Student directions *Reactions and Rates* : Introduction to reaction kinetics
Revised for College Chemistry November 2008
Learning Goals: Students will be able to:

- Describe how the **reaction coordinate** can be used to predict whether a reaction will proceed including how the potential energy of the system changes.
- Describe what affects the potential energy of the particles and how that relates to the energy graph.
- Describe how the reaction coordinate can be used to predict whether a reaction will proceed **slowly, quickly or not at all**.
- Use the potential energy diagram to determine:
    - The *approximate* activation energy for the forward and reverse reactions.
    - The *sign* difference in energy between reactants and products.
- Draw a potential energy diagram from the energies of reactants and products and activation energy.

Directions:

1. Talk with your partner about what you think is happening on a microscopic level when the iron (III) nitrate and sodium thiocyanide mix.
    a. Draw pictures that would help you describe the process.
    b. Make a list of what things that might make the color change happen faster and explain your reasoning.
    c. Make a list of what things might make more of the colored complex form and explain your reasoning.

2. Run experiments using **Single Collisions** to determine on a simplest level what contributes to a successful reaction. Make sure that you use the **Energy view** and **Separation view** to help you explain how the energy changes in a reaction can help you make predictions.
    a. Explain the difference between total energy and potential energy. Describe how each can be changed.
    b. How does the **Separation view** help you?
    c. Make sketches of energy graphs to help describe how the energy diagram can be used to predict if the reaction will occur or not.

3. Run experiments using **Many Collisions** to determine what contributes to a **successful** reaction and what affects the **speed** of the reaction.
    a. Describe how this model relates to the single collision model.
    b. Make a table to demonstrate that you have thoroughly used all the simulation features.

4. Sketch what the energy graph could look like for the forward reaction to be an exothermic reaction.
    a. What would the sign for ΔH be for the forward reaction? and reverse reaction?
    b. Select the Design Your Own Reaction to make your own exothermic reaction.
    c. Run tests to see if your ideas for number 3 still work. Make changes if necessary.
    d. Explain how the Activation energy for the forward and the one for the reverse reaction are similar and how they differ.

5. Sketch what the energy graph could look like for the forward reaction to be an endothermic reaction.
    a. What would the sign for ΔH be for the forward reaction? and reverse reaction?
    b. Select the Design Your Own Reaction to make your own exothermic reaction.
    c. Run tests to see if your ideas for number 3 still work. Make changes if necessary.
    d. Explain how the Activation energy for the forward and the one for the reverse reaction are similar and how they differ.

For practice:

6. Sketch the energy graphs for the following situations.
    a. The reactants have a lower potential energy than the products.
    b. The activation energy of the reverse reaction is greater than the forward reaction
    c. The products have a lower potential energy than the reactants.
    d. The forward reaction has a positive ΔH.
    e. The reverse reaction has a negative ΔH.