

Plants Unit Read Me

The Plants Unit is a tool kit, not a script.

While the *Plants 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 *Plants*. See the [Student Challenges and Teacher Choices in the Plants Unit](#) document for a more in-depth discussion.

Pre-Lesson: Plant seeds before starting the unit and choose more or less demanding protocols.

When to plant radish seeds: Students should plant their radish seeds before beginning the *Plants Unit* so that plants will grow big enough for the Lesson 3 investigations. Allow at least 2-4 weeks from the Pre-Lesson to Lesson 3, depending on which Turtle Trail you choose.

How to plant radish seeds: Decide whether to follow a [1-Turtle or 2-Turtle Trail](#). Both versions give students the invaluable experience of watching plants grow, then analyzing plant gas exchange and mass change data. The 2-Turtle Trail is more complex and rigorous, and there are more things that can go wrong. Two other differences include **materials** (the growing material on the 1-Turtle Trail is paper towels; for the 2-Turtle Trail it's gel) and **time** (the 2-Turtle Trail has two additional activities, some 2-Turtle activities may take longer, and the plants will need longer to grow).

Lesson 1: Choose when to start the main unit activities.

For the 1-Turtle Trail, wait at least one week after planting radishes before beginning Lesson 1.

For the 2-Turtle Trail, wait at least three weeks after planting radishes before beginning Lesson 1.

Lesson 2: Choose how to use repeating activities.

Activities 2.1, 2.2, and 2.3 are *exactly the same* as the equivalent activities in the *Animals* and *Decomposers* units. These are important and foundational activities, but students may not need to repeat them. Within Activity 2.1, the Cells: The Building Blocks Reading is optional.

Activity 2.4 is plant-specific, so we recommend teaching it.

Lesson 3: Choose which investigation to do first and what plants to use for the Light and Dark investigation.

To be ready, your plants should have at least two sets of leaves open and well developed (two cotyledons and two true leaves; see Figures 1 and 2).

- If plants are ready, you can begin with the Mass Change investigation. While plants are drying, use extra radish plants (or another leafy plant such as a houseplant) for the light and dark investigation.

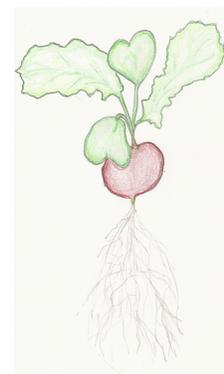


Figure 1. Drawing of a radish plant ready for Lesson 3.

- If plants are not ready, we recommend using another leafy plant such as a houseplant for the Light/Dark investigation, giving your plants a little more time to grow. This will mean teaching the two Mass Change Activities (3.2 & 3.4) consecutively, but you will need **time** in between them for plants to dry! In this case, we recommend that you (a) partially complete the Evidence-Based Arguments tool after the Light/Dark investigation in Activity 3.3, (b) harvest the radish plants in Activity 3.2, (c) move on to Lesson 4 to teach Cellular Respiration and Photosynthesis, and (d) return to complete Activities 3.4 and 3.5 after plants have dried.



Figure 2. Photograph of radish plants ready for Lesson 3.

Lessons 4-5: Choose which order to teach the carbon-transforming processes in

You and your students can choose whether to start with cellular respiration (Activities 4.1 and 4.2), photosynthesis (Activities 4.3 and 4.4), or biosynthesis (Activities 5.1-5.3). You may choose the order presented in the curriculum, an order more familiar to you, or according to the types of questions students are asking.

Note: The molecular modeling parts of Activities 4.1 and 5.2 are *exactly the same* as the molecular modeling for cellular respiration and biosynthesis, respectively, in the *Animals* and *Decomposers* units. Consider skipping the molecular modeling parts of the activities if you have already done them in another unit. Additionally, Activity 5.2 is also a 2-Turtle activity.

There are a set of scaffolding tools you can choose to use with your students in Activities 4.2, 4.4, and 5.3, These tools include:

- The Explanation Tool, which gives the students both more structured and less-structured ways to construct explanations that answer the Three Questions
- The Explanation PPTs
- The Three Questions Explanation Checklist, which students can use to evaluate their own explanations or other examples
- Example explanations that students can analyze and discuss
- Readings (4.2 How do Plants get the Energy They Need to Move? Reading, 4.4 How do Plants Produce Food? Reading, and 5.3 How do Plants Grow? Reading), and a graphic organizer (Matter and Energy in Plants 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 6: Choose how students will share their work.

Activity 6.1 engages students in reading about three different plants and explaining how they grow, move, and function. You probably don't want every student to do a worksheet on all three plants, so there are several ways that students could become "experts" on one plant, then compare what they have learned: a jigsaw activity, working in groups to make posters, etc.

For Activity 6.2, students can compare plants and animals (6.2a) or develop a summary explanation that applies to all plants (6.2b). Both provide students with a review of the unit concepts in preparation for the posttest, so you should select one of the versions based on if you have previously taught the Animals Unit and your students' needs.

- For Activity 6.2a, students will compare what they know about animals from the Animals Unit to what they have learned about plants in the Plants Unit.
- For Activity 6.2b, students will work with partners or groups to complete the provided worksheet, make a poster, or make a PowerPoint presentation.

Different pathways through the unit

All of these choices mean that you can follow several different pathways through the unit. The diagram below illustrates those different pathways.

Key to text colors:

-  Black Text Activities for All Students
-  Red Text 1-Turtle Activities
-  Orange Text 2-Turtle Activities
-  Blue Text Repeated Activities (Omit if students have already completed and are proficient)

Pre-Lesson	Consider your knowledge of your students and learning goals. Decide whether to pursue a 1-Turtle or 2-Turtle Trail.			
	 1 Turtle		2 Turtles 	
	NA		Pre-Activity 0.1GL Keeping Track of Water	
	Pre-Activity 0.2PT Plant Investigation Setup		Pre-Activity 0.2GL Plant Investigation Setup	
Lesson 1	Wait at least 1 week before starting Lesson 1		Wait at least 3 weeks before starting Lesson 1	
	1.1 Plants Unit Pretest			
	1.2 Expressing Ideas Plants			
Lesson 2	Consider your knowledge of your students and learning goals. Decide whether to teach the Repeating Activities in this lesson, modify them, or skip them.			
	 2.1 Zooming into Plants, Animals, and Decomposers			
	 2.2 Molecules Cells Are Made of			
	 2.3 Molecules in Cells Quiz			
	2.4 Questions about Plants			
Lesson 3	Check your plants' growth progress. Decide if they are ready for drying.			
	 1 Turtle		2 Turtles 	
	Plants Ready	Plants Not Ready	Plants Ready	Plants Not Ready
	3.1PT Predictions	3.1PT Predictions	3.1GL Predictions	3.1GL Predictions
	3.2PT Mass Change, 1	3.3 Light/Dark	3.2GL Mass Change, 1	3.3 Light/Dark
	3.3 Light/Dark	3.2PT Mass Change, 1	3.3 Light/Dark	3.2GL Mass Change, 1
	3.4PT Mass Change, 2	3.4PT Mass Change, 2	3.4GL Mass Change, 2	3.4GL Mass Change, 2

		3.5 EBA Plants	3.5 EBA Plants	3.5 EBA Plants	3.5 EBA Plants	
Lessons 4-5	Consider your students' questions on the EBA Tool: <i>What are they wondering?</i> Use their unanswered questions to guide instructional sequencing of the three carbon-transforming processes.					
	How do plants move and function?		How do plants make their own food?		How do plants grow?	
	Cellular Respiration (CR)  4.1 MM for Cellular Respiration 4.2 Explaining How Plants Move and Function  		Photosynthesis (Photo.) 4.3 MM for Photosynthesis 4.4 Explaining How Plants Make Food  		Biosynthesis (Bio.) 5.1 Tracing Potatoes Growing 5.2 MM for Biosynthesis  5.3 Explaining How Plants Grow  	
	How do plants make glucose?		How do plants move and function with glucose?		How do plants move and function?	
	How do plants grow?		How do plants grow with glucose?		How do plants make glucose?	
	<u>Photo.</u> (4.3 & 4.4) 		<u>Bio.</u> (5.1 – 5.3) 		<u>CR</u> (4.1 & 4.2) 	
	How do plants grow?		How do plants make glucose to grow, move, and function?		How do plants make glucose to grow, move, and function?	
	<u>Bio.</u> (5.1 – 5.3)		<u>Photo.</u> (4.3 & 4.4)		<u>CR</u> (4.1 & 4.2)	
Consider your knowledge of your students and learning goals. Decide how students will share their work in the activities and which version of 6.2 you will teach.						
Lesson 6	6.1 Explaining Other Examples of Plants Growing, Moving, and Functioning					
	6.2a Comparing Plants and Animals OR 6.2b Functions of All Plants					
	6.3 Plants Posttest					