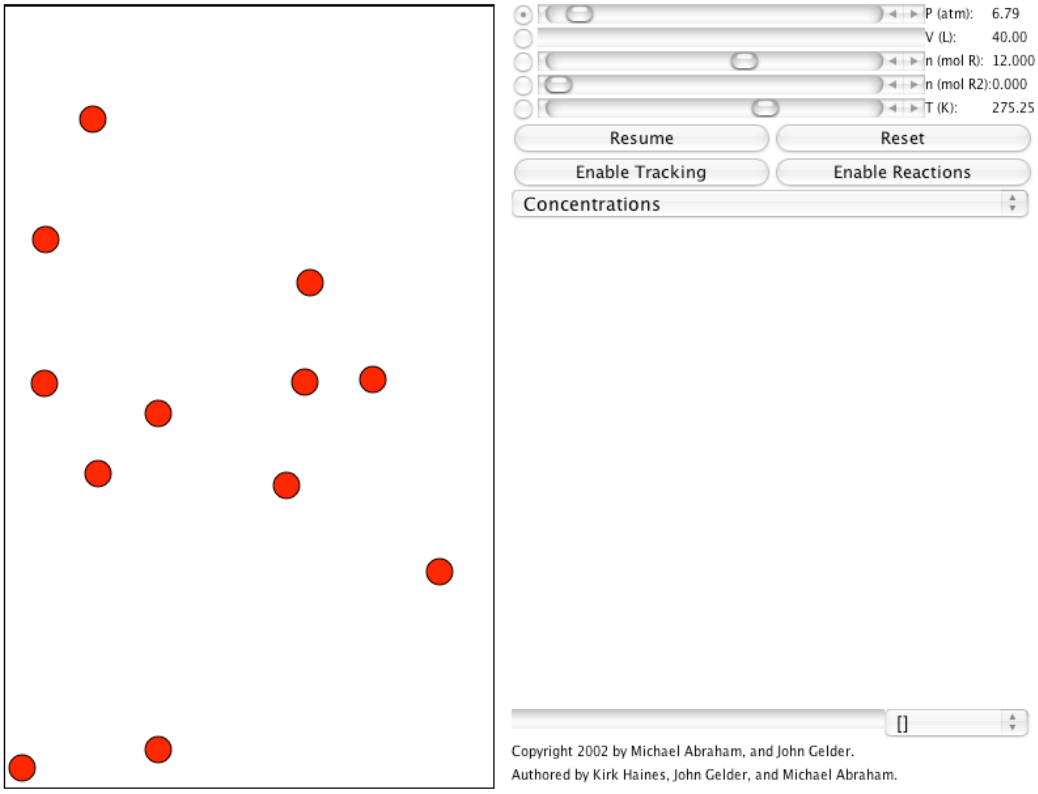

Figure 1.

Problem Statement: What factors influence how fast a chemical reaction proceeds?

I. Data Collection:
Open the molecular simulation K2RM:
http://cheminfo.chem.ou.edu/~mra/CCLI2004/K2RM.htm

A. Record what you observe in the sample region of the screen. Indicate the number and the concentration of the reaction particles.

	R	R_2
# of Particles		
Concentration (M)		

B. Click on the Resume button and then the Enable Reactions button and allow the simulation to run until no more changes occur. Click on the Pause button and record the number and the concentration of the reaction particles.

	R	R_2
# of Particles		
Concentration (M)		

C. Reset the simulation. Calibrate the time axis (x-axis) of the Concentration Strip Chart. To do this, click on the Resume button and with a stopwatch time how long it takes for the strip chart line to proceed across the graphing space. Measure the length of the line in millimeters (mm) with a ruler. Record your data in the spaces below. Develop a formula for converting mm to seconds.

Time (in sec)	
Time (in mm)	
Formula	1mm = __seconds

D. Click on the Reset button. Record the temperature of the sample. Click on the Enable Reactions button and then click on the Resume button. Pause the reaction when five product particles are formed and measure the time elapsed by measuring the time on the strip chart's x-axis using the length (in mm) as a measure of time. Repeat this experiment two more times and record your results in the following table. Calculate the average time.

	Trial 1	Trial 2	Trial 3	Average
Temperature				
Time (mm)				
Time (sec)				

E. Repeat the procedure in section I. D. at a temperature of 400K. (When resetting for a new trial, don't forget to reset the temperature to 400K

	Trial 1	Trial 2	Trial 3	Average
Temperature				
Time (mm)				
Time (sec)				

F. Repeat the procedure in section I. D. with 20 moles of R.

	Trial 1	Trial 2	Trial 3	Average
Temperature				
Time (mm)				
Time (sec)				

II. Data Analysis and Interpretation:

A. Write a balanced equation for the reaction you observed in this simulation.

B. Determine the initial concentration ($[R]_i$ in units of mols/L), the final concentration ($[R]_f$), and the change in concentration ($\Delta [R] = [R]_f - [R]_i$) of the reactant R for each of the experiments you did in sections I. D, E and F. Use the average values in your calculation.

	I. D	I. E	I. F
$[R]_i$			
$[R]_f$			
$\Delta [R]$			

C. What is the sign (positive or negative) of the change in concentration? What is the meaning of the sign?

D. How is the time it takes for a reaction to proceed related to the speed of the reaction?

E. The speed for an automobile is expressed in units of miles per hour (change in distance divided by the change in time). Since what changes in a chemical reaction is not distance (see section II.D.), what units would you use for the speed of a chemical reaction?

F. Using the data from II.D, calculate the speeds for the three experimental conditions you explored in sections I. D, E and F using the average data you collected. Make sure you include the units for the speeds.

Speed of the reaction for conditions in section D (starting with 12 mol R, temperature = 275K)

Speed of the reaction for conditions in section E (starting with 12 mol R, temperature = 400K)

Speed of the reaction for conditions in section F = (starting with 20 mol R, temperature = 275K)

G. Chemists refer to the speed of a chemical reaction as its rate. Write a statement summarizing the effect that temperature has on the rate of a chemical reaction. What is the evidence for your statement. Propose a reason(s) why temperature has this effect. Use a molecular explanation.

H. Write a statement summarizing how the initial concentration of the reactants influences the rate of the chemical reaction. What is the evidence for your statement. Propose a reason(s) why concentration has this effect.