Peer-Graded Assignment #1 **October 8, 2016**
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First, select a topic that would be appropriate for an introductory STEM course you might teach one day. You can choose any topic you like, but feel free to pick one of the following suggestions:

- Photosynthesis (biology)
- **Reactions and rates (chemistry)**
- Buoyancy (physics)
- Plate tectonics (geology)
- The derivative (mathematics)
- Conditionals (computer science)

(By focusing on an introductory course, you'll make it easier for your peers, who might not be in your discipline, to give you feedback.)

Second, write an appropriate course-level learning goal for the course that this topic would appear in. Your goal should start with the phrase, "Students should be able to…"

> Students should be able to identify the effect that the type of reactants, reactant concentration, temperature, and the presence or absence of a catalyst has on the rate of a chemical reaction.

Third, write three topic-level learning objectives for this topic. Your objectives must begin with the phrase, "Students should be able to…" One of your objectives should fall at the "understand" level of Bloom's taxonomy, one at the "apply" level, and one at the "analyze" level. (This three-level structure is a bit artificial, but it's useful for this practice activity.)
Finally, answer the following questions about your three topic-level learning objectives.

1. For your "understand" objective, what one or two misconceptions might your students have that would make it challenging for them to meet this objective? (Consider the discussion of prior knowledge in Week 1.)

   Students should be able to understand that a catalyst accelerates the rate of a reaction by lowering the activation energy of a key intermediate.

   Misconception 1: Activation energy is a fixed value that is not affected by external factors such as the presence of a catalyst or temperature.

   Misconception 2: The presence of a catalyst will increase the reaction yield.

2. For your "apply" objective, what aspects of the objective might be hard for a novice but second-nature to an expert? How might you make these aspects more explicit when working with students? (Consider the discussion of expert blind spots in Week 2.)

Students should be able to apply their knowledge by writing a general form of the rate law for any chemical reaction.

One thing that is hard for a novice but second-nature to an expert is realizing that no matter how complicated a chemical reaction may seem, a rate equation can be written for it.

When working with students, this can be made more explicit by providing a variety of examples with different levels of difficulty, emphasizing the process.

3. For your "analyze" objective, how would this objective require students to understand relationships among multiple concepts or principles? (Consider the discussion of knowledge organizations in Week 1.)

Students should be able to analyze experimental reactant and product concentration data over time to determine the rate law and rate constant for a chemical reaction.

The "analyze" objective requires that students understand the way experimental data connects to the theory of reactions and kinetics. Not only do they need to write a rate law, but plotting the data they are given and determine the rate constant. Further, they can show the order of the reaction based on the shape of the plotted data.

4. For each objective, how might you measure a student's achievement of that objective? (Next week will feature an in-depth discussion of assessment, but it's useful to have some ideas at this stage.)

Course Objective: Homework, quiz or exam question that integrates the variation of these factors showing a change in the rate of a chemical reaction.

Understand: Homework, quiz or exam question where students must identify the rate data in the form of a reaction progression diagram where a catalyst is involved.

Apply: Homework, quiz or exam question where students need to write a rate law for a given chemical reaction, perhaps a slightly more challenging one than was presented in class.

Analyze: Homework, quiz or exam question where students are given experimental kinetics data from a peer-reviewed journal article (or collect their own, if lab time/coordination is possible) and write their own lab report based on their interpretation and analysis.