

# Systems and Scale Unit Read Me

***The Systems and Scale Unit is a tool kit, not a script.***

While the *Systems and Scale Unit* Teachers' Guide may look like a script with lots of activities to do one after another, it is actually designed to be more like a user's manual for a set of tools. You can decide which tools are right for your students and your goals. This document alerts you to choices to make before each lesson.

## ***Making Your Choices***

Here is a brief summary of choices for teaching *Systems and Scale*. See the Teacher's Guides for more in depth discussions of your choices.

### **Lesson 1**

All students should complete Lesson 1.

### **Lesson 2: Choose whether or not to teach Activity 2.2.**

The activities in Lesson 2 are important and foundational for the *Carbon TIME* curriculum. Depending on the academic level of your students, you may not need to teach Activity 2.2. It is a tactile opportunity for students to continue exploring scale. Use your professional judgement about the best choice for your students.

### **Lesson 3: Choose whether or not to teach Lesson 3.**

We have found that for students who have not previously studied chemistry or chemical change, the relatively complicated chemical change in Lesson 4 (burning ethanol) is a heavy load. Lesson 3 is an optional opportunity to engage your students in the *Carbon TIME* activity structures (using investigations, molecular modeling, and chemical equations to explain chemical changes) while focusing on the simpler chemical change of soda water fizzing. Use your professional judgement to decide whether or not to teach this lesson.

### **Lesson 4: Choose how to use scaffolds in Activity 4.5.**

There are a set of scaffolding tools you can choose to use with your students in Activity 4.5, including example explanations, the Three Questions Explanation Checklist, a reading, and a graphic organizer. You may find that you use more of these scaffolds early on and gradually use fewer over time depending on your students' needs. Use your professional judgement about the best choice for your students

### **Lesson 5: Choose whether to use embedded activities for additional scaffolding.**

There are three main choices to make about activities in this lesson:

- Activity 5.1 is optional. Students will use molecular models to model the chemical change which occurs when methane burns. Your students may not need to do this depending on their performance in Activity 4.4 using molecular models with ethanol burning.
- Activity 5.2 is also optional, and you should consider whether your students can already explain what happens to matter and energy when methane burns at an atomic-molecular scale. If so, you may choose to modify or skip Activity 5.2.
- Activity 5.4 engages students in reading about three different fuels and explaining their combustion. You probably don't want every student to do a worksheet on all three fuels, so there are several ways that students could become "experts" on one fuel, then

compare what they have learned: a jigsaw activity, working in groups to make posters, etc. You may choose to scaffold the explanation writing on the worksheets using the Three Questions Explanation Checklist, as in Activity 4.5.

**Key to text colors:**

Black Text      Activities for All Students



Blue Text      *Optional Activities (Omit if students are already proficient)*

Lesson 1	<b>Use this opportunity to learn more about what your students already know and think they know about ethanol and burning fuels.</b>
	1.1 Systems and Scale Unit Pretest
	1.2 Expressing Ideas about Ethanol Burning
Lesson 2	<b>Consider your knowledge of your students and learning goals. Decide whether to teach Activity 2.2 in this lesson, modify it, or skip it. We recommend it for middle schoolers and students with special needs.</b>
	2.1 Powers of Ten Video and Discussion
	<i>(Optional) 2.2 From Big to Small</i>
	2.3 Zooming into Air
	2.4 Atoms and Molecules Quiz and Discussion
(Optional) Lesson 3	<b>Consider your knowledge of your students and learning goals. Decide whether to teach Lesson 3, modify it, or skip it. We recommend it for middle schoolers to introduce them to using investigations, molecular models, and chemical equations to describe a simple chemical change.</b>
	<i>3.1 Predictions about Soda Water Fizzing</i>
	<i>3.2 Observing Soda Water Fizzing</i>
	<i>3.3 Evidence-Based Arguments about Soda Water Fizzing</i>
	<i>3.4 Molecular Models for Soda Water Fizzing</i>
	<i>3.5 Explaining Soda Water Fizzing</i>
Lesson 4	<b>Use this lesson to help students explain combustion.</b>
	4.1 Predictions about Ethanol Burning
	4.2 Observing Ethanol Burning
	4.3 Evidence-Based Arguments about Ethanol Burning
	4.4 Molecular Models for Ethanol Burning
Lesson 5	<b>Consider your knowledge of your students and learning goals. Decide whether to teach Activity 5.1 and 5.2, modify them, or skip them. If your students can already explain what happens to matter and energy when methane burns at an atomic-molecular scale, you may want to skip these activities.</b>
	<i>(Optional) 5.1 Molecular Models for Methane Burning</i>
	<i>(Optional) 5.2 Explaining Methane Burning</i>
	5.3 Preparing for Future Units: Organic vs. Inorganic
	5.4 Explaining Other Examples of Combustion
	5.5 Systems and Scale Unit Posttest

