Lesson 2 Foundations: Zooming into Plants

Overview

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Students "zoom into" plants, animals, and decomposers to learn about structures and functions that they all share:

- All organisms are made of cells.
- All the functions of organisms are done by their cells.
- All cells are made of molecules, including large organic molecules (fats, carbohydrates, and proteins).
- All functions of cells involve moving and changing molecules.

Guiding Question

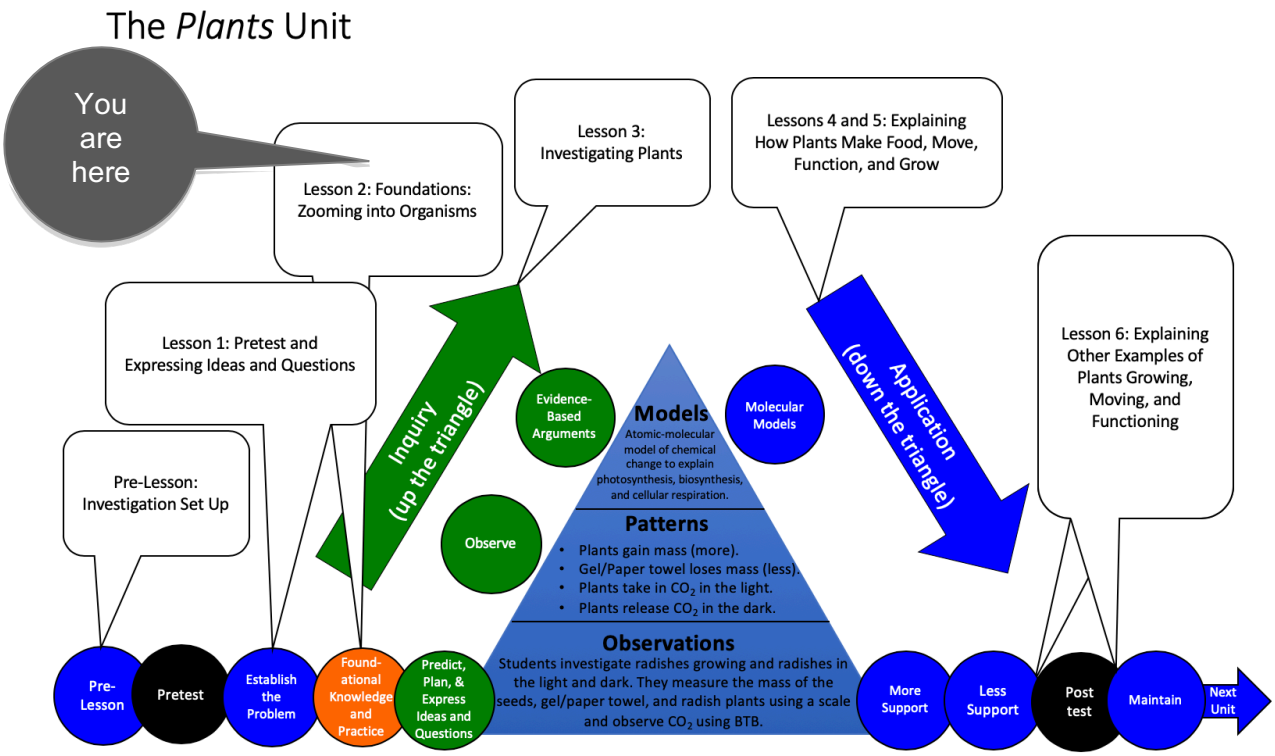
What makes up our food?

Activities in this Lesson

Note: Activities 2.1, 2.2, and 2.3 are **repeating activities***: They are the same in the three organism-scale units:* Animals*,* Plants*, and* Decomposers*. Activity 2.4 focuses specifically on plants. Teach Activities 2.1, 2.2 and 2.3 during the first of the organism-scale units you teach (*Animals*,* Plants *or* Decomposers*). These activities can be skipped when you teach subsequent organism-scale units. Activity 2.4 is different for each unit though and should be taught each time.*

- Activity 2.1: Zooming into Plants, Animals, and Decomposers (40 min)
- Activity 2.2: Molecules Cells Are Made of (45 min)
- Activity 2.3: Molecules in Cells Quiz (20 min)
- Activity 2.4: Questions about Plants (20 min)

Unit Map



Learning Goals

Target Performances

Activity	***Target Performance***
Lesson 2 – Foundations: Zooming into Organisms (students developing foundational knowledge and practice)	
Activity 2.1: Zooming into Plants, Animals, and Decomposers	Students "zoom in" to animals, plants, and decomposers, describing how all of these organisms are made of cells with special structures and functions.
Activity 2.2: Molecules Cells Are Made of	Students use food labels to describe molecules in animal, plant, and decomposer cells: large organic molecules (carbohydrates, proteins, and fats), as well as water, vitamins, and minerals.
Activity 2.3: Molecules in Cells Quiz	Students complete a quiz to assess their understanding of the molecules in cells and how to identify which molecules store chemical energy.
Activity 2.4: Questions about Plants	Students observe their growing radish plants and pose questions about plants to prepare for their upcoming investigation.

NGSS Performance Expectations

Middle School

- MS. Matter and its Interactions. MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

High School

- HS. From Molecules to Organisms: Structures and Processes. HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Background Information

Three-dimensional Learning Progression

Lesson 2 focuses on essential foundational knowledge that students will need to achieve the objectives for this unit. In this lesson students learn to read nutrition labels to identify the key materials in the foods we eat, which are also the materials in plant and animal bodies. The activities in this lesson serve as the Foundational Knowledge and Practice Phase of the Instructional Model, where students are introduced to key ideas and practices that they will use throughout the rest of the *Plants* unit.

Key Ideas and Practices for Each Activity

In Activity 2.1, students review the anatomy of a molecule using the Molecule 11 x 17 Poster to refresh their memory of the precise use of words we use to describe matter at the atomic-molecular scale. Then, students examine nutritional labels to learn that there are three broad classes of materials in food:

- **Organic materials,** including fats, proteins and carbohydrates (sugars, starches, and indigestible fibers such as cellulose). These are the key materials that make up biomass (everything but water) of all living things and are essential for life.
- **Vitamins and minerals,** including sodium, iron, calcium, and many others. These materials are also essential for life, but only in small amounts—less that 1% of almost all foods.
- **Water** is not listed on nutrition labels, but it makes up more than 50% of the mass of almost all plant and animal bodies and almost all the foods we eat. Students can figure out how much of a food is water by subtracting the mass of the organic matter from the total serving size (100 grams for all the nutrition labels used in this lesson).

Activity 2.2 uses nutrition labels as the basis for a simplified account of the materials that foods—and the living organisms that foods come from—are made of. All living things are made of thousands of different substances, all created by the plants from glucose, water, and soil minerals. *Carbon TIME* units emphasize the most important of these macromolecules: polysaccharides (including starch and cellulose), fats or lipids, and proteins. Many other essential macromolecules such as nucleic acids are left for more advanced treatments.

The large organic molecules (sometimes called macromolecules) in plants, animals, and decomposers are actually much larger than the molecules shown in the presentation and modeling activity:

- Fatty acids typically contain 10 to 25 carbon atoms.
- Proteins can consist of hundreds of amino acids. Humans are typical of many organisms in that our proteins contain 21 different kinds of amino acids.

- Starch and cellulose molecules can be made of hundreds or thousands of sugar monomers. Different kinds of starch and fiber can also include other 5-carbon and 6-carbon sugars besides glucose.

Although we hope that students will come to appreciate the vast number and complexity of biomolecules, our emphasis in *Carbon TIME* is on helping students understand that all of this complexity arises from a simple starting point—glucose and minerals—and a few simple chemical processes in biosynthesis.

Although there are obvious differences in the chemical composition of plants, animals, and decomposers, the *Carbon TIME* units emphasize their similarities. Most of the monomers (sugars or monosaccharides, amino acids, fatty acids and glycerol) in all living things are created in plants and made into polymers by the plants. Animals and decomposers break these polymers back down into monomers through the process of digestion, then alter the monomers and build new polymers through their own biosynthesis.

In Activity 2.3, students take a short quiz to check their knowledge of these concepts before applying these ideas throughout the rest of the Unit.

In Activity 2.4, students begin to consider questions about cells related specifically to plants, which they will study throughout the unit.

Key Carbon-Transforming Processes: Photosynthesis, Biosynthesis, Cellular Respiration

Content Boundaries and Extensions

Talk and Writing

At this stage in the unit, the students will be learning **Foundational Knowledge and Practice** that is important for the rest of the unit. The table below shows specific talk and writing goals for this phase of the unit.

Talk and Writing Goals for the Foundations Phase	Teacher Talk Strategies That Support This Goal	Curriculum Components That Support This Goal
Treat this as background information.	*We want to talk about a few basic practices and some basic knowledge to prepare us for the unit.*	
Listen for student ideas about **matter** and **energy** at different **scales** and attend to wrong ideas.	*What is happening to matter and energy at _____ scale? Who can explain?* *Are you in the macroscopic scale or the atomic-molecular scale?* *Who can explain that at a different scale?*	The **PPT** that "Zooms into" the macroscopic subjects of the unit: a leaf, a potato, air, fossil fuels, etc.
Examine student ideas and correct them when there are problems. It's ok to give the answers away during this phase! Help students practice using **precise language** to describe **matter and energy** at different **scales**.	*Let's think about what you just said: food molecules. What are food molecules?* *Are you talking about matter or energy?* *Remember: atoms can't be created. So that matter must have come from somewhere. Where did it come from?* *Let's look at the molecule poster again… is carbon an atom or a molecule?*	Powers of Ten Poster Molecule Poster Three Questions Poster

	Let's revisit our scale poster… what is happening to matter at a macroscopic scale?	
Grade student ideas.		There is a **quiz** during this phase of the unit to help you decide if your students are ready to move on.

Activity 2.1: Zooming into Plants, Animals, and Decomposers (40 min)

Overview and Preparation

Target Student Performance

Students "zoom in" to animals, plants, and decomposers, describing how all of these organisms are made of cells with special structures and functions.

Resources Provided

- 2.1 Zooming Into Plants, Animals, and Decomposers PPT
- 2.1 Comparing Plants, Animals, and Decomposers Worksheet (1 per student)
- 2.1 Assessing the Comparing Plants, Animals, and Decomposers Worksheet
- (Optional) 2.1 Cells: The Building Blocks of Organisms Reading (1 per student)

Recurring Resources

- Three Questions 11x17 Poster (1 per class)
- Questions, Connections, Questions Student Reading Strategy
- Driving Questions Board

Setup

Print one copy of 2.1 Comparing Plants, Animals, and Decomposers Worksheet and 2.1 Cells: The Building Blocks of Organisms Reading (optional) for each student. If you do not have the Three Questions 11x17 Poster on the wall from the *Systems and Scale* unit, print it and put it up. If you decide to have students explore the Powers of 10 sliders (Slide 10 of the PPT), make sure that they have access to laptops or other computers.

Directions

1. Use the instructional model to show students where they are in the course of the unit.

Show slide 2 of the 2.1 Zooming into Plants, Animals and Decomposers PPT.

2. Discuss students' ideas about how animals, plants, and decomposers are alike and different.

Use the PPT and worksheet to initiate a discussion of how animals, plants, and decomposers are alike and different.

- Distribute one copy of 2.1 Comparing Plants, Animals, and Decomposers Worksheet to each student.
- Show Slides 3-4 of 2.1 Zooming Into Plants, Animals, and Decomposers PPT. Discuss how to use the Venn diagram to identify characteristics that are alike and different and practice locating one characteristic from the list on the diagram.
- Show Slides 5-7 of the PPT, asking students to notice how the Zooming In animations are alike and different.
- Draw or project the Venn diagram on a whiteboard. Have students discuss where each characteristic from their list belongs on the Venn diagram.

3. Discuss shared characteristics in terms of structure and function.

Show Slides 8 and 9 of the PPT

- Have students correct their worksheets based on this slide and save their worksheets. (They will refer back to them in Activity 2.4.)
- Discuss why the slide has two columns for Structure and Function. Tell the students that we will be using those words in the future, so they need to understand the distinction.
- Slide 9 has structure and function questions that the students will answer in the rest of the unit.

4. (Optional) Have students read about cells.

Have middle school and lower level high school students with limited prior knowledge about cells, read the 2.1 Cells: The Building Blocks of Organisms Reading using the Questions, Connections, Questions Student Reading Strategy. See the Questions, Connections, Questions Reading Strategy Educator Resource document for information about how to engage students with this strategy.

- As students read with a partner, have them stop and discuss the italicized questions in the reading with their partner.
- After pairs are finished reading, have students share with the class what they found interesting and any questions they have.

5. Discuss structure questions about cells.

Slides 10 and 11 address the two structure questions about cells in Slide 9

- Show the students Slide 10, then you have a choice:
  a. Option 1: Give students time to explore the website sliders and report what they found about cells.
  b. Option 2: Show the sliders on the display computer and look for cells with the students.
  c. Option 3: Look back at Slides 5-7 for the approximate size of animal, plant, and decomposer cells. (A narrower range of cell sizes than cells in general.)
- Show students Slide 11 and ask for their ideas and questions. (Their questions will be addressed in Activity 2.2.)

6. Discuss function questions about cells

Slides 12-14 address the two function questions on Slide 9.

- Slide 12 addresses how cells work together to accomplish the macroscopic functions of organisms. Pause after showing each question to get students' ideas before showing the answer.
- Slide 13 elicits students' ideas and questions about how cells grow and function.
- Use Slide 14 to remind students of the Three Questions, which they should remember from *Systems and Scale*. They will be learning to explain cell functions by describing movement of matter, and changes in matter and energy, at the atomic-molecular scale.
- Point out the Three Questions 11x17 Poster on the wall.

7. Have students complete an exit ticket.

Show slide 15 of the 2.1 Zooming into Plants, Animals and Decomposers PPT.

- Conclusions: What do animals, plants, and decomposers have in common?
- Predictions: What do you think cells are made up of?
- On a sheet of paper or a sticky note, have students individually answer the exit ticket questions. Depending on time, you may have students answer both questions, assign students to answer a particular question, or let students choose one question to answer. Collect and review the answers.
- The conclusions question will provide you with information about what your students are taking away from the activity. Student answers to the conclusions question can be used on the Driving Question Board (if you are using one). The predictions question allows students to begin thinking about the next activity and allows you to assess their current ideas as you prepare for the next activity. Student answers to the predictions question can be used as a lead into the next activity.

Assessment

Use 2.1 Assessing the Comparing Plants, Animals, and Decomposers Worksheet to assess student responses. This worksheet is designed to elicit students' ideas about similarities and differences among plants, animals, and decomposers. All students, though, should correct their placement of the numbered characteristics based on Slide 8.

Differentiation & Extending the Learning

Differentiation

- Target challenging vocabulary to build background knowledge that is assumed for American learners
- Provide lists with definitions and relevant pictures to students
- Begin a word wall with pictures to accompany important vocabulary
- Have students highlight challenging vocabulary in the reading to add to the word wall

Modifications

Use the 2.1 Cells: The Building Blocks of Organisms Reading with students who have not had significant exposure to cells in prior classes.

Note the three options about how to engage students in discussing the size of cells Slide 10.

Extending the Learning

Slides 10-13 provide a VERY superficial introduction to cells, including information essential to tracing matter and energy through cellular processes, but nothing more. If your curriculum goes deeper into cell theory or into cell structure and function than these lessons, then you may want to consider adding activities, either here or in later lessons:

- You can add information about specialized functions of different cells in association with Slide 12, discussing a wider range of organismal functions and how each one is carried out by cells acting in concert.
- You can discuss organelles and their specialized functions either here or in later lessons focusing on cellular respiration (mitochondria), photosynthesis (chloroplasts), and biosynthesis (cell membrane, ribosomes).

Activity 2.2: Molecules Cells Are Made of (45 min)

Overview and Preparation

Target Student Performance

Students use food labels to describe molecules in animal, plant, and decomposer cells: large organic molecules (carbohydrates, proteins, and fats), as well as water, vitamins, and minerals.

Resources Provided

- 2.2 Food Labels Worksheet (1 per student)
- 2.2 Grading the Food Labels Worksheet
- 2.2 Molecules Cells Are Made of PPT
- 2.2 Reading Nutrition Labels Handout (1 per pair of students)
- 2.2 Food Label Cards (1 per pair of students)

Recurring Resources

- (Optional for more demanding classes) Posters about large organic molecules:
    - Digestion and Biosynthesis of Carbohydrates 11 x 17 Poster (1 per class)
    - Digestion and Biosynthesis of Fat 11 x 17 Poster (1 per class)
    - Digestion and Biosynthesis of Protein 11 x 17 Poster (1 per class)
- Molecule 11 x 17 Poster (1 per class)
- Metabolic Pathways Poster (http://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma/General_Information/metabolic_pathways_poster.pdf) (1 per class)

Setup

Print one copy of 2.2 Food Labels Worksheet for each student. Print the reusable handouts one copy of 2.2 Reading Nutrition Labels Handout and one copy of 2.2 Food Label Cards per pair of students. Print one copy each of the molecule posters and post them on your classroom wall.

Directions

1. Use the instructional model to show students where they are in the course of the unit.

Show slide 2 of the 2.2 Molecules Cells Are Made of PPT.

2. Organize the class for the activity

Divide the students into pairs and give each pair the materials that they will need to complete the activity.

- Put posters you intend to use on the wall.

3. Review how atoms bond together to make molecules.

Show Slide 3 of 2.2 Molecules Cells Are Made of PPT and point to the copy of the Molecule 11 x 17 Poster on your classroom wall. Ask students to examine the key features of this poster:

- Atoms are represented by differently colored circles. In the *Carbon TIME* units: carbon is black, oxygen is blue, nitrogen is red, and hydrogen is white.
- Bonds that connect carbon to carbon and carbon to hydrogen bonds are colored yellow. This color represents the chemical energy stored in these bonds. Other types of bonds are not yellow because they do not contain as much stored chemical energy.
- When two or more atoms bond together, this creates a molecule.

4. Review ideas and unanswered questions from Activity 2.1.

Show Slide 4 of the PPT:

- Review some things we know in the left column
- Review unanswered questions in the right column
- This activity focuses on the question in red: "What kinds of molecules are cells made of?"

5. Present and discuss how to interpret nutrition labels

Have students follow on 2.2 Reading Nutrition Labels Handout as you present Slides 5-18 in the PPT. Each slide points toward parts of the nutrition labels that are also presented on the handout:

- Slide 5 points out that (unlike nutrition labels on most foods) these labels use a standard serving size of 100g.
- Slides 6 and 7 focus on carbohydrates, including how to calculate the amount of starch (total carbohydrate – sugar – fiber)
- Slides 8 and 9 focus on fats, including the atoms in fat molecules (CHO)
- Slides 10 and 11 focus on proteins, including the atoms in protein molecules (CHON)
- Slide 12 points out that all the organic molecules in cells are made primarily of 4 kinds of atoms: CHON. (If you wish to discuss other atoms in organic molecules such as P and S, you could do so later with Slides 21 and 22.)
- Slides 13 and 14 point to cholesterol, vitamins, and minerals: molecules found in cells but always less than 1% of cell mass.
- Slides 15 and 16 focus on how to calculate the amount of water in cells by subtracting the total mass of organic matter from 100g.
- Slides 17 and 18 connect information about calories on food labels with what students have already studied about chemical energy in organic molecules in the *Systems and Scale* unit. Note that high-energy C-C and C-H bonds are yellow on the illustrations of molecules.

6. Optional for more demanding classes: Have students examine the difference between three types of organic molecules.

Tell students that now that they have zoomed into food, you will visit the three types of organic molecules more closely. Post three different posters on the wall in your classroom and invite students to examine the difference between them:

- In the Digestion and Biosynthesis of Carbohydrates 11 x 17 Poster, encourage students to notice that large carbohydrates molecules are built of smaller glucose molecules during biosynthesis, and the reverse for digestion.
- In the Digestion and Biosynthesis of Fat 11 x 17 Poster, encourage students to notice that large fat molecules are built of smaller fatty acids and glycerol molecules during biosynthesis, and the reverse for digestion.
- In the Digestion and Biosynthesis of Protein 11 x 17 Poster, encourage students to notice that large protein molecules are built of smaller amino acids during biosynthesis, and the reverse for digestion.

7. Have students work together to complete the worksheet.

Now that students are somewhat familiar with the molecules in food, have them explore the makeup of other foods. Divide students into pairs to complete 2.2 Food Labels Worksheet.

- Show Slide 19 on the PPT.
- Have pairs of students work together to complete the first row of the worksheet for "beef."
- Show Slide 20. Check to make sure that all pairs successfully completed the first row.
- Discuss the last question on the worksheet: How are plant and animal cells different? Students should note that plant cells tend to have more carbohydrates and water and less fat and protein than animal cells (with seeds such as peanuts being the exception).

8. Discuss the complexity of all cells.

Use Slides 21 and 22 and the Metabolic Pathways Poster to point out that the "whole story" of cell structure and function is much more complicated than they can study in this class:

- Slide 21 points out that large organic molecules—carbohydrates, fats, and proteins—are actually much larger than the molecules illustrated on the slides (too large for illustrations that would show all the atoms).
- Slide 22 points out that there are many smaller organic molecules than the ones we have discussed, and that cells have many ways to change one kind of small organic molecule into another.
- Show students the Metabolic Pathways Poster and invite them to look at it more closely when they have time. The poster is still "incomplete" in that it shows only pathways involving small organic molecules. When they study cellular processes such a cellular respiration and photosynthesis, students may enjoy locating them on the poster.

9. Have students complete an exit ticket.

Show slide 24 of the 2.2 Molecules Cells Are Made of PPT since you are teaching plants.

- Conclusions: What molecules make up plant cells?
- Predictions: Where do you think the molecules that make up plant cells come from?
- On a sheet of paper or a sticky note, have students individually answer the exit ticket questions. Depending on time, you may have students answer both questions, assign students to answer a particular question, or let students choose one question to answer. Collect and review the answers.
- The conclusions question will provide you with information about what your students are taking away from the activity. Student answers to the conclusions question can be used on the Driving Question Board (if you are using one). The predictions question allows students to begin thinking about the next activity and allows you to assess their current ideas as you prepare for the next activity. Student answers to the predictions question can be used as a lead into the next activity.

Assessment

Use 2.2 Grading the Food Labels Worksheet to grade student responses. At this point, students can be held accountable for correct answers. If students are still struggling with these concepts, you may want to revisit parts of the activity they are finding difficult.

Differentiation & Extending the Learning

Differentiation

- Add challenging vocabulary to the word wall
- Pair students strategically
- Provide sentence stems for discussion
- Emphasize use of visual aids in both PowerPoints and printed material
- Bring in example foods to show students macromolecules in the food they eat
- Complete one part of the 2.2 Food Labels Worksheet together before having students work on their own

Modifications

Instead of beginning with the food labels of beef and carrots in the PPT, have students bring in food labels from home and share what they know about the food from the labels. Then, continue with the activity.

Extending the Learning

There are many opportunities to explore cell structure and function in greater depth:

- Students could learn about other molecules not included in this activity, such as nucleic acids.
- Students could learn about organelles and their functions. (Some organelles, such as mitochondria, could be included in later lessons on cell processes.)
- Students could also learn about functions of specific molecules, such as the role of lipids in the cell membrane or functions of proteins as enzymes.

Activity 2.3: Molecules in Cells Quiz (20 min)

Overview and Preparation

Target Student Performance

Students complete a quiz to assess their understanding of the molecules in cells and how to identify which molecules store chemical energy.

Resources You Provide

- Pencils (1 per student)

Resources Provided

- 2.3 Molecules in Cells Quiz (1 per student)
- 2.3 Grading the Molecules in Cells Quiz

Setup

Print one copy of the 2.3 Molecules in Cells Quiz for each student.

Directions

1. Review for the quiz.

Ask students which main ideas about atoms and molecules they remember from the *Systems and Scale* unit. Remind students of three important facts about atoms:

- Atoms last forever (except in nuclear changes).
- Atoms make up the mass of all materials.
- Atoms are bonded to other atoms in molecules.

Review what students learned about molecules in food and how to read nutritional labels. Remind them that they can identify molecules with chemical energy by their bonds (C-C and C-H). Remind them how to read nutritional labels to find different molecules, to find calories, and to find if the food has chemical energy.

2. Have students take the quiz.

Pass out one copy of the 2.3 Molecules in Cells Quiz to each student and give them 10-20 minutes to take the quiz. Tell students that they will be graded for their answers on this quiz.

3. Discuss their answers to the quiz.

You could have students grade the quiz themselves as you go through the answers with them. Discuss any questions that many students had a difficult time with. This should serve as formative assessment for you as a teacher to identify which concepts students are still struggling with.

Assessment

Use 2.3 Grading the Molecules in Cells Quiz to grade student ideas about the materials in food. Use this quiz to determine if you need to revisit Activity 2.2, or if students are ready to move on to Activity 2.4 and Lesson 3. Because this is the Foundational Knowledge and Practice Stage of the unit, it is ok to evaluate student ideas at this point to see how they do and do not align to scientific ideas.

Differentiation & Extending the Learning

Differentiation

- Read questions out loud during the quiz
- Provide multiple choice answers or sentence stems for some written response
- Provide possible answers to be written for written response

Modifications

Extending the Learning

Activity 2.4: Questions about Plants (20 min)

Overview and Preparation

Target Student Performance

Students observe their growing radish plants and pose questions about plants to prepare for their upcoming investigation.

Resources You Provide

- (From previous lesson) 1.2 Expressing Ideas and Questions Tool for Plants Growing

Resources Provided

- 2.4 Questions about Plants PPT

Recurring Resources

- Learning Tracking Tool for Plants (1 per student)
- Assessing the Learning Tracking Tool for Plants

Setup

Prepare the PPT and saved worksheets.

Directions

1. Use the instructional model to show students where they are in the course of the unit.

Show slide 2 of the 2.4 Questions About Plants PPT.

Discuss where the class is on the unit storyline.

- The students have studied or reviewed ideas about plant structure.
- They will soon be using their growing radish plants for an investigation of plant function.

In this activity, they will be reviewing what they know and discussing questions that they still have to answer.

2. Have students observe plants and discuss their observations.

As you show Slide 3:

- Have students record observations of their growing radish plants and share what they are noticing.
- Show students either or both of the videos and discuss what they notice.
- Discuss questions based on these observations that the students would like to investigate further.

3. Ask students to review their ideas about characteristics of plants.

Slides 4-8 review what the students have learned about the structure of plants at different scales.

Slide 4 introduces the review slides.

Slide 5 reminds students that, like all living organisms, plants contain systems at different scales:

- Macroscopic scale plants are made of
- Microscopic scale cells, which are made of

- Atomic-molecular scale molecules, which are made of
- Atoms (especially CHON for organic molecules)

Slide 6 reminds students of the many different kinds of macroscopic-scale plants.

Slide 7 reminds students that all plants include different kinds of cells, including leaf cells, stem cells, root cells, and other specialized cells.

Slide 8 organizes facts students know about plants in terms of system characteristics—structure and function.

4. Ask students to compare the molecules in plant nutrients and the molecules in plants.

As you show Slide 9:

- Ask students to read the names of the molecules in Ionic Grow and the radish food label.
- Ask students to discuss how the molecules are alike and different.
- If necessary, remind students of the two basic kinds of molecules that they learned about in *Systems and Scale:* organic and inorganic.
- Student should notice that:
  - The plant nutrient molecules are all inorganic and do not contain carbon atoms.
  - Besides water, the main molecules in radishes are all organic and contain carbon atoms.

5. Review the Three Questions and Rules to Follow.

Show slide 10 of the PPT. Discuss with students how the rules about matter and energy also apply to radish plants.

Show slide 11 with the Three Questions. Remind students that when explaining plants, they will be answering the Three Questions which describe movements and changes in matter and energy

Review the rules to follow with students. Have students discuss how the rules to follow can apply to plants

6. Look back at the Expressing Ideas and Questions Tool.

Show slide 12 of the PPT. Have students look back at their 1.2 Expressing Ideas and Questions Tool for Plants Growing. Students should consider their ideas in light of what they have learned in Lesson 2. Students can add to or change their ideas in a different color pen or pencil.

7. Allow students to share new questions.

Show slide 13 of the PPT. Have students share out any new questions they have about how radish plants grow, move, and function.

8. Have students complete an exit ticket.

Show slide 14 of the 2.4 Questions about Plants PPT.

- Conclusions: How are all plants similar?
- Predictions: How do you think we could find out more about how radishes grow, move, and function?
- On a sheet of paper or a sticky note, have students individually answer the exit ticket questions. Depending on time, you may have students answer both questions, assign students to answer a particular question, or let students choose one question to answer. Collect and review the answers.

- The conclusions question will provide you with information about what your students are taking away from the activity. Student answers to the conclusions question can be used on the Driving Question Board (if you are using one). The predictions question allows students to begin thinking about the next activity and allows you to assess their current ideas as you prepare for the next activity. Student answers to the predictions question can be used as a lead into the next activity.

9. Have a discussion to complete the Learning Tracking Tool for this activity.

Show slide 15 of the 2.4 Questions about Plants PPT.

- Pass out a Learning Tracking Tool for Plants to each student.
- Have students write the activity chunk name in the first column, "Questions about Plants."
- Have a class discussion about what students did during the activity chunk. When you come to consensus as a class, have students record the answer in the second column of the tool.
- Have a class discussion about what students figured out during the activity chunk that will help them in answering the unit driving question. When you come to consensus as a class, have students record the answer in the third column of the tool.
- Have a class discussion about what students are wondering now that will help them move towards answering the unit driving question. Have students record the questions in the fourth column of the tool.
- Have students keep their Learning Tracking Tool for future activities.
- Example Learning Tracking Tool

Activity Chunk	What Did We Do?	What Did We Figure Out?	What Are We Asking Now?
Questions about Plants	"Zoom into" food and examine nutrition labels to learn about the materials in plants, animals, and food including organic materials (fats, carbohydrates, and proteins).	Plants are made of small and large organic molecules that contain matter and chemical energy, as well as water and minerals.	Where does a plant's mass come from? What happens when plants are left in the light and in the dark?

Assessment

Differentiation & Extending the Learning

Differentiation

- Ask questions about what students see happening in the videos of plants

Modifications

Extending the Learning