

## **Systems Thinking Module Formative Assessments**

### **Unit 1**

Activity 1.1: Terminology pre-test and post-test (Pretest: 15 minutes, inside or outside class; Post-test: 10 minutes inside class).

### **Unit 2**

Activity 2.3: Self-reflection on motivation for taking the chemistry course, anticipation of how content in the course will connect to other courses, and on systems thinking as means to connect concepts between courses. (20 minutes, outside of class, individual).

### **Unit 4**

Activity 4.2: Activity on analyzing and drawing causal loop diagrams (30 minutes, in or outside of class).

### **Unit 5**

Activity 5.2: Activity introducing systems dynamics models with simple water in tub models to familiarize students with stocks, flows, converters, behavior over time graphs, and feedback loops in the context of a systems dynamics model. (20 minutes, in or out of class)

Activity 5.3: Activity in which students analyze systems dynamics models of chemical reactions (first order and second order), a simplified Keeling curve, and a temperature controlled hot-plate. (30 minutes, in or out of class)

### **Unit 6**

Activity 6.2: Analyzing and extending a stock flow diagram for single-use PE bags, paper bags, and reusable PP bags. (30 minutes in class or out of class). Guided activity where students will think about the impacts of steps in the life cycle of grocery bags and how they affect the real world. Terminology and concepts from the prior five units are applied in this activity.