Student Guide for the Diffusion Model

1. Understanding the model
   1. Select the following settings on the model
      * Show-Direction? **On**
      * Show-path? **Off**
      * Number-of-Particles-on-Left **50**
      * Number-of-Particles-on-Right **50**
      * Barrier? **On**
      * Number-of-Slits **0**
      * Temperature **25**
   2. Press Setup
   3. Observe what you see in black window
   4. Press Go and observe what happens as the model runs
      * How do the particles interact with each other? The walls? The yellow barrier?
   5. Start and stop the particles from moving by pressing the go button.
   6. Change the settings of Show-Direction? and Show-Path? to see what happens.
      * What information can you can from these commands?
      * What are the pros and cons of having these options set to yes?
      * Pick the settings for these two commands that you prefer.
2. Observing Diffusion
   1. Select the following settings on the model
      * Show-Direction? **Your choice**
      * Show-path? **Your choice**
      * Number-of-Particles-on-Left **50**
      * Number-of-Particles-on-Right **50**
      * Barrier? **Off**
      * Temperature **25**
   2. Press Setup
      * What is different about this setup?
      * How do you think this will affect the model?
   3. Press Go and observe what happens as the model runs. To reset the model at any time, stop the model and press Setup. Press Go again to start the model.
      * What happens to the particles?
      * Do the particles on the left behave differently from those on the right?
   4. Stop the model, change the settings for Number-of-Particles-on-Left & Number-of-Particles-on-Right, press Setup, and then press Go.
      * Do this different times with different numbers. What do you observe? Is there a pattern to your observations? Use the graph and counts on the right to track how many particles are on either side at any time.
3. How Temperature Affects Particles
   1. Leave Barrier? set to off and pick your own settings for the particles on the left & right (but then leave these constant)
   2. Run the model once. Then change the temperature, press setup, and run it again
      * Try out lower and higher temperatures.
      * Note the changes you observe in the model.
      * How does temperature affect particles?
      * How does temperature affect the process of diffusion?
4. How a Barrier with Slits Affects Diffusion
   1. With the model turned off, pick settings for the number of particles on each side, and temperature. Leave these settings constant.
   2. Set Barrier? to Off, Press Setup & Go. (This is your control system without a barrier. To compare models with barriers to this at any time, just switch barrier? to off and setup the model again)
   3. Set Barrier? to On, Number-of-Slits to 5, and Width-of-Slits to 2.
   4. Press Go and observe the behavior of the particles and compare it to how they behave without the barrier.
   5. Select other setting for the number of slits.
      * How does changing the number of slits affect the behavior of the particles?
      * How does it change the process of diffusion?
   6. Pick one setting for the number of slits. Run the model several times, changing just the slit width each time.
      * How does the slit width affect the particles and diffusion?
5. Exploring the Model & Creating an Experiment
   1. Try various combinations of the settings to see how all of the variables interact to affect the particles and the process of diffusion.
   2. Pick a variable that you want to study more in depth for how it affects particle behavior and the rate of diffusion.
   3. Pick values for all of the other variables – these will be your control variables.
   4. Use the counts and graph on the right so that you can track how many particles are on each side.
   5. If the Stop-At-Equilibrium? Function is on, the model will automatically stop when there are the same number of particles on the left and the right (or one apart if the total number of particles is an odd number). This function can be used to help you time how long it takes for the number of particles on each side to be equal.
   6. Make observations and collect data to show how your chosen variable affected both the particles and the process of diffusion.