

## Alternative Activity 7.1

### Description

In this activity playing cards will be moved from a pile representing reactants to a pile representing reactive intermediates and then to a pile representing products as a simulation of a reaction mechanism.

### Objective

The objective of the activity is to illustrate that reactive intermediates quickly attain and then maintain a low, steady state concentration over the course of a non-elementary reaction.

### Preparation

1. Bring a deck of playing cards to class for use during the activity.

### Lesson Plan

1. Display the first slide and explain that the activity will begin with one stack of playing cards representing the reactants.
2. Call up a volunteer to represent the first mechanistic reaction step. Explain that because reactants are relatively stable, the person representing the first step should occasionally (once every 2 to 5 seconds) take a card from the reactant pile and put it on the intermediate pile.
3. Call up a second volunteer to represent the second mechanistic step (converting the reactive intermediates to products). Explain that because reactive intermediates are highly reactive, the person representing this step should take cards from the intermediate pile one at a time, but as quickly as they can, and move them to the product pile.
4. Tell the class to observe how the height of the three piles varies over the course of the reaction, and then tell the volunteers representing the mechanistic steps to begin.
5. When the reaction has gone to completion, call on the class for observations, and bring out the point that there never was a "pile" of intermediates; at most there was one card, and that was only true a small fraction of the time. Draw the analogy to chemical reaction mechanisms.
6. Ask the class which of the reactions was "fastest"
  - a. It is likely that they will say the conversion of the intermediates was faster.
  - b. Point out that in fact, the two steps occurred at essentially the same rate.
7. Put up the second slide and call up two more volunteers to represent the reverse of the two steps
8. Again explain that the reverse of the first step should be as fast as possible because the the reactant is an intermediate while the reverse of the second step should be moderate since the reactant for that step is a stable species (the products).
9. Repeat the observations, question about fastest and discussion.

### Tips and Suggestions

It is important that the volunteers representing the reverse of the first step and the forward second step understand that they should be snatching up a card as soon as it appears; they do not have to wait at all. The only restriction is that they move only one card at at time.