

Inquiry-Based Activity 1: Cough Drops (simulation)

Student Name _____

In the following experiment, you will observe dissolution of cough drops in water both in batch and continuous configurations. You will be assessing qualitatively the resulting concentrations of “cough drop” in the water over time by observing the color change in the water. Following the experiment, there will be a series of questions to answer about what was observed.

Materials:

A javascript enabled webbrowser and an internet connection.

Directions:

1) In this experiment there will be two systems. Predict what will happen in each given the following scenarios:

a) The first will be a closed system that has a large number (25-50) cough drops in 100-200 mL of water. The system will be well mixed, and the cough drops have had a long time to sit in the water (>5 hours) before your observations begin. Predict what will happen to the color of the solution as *your* experiment progresses.

b) The second vessel will be an open system that starts with 10-25 cough drops in a funnel. Water will flow in and out of this system such that the total volume of water in the funnel is constant, and new cough drops will be added to the system as the old ones dissolve. Predict what will happen to the color of the solution emerging from the bottom of the funnel as the experiment progresses.

2) Visit the following webpage:

http://www.facstaff.bucknell.edu/mvigeant/Thermo_JS/Steady_State/steadyState.html

3) You may control both the addition of cough drops and the water flow rate in this system.

Start by getting a feel for the controls by adding several cough drops and starting the water flow by typing in a flow rate between 1-10 mL/s.

4) Your team's goal is to adjust the water flow *and* the rate of cough drop addition such that the color of the water stream out of the funnel is a consistent shade of pink.

- Start with at least 2 (but up to 12) cough drops in the funnel.
- Allow water to flow into the funnel. Adjust the flow rate to the desired level (note you may change this as the experiment progresses or you may leave it constant).
- As needed, add cough drops to the system (note that you do not have to completely dissolve a cough drop before an additional cough drop is needed – think about this).
- Collect samples from the outflow using the “Take a Measurement” button. Examine the resulting shade of pink, and make adjustments as needed. The color bar at the

