

Lessons 16–20

Surviving Seasonal Changes

Prepare

In Lessons 16 through 20, students explore how seasonal changes in an environment affect the organisms that live there. In Lesson 16, students use maps to create a visual representation of monarch butterfly sighting data to understand that migration is a response to seasonal changes in environments. These observations lead students to think about the cause and effect relationship between seasonal changes and the migration of monarch butterflies. In Lesson 17, students compare the life cycle stages of a butterfly to other organisms. Students explore that all organisms grow and change through their lives, but the stages of life are different for different organisms. In Lesson 18, students study how other kinds of butterflies survive during winter. Then in Lesson 19, students explore how animals other than butterflies respond to seasonal changes in their environments. An examination of plants follows in Lesson 20. The observations students make throughout these lessons help them determine that when seasonal changes occur in an environment, some organisms are able to survive better than others in the changed environment. Students conclude that an organism's ability to survive in the changed environment affects the organism's response to the change.

Concept 3: Effects of Environmental Change

Focus Question

What happens to organisms when the environment changes?

Phenomenon Question

How do organisms survive seasonal changes?

Student Learning

Knowledge Statement

Seasonal changes affect the suitability of organisms to their environment, which may cause some organisms to survive less well than others.

Objectives

- Lesson 16: Make observations to determine that monarch butterflies migrate in response to seasonal changes in their environment.
- Lesson 17: Observe and compare the life cycle stages of different organisms.
- Lesson 18: Investigate how other kinds of butterflies survive seasonal changes.
- Lesson 19: Describe how seasonal changes affect the suitability of animals to their environment.
- Lesson 20: Investigate plants to determine that they are also affected by seasonal changes.

Standards Addressed

		Lesson 16	Lesson 17	Lesson 18	Lesson 19	Lesson 20
Texas Essential Knowledge and Skills: Content						
3.9A	Observe and describe the physical characteristics of environments and how they support populations and communities of plants and animals within an ecosystem. (Addressed)	●		●	●	●
3.9C	Describe environmental changes such as floods and droughts where some organisms thrive and others perish or move to new locations. (Addressed)	●		●	●	●
3.10A	Explore how structures and functions of plants and animals allow them to survive in a particular environment. (Addressed)	●		●	●	●
3.10B	Investigate and compare how animals and plants undergo a series of orderly changes in their diverse life cycles such as tomato plants, frogs, and lady beetles. (Addressed)	●	●	●		

Texas Essential Knowledge and Skills: Investigation and Reasoning

3.2A	Plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world.	●		●	●	●
3.2B	Collect and record data by observing and measuring using the metric system and recognize differences between observed and measured data.	●	●			●
3.2C	Construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data.	●	●			●
3.2D	Analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations.	●	●	●	●	●
3.2F	Communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.	●		●		●
3.3A	Analyze, evaluate, and critique scientific explanations by using evidence, logical reasoning, and experimental and observational testing.	●		●	●	●
3.3B	Represent the natural world using models such as volcanoes or the Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials.	●		●	●	●
3.4	Collect, record, and analyze information using tools, including cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, notebooks, and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums.	●		●	●	●

English Language Proficiency Standards

2E	Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.	●		●		●
3F	Ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments.	●			●	

Materials

		Lesson 16	Lesson 17	Lesson 18	Lesson 19	Lesson 20
Student	Analyze Sighting Maps: flipbook maps (1 set per student), colored pencils or markers	●				
	Science Logbook (Lesson 16 Activity Guide)	●				
	Butterfly Life Cycle Cards (1 set per student pair)		●			
	Organism Life Cycle Cards (1 set per group)		●			
	Science Logbook (Lesson 17 Activity Guide)		●			
	Science Logbook (Lesson 18 Activity Guide)			●		
	Science Logbook (Lesson 7 Activity Guide B, Lesson 19 Activity Guide)				●	
	Category Headings and Animal Cards (1 set per student pair)				●	
	Plant Investigation (1 per group): one radish plant grown in direct sunlight, one radish plant grown in dark, ruler					●
	Science Logbooks (Lesson 20 Activity Guide)					●

		Lesson 16	Lesson 17	Lesson 18	Lesson 19	Lesson 20
Teacher	Monarch Butterfly Range Map (Lesson 16 Resource A)	●				●
	North America Climate Zone Map (Lesson 16 Resource B)	●				
	Using the Journey North Website (Lesson 16 Resource C)	●				
	Monarch Migration Map (Lesson 16 Resource E)	●				
	Prepared migration wall labels	●				
	<i>A Butterfly Is Patient</i> by Dianna Hutts Aston and Sylvia Long (2015)	●				
	Butterfly in Snow Photograph (Lesson 17 Resource A)		●			
	Monarch Butterfly Life Cycle (Lesson 18 Resource A)			●		
	Butterfly Life Cycle Stations: coral hairstreak life cycle, Baltimore checkerspot life cycle, black swallowtail life cycle, mourning cloak life cycle			●		
	Forest Environment Photograph (Lesson 19 Resource A)				●	
	Anchor chart				●	●
	Anchor model				●	
	Radish Plant Preparation: 1 packet of radish seeds, 2 9-ounce cups (per group), 2 cups of soil (per group), water					●
	Birch Forest in Summer and Winter Photographs (Lesson 20 Resource B)					●

		Lesson 16	Lesson 17	Lesson 18	Lesson 19	Lesson 20
Preparation	Prepare flipbook maps (see Lesson 16 Resource D).	●				
	Prepare migration wall labels (see Lesson 16 Resource F).	●				
	Cue clustering butterflies video from Lesson 14 and “Masses of MONARCHS arriving at Cerro Pelon!” (Rosenblatt 2017) video: http://phdsci.link/1219 and http://phdsci.link/1224 .	●				
	Prepare Butterfly Life Cycle Cards (see Lesson 17 Resource B).		●			
	Cue “Egg to Butterfly: The Life of a Monarch” (Belchamber 2018) video: http://phdsci.link/1225 .		●			
	Prepare Organism Life Cycle Cards (see Lesson 17 Resource C).		●			
	Prepare Butterfly Life Cycle Stations (see Lesson 18 Resource B).			●		
	Prepare Category Headings and Animal Cards (see Lesson 19 Resource B).				●	
	6–7 Days Before: Prepare radish plants for plant investigation (see Lesson 20 Resource A).					●

Lesson 17

Objective: Observe and compare the life cycle stages of different organisms.

Launch

5 minutes

Display the photograph of the butterfly in the snow (Lesson 17 Resource A).



► How does this picture challenge what you think about butterflies and migration?

- Monarch butterflies migrate to warmer environments for the winter, but this butterfly didn't go south for the winter.
- I thought butterflies migrate because they aren't suited to live in cold weather. This butterfly is in the snow.

Agenda

Launch (5 minutes)

Learn (35 minutes)

- Introduce Butterfly Life Cycle (7 minutes)
- Sequence Organism Cards (13 minutes)
- Compare Life Cycles (15 minutes)

Land (5 minutes)

Explain to students that to better understand how butterflies survive seasonal changes, students need to consider how butterflies change and grow during their lifetime.

Learn 35 minutes

Introduce Butterfly Life Cycle 7 minutes

Instruct students to find a partner. Distribute a set of butterfly life cycle cards (Lesson 17 Resource B) to each pair. Ask students to arrange the cards to show the butterfly life cycle. Invite pairs to share their sequence with the class. 

Sample student responses:

- An adult butterfly lays an egg. A caterpillar hatches out of the egg and forms a chrysalis.
An adult comes out of the chrysalis.
- An egg hatches and a caterpillar comes out. The caterpillar makes a chrysalis, and then
an adult butterfly comes out of the chrysalis.

Play the “Egg to Butterfly: The Life of a Monarch” (Belchamber 2018) video (<http://phdsci.link/1225>) without sound. After students watch the video, allow them the opportunity to rearrange their cards. As needed, guide students to sequence the cards correctly. 

Confirm that the butterfly goes through the stages of egg, caterpillar, chrysalis, and adult during its life cycle. Wonder aloud whether other organisms go through the same stages during their life cycle.

► How can we learn more about the life cycles of other organisms?

- We can observe pictures of other organisms at different stages of their life cycle.
- We can watch videos of different organisms going through their life cycle.

Teacher Note

 If students have been observing live painted lady caterpillars in the classroom, invite them to refer to the changes they have observed in the caterpillars over time as they share their life cycle sequence.

Spotlight on Knowledge and Skills

In Level 1, students study a bullfrog life cycle model. Remind students that a life cycle is a repeating cycle as opposed to a linear process. As necessary, support students who create a linear model by reminding students that adults produce offspring (3.1OB, 2E).

Teacher Note

 Students may place any stage of the life cycle at the top of their arrangement as long as the sequence is correct.



Differentiation

If students need additional support, consider rereading pages 1 through 4 of *A Butterfly Is Patient*. Invite students to observe the illustrations of the butterfly life cycle on pages 3 and 4 (2E).

Sequence Organism Cards 13 minutes

Have pairs join to form groups of four. Distribute the organism life cycle cards (Lesson 17 Resource C) to each group.  Instruct students to arrange the cards of each organism to show its life cycle. Instruct students to create a life cycle for all five organisms.

Teacher Note

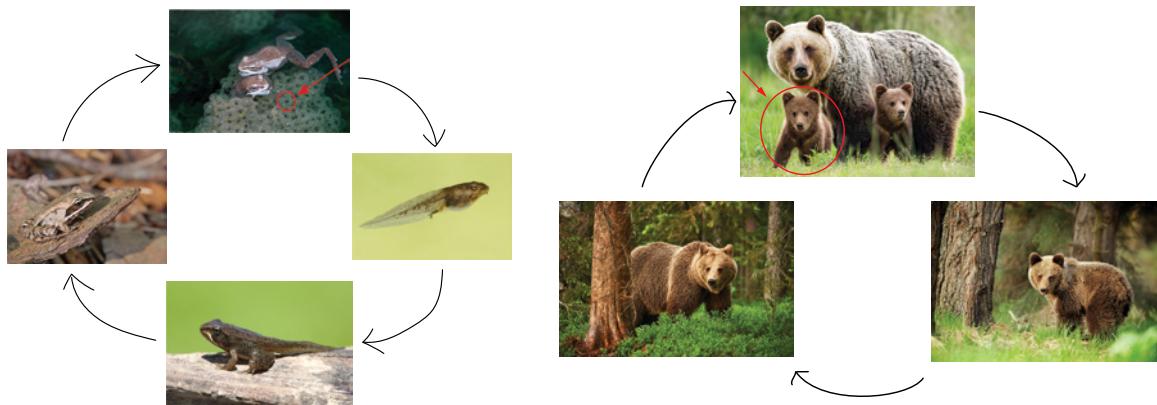
Students use their life cycle models to make observations during the next part of the activity. Consider having students glue or tape the cards onto a large sheet of paper so they can more easily observe the sequences. Students may add labels to note life cycle stages or changes.

Point out that some cards have marks to show what students should focus on. For example, students should focus on the egg that is circled on the card that shows two frogs with a pile of eggs.

Teacher Note

Circulate to help students sequence the cards correctly. As needed, ask questions such as these to facilitate students' reasoning: What do you think changed or happened between these two pictures? What do you think this organism looked like earlier in its life? What do you think this organism looked like later in its life? Ensure that all groups have correctly sequenced all five life cycles before moving on.

Sample sequences: 



Differentiation

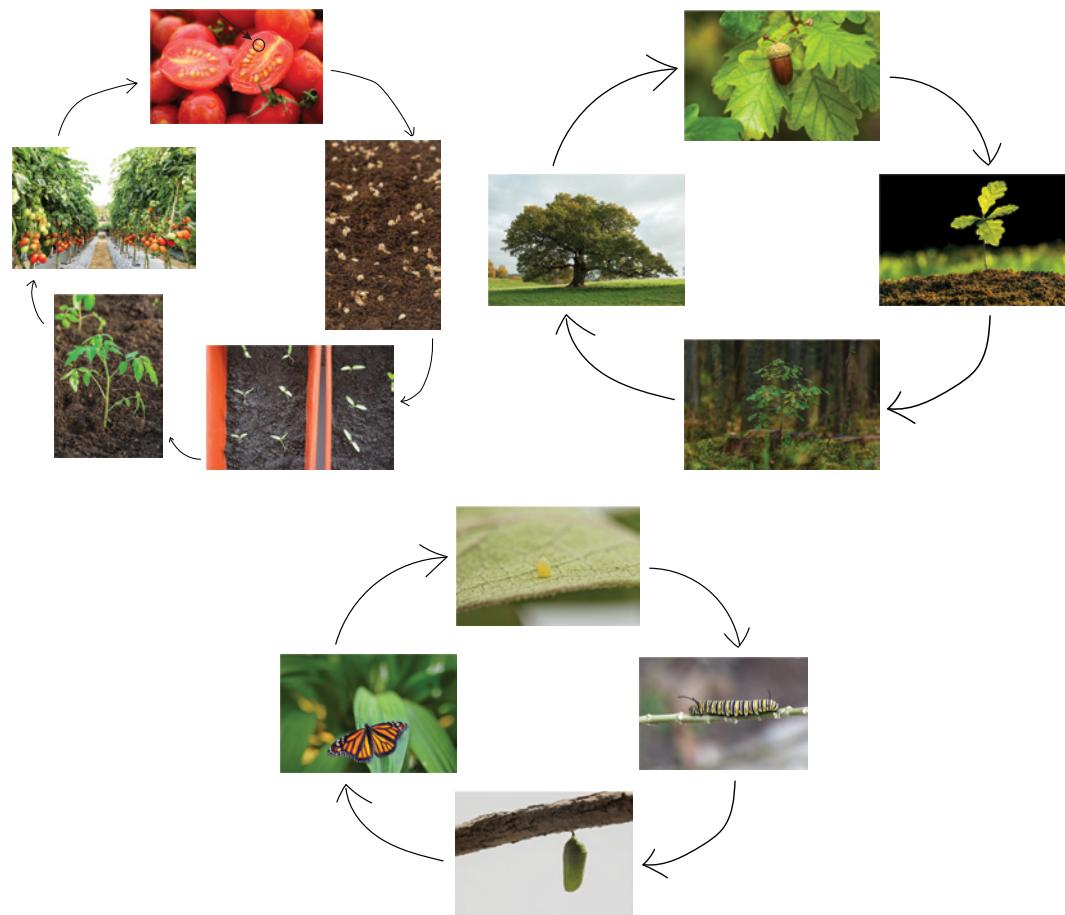
Consider grouping students in heterogeneous groups based on differing interests and ability levels.



Extension

Butterflies go through complete metamorphosis, which means their physical form is different in each life cycle stage. An insect that goes through incomplete metamorphosis changes gradually, and its physical form does not differ between the nymph (juvenile) and adult stages.

As an extension, consider asking students to compare the butterfly life cycle to the life cycle of an insect that goes through incomplete metamorphosis, such as a grasshopper. Students are not expected to know the term *metamorphosis* at this level. Encourage students to focus on the insects' body parts when they compare the insects' life cycles.



Compare Life Cycles 15 minutes

Tell students to choose one organism's life cycle and share their observations with their group. Students should discuss what they notice about the organism at each stage of its life cycle. Then instruct students to repeat the activity until they have shared observations for all five life cycles.

Provide the following question prompts to guide group discussion.

- ▶ What do you observe about the organism at each stage?
- ▶ How does the organism change during its life cycle?

On a piece of chart paper, create a two-column chart. Title the first column Organism and the second column Observation of Life Cycle Stages. Invite students to share their observations of the life cycles. As students share, record key ideas on the class chart.

Sample class chart:

Organism	Observations of Life Cycle Stages
Wood frog	<p><i>The offspring are eggs.</i></p> <p><i>A tadpole hatches from an egg.</i></p> <p><i>The tadpole becomes a frog with a tail.</i></p> <p><i>The adult frog doesn't have a tail.</i></p>
Brown bear	<p><i>The offspring is a cub.</i></p> <p><i>The young bear is larger than the cub. The adult bear is larger than the young bear.</i></p> <p><i>The bear has the same body parts at each stage.</i></p>
Monarch butterfly	<p><i>The offspring are eggs.</i></p> <p><i>The caterpillar hatches from the egg.</i></p> <p><i>The caterpillar makes a chrysalis, and then a butterfly comes out of the chrysalis.</i></p> <p><i>The adult butterfly has wings.</i></p>
Oak tree	<p><i>The offspring are seeds inside acorns.</i> </p> <p><i>A tree grows from the seed.</i></p> <p><i>The adult tree has more branches than in the other stages.</i></p>
Tomato plant	<p><i>The offspring are seeds.</i></p> <p><i>A seedling grows from a seed.</i></p> <p><i>A seedling grows into a plant with tomatoes.</i></p> <p><i>Adult tomatoes are different colors.</i></p>



Teacher Note

Level 1 introduces the concept that acorns are nuts that grow on certain trees and contain the seed of the tree. Remind students of this learning as necessary.

Have students pick one plant and one animal and compare the life cycles of the two organisms in their Science Logbook (Lesson 17 Activity Guide). Discuss student responses as a class.

► **How are the life cycles similar?**

- Both the tomato plant and the monarch butterfly look different at each stage of its life cycle.
- The brown bear and the oak tree both produce offspring after the adult stage of the life cycle.

► **How are the life cycles different?**

- The tomato plant and wood frog offspring look different. Tomato plants grow from seeds and wood frogs grow from eggs.
- The frog has different body parts in different life cycle stages. The tadpole has a tail, but the adult frog does not. After the oak tree grows from the seed, the parts of the tree stay the same.
- The bear has three life cycle stages, and the tomato plant has six life cycle stages. 



Check for Understanding

Students compare the life cycles of one plant and one animal.

TEKS Assessed

3.10B Investigate and compare how animals and plants undergo a series of orderly changes in their diverse life cycles such as tomato plants, frogs, and lady beetles.

Evidence	Next Steps
Students identify similarities between the life cycles (e.g., both organisms change during their life cycles, the life cycles consist of different stages). Students identify differences between the life cycles (e.g., the organisms have different kinds of offspring, different changes occur during the stages of the life cycles).	Students who need support to identify similarities and differences may benefit from revisiting the photographs. Prompt students with the following questions: What changes do you observe in this organism at each life cycle stage? Are these changes the same as or different from the changes in the other organism?

Use student responses to summarize that the organisms all change during their life cycles, but that the organisms change in different ways.



Teacher Note

Students may notice that the number of life cycle stages in their sequences varies by organism. Ensure that students understand the number of stages does not correspond with the length of life or how long the organism takes to grow and change.

Land

5 minutes

Revisit the butterfly photograph from the Launch (Lesson 17 Resource A).

► How can you use your knowledge about life cycles to describe this picture?

- I see an adult butterfly in the snow.
- This butterfly is in the adult stage of its life cycle.

Remind students of previous learning that monarch butterflies migrate to avoid the cold. Ask students to think of questions about the timing of a butterfly's life cycle.

Sample student responses:

- Do all monarch butterflies become adults before winter?
- Do other butterflies spend winter in the adult stage of their life cycle?
- Do butterfly life cycle stages depend on the season?

Tell students in the next lesson they will observe life cycles of different butterflies as they continue to explore the Phenomenon Question **How do organisms survive seasonal changes?**