Animals Unit Front Matter

Unit Home

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Animals is one of the six *Carbon TIME* units. If you are new to teaching *Carbon TIME*, read the *Carbon TIME* FAQ: Which Units Should I Teach.

The *Animals Unit* supports students in using core disciplinary ideas, science practices, and cross-cutting concepts to develop scientific explanations of how different animals *transform matter and energy* as they grow, move, and function.

Follow these steps to get ready to teach the *Animals Unit.*

Step 1	Step 2	Step 3	Step 4	Step 5
Read The Unit Overview	Choose Your Unit Sequence	Learn About The Instructional Model & Storyline	Prepare Unit Materials	Dig Into The Lessons

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This unit is also available online at http://carbontime.bscs.org/. Contact the MSU Environmental Literacy Program for more information: EnvLit@msu.edu.

Overview

The Driving Question

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The *Animals Unit* starts by asking students to express their ideas about the driving question about an anchoring phenomenon.

Carbon is the key! In the unit, students learn to tell the story of how matter and energy are transformed as they move through animal systems. A particularly powerful strategy for explaining how animal systems transform matter and energy involves *tracing carbon atoms*. For more information about the *Next Generation Science Standards* **disciplinary core ideas** included in this unit, see sections on the Matter Movement, Matter Change, and Energy Change Questions below and the Unit Goals.

Research base. This unit is based on learning progression research that describes the resources that students bring to learning about animals and the barriers to understanding that they must overcome. It is organized around an instructional model that engages students in three-dimensional practices.

Students' Roles and Science Practices

As students learn to answer the driving question by explaining how animal systems transform matter and energy, they play three different roles that encompass all of the *Next Generation Science Standards* science and engineering practices.

- Questioners: Students explore the driving question, clarify, and generate more detailed questions
- Investigators: Students conduct matter-tracing investigations of mealworms eating and develop evidence-based arguments about key observations and patterns
- Explainers: Students construct model-based explanations of how animals grow.

Investigation: Mealworms eating and breathing

Key observations and patterns

- Mealworms gain mass
- The potato loses mass
- The potato loses more mass than the mealworms gain
- Mealworms breathe CO_2 out into the air

The roles that students play are also embedded in the *Carbon TIME* Instructional Model and Discourse Routine. The Discourse Routine guides how classroom discourse aimed first at divergent thinking and then at convergent thinking should be sequenced through the unit.

Good Explanations Answer the Three Questions

Students figure out how to answer the driving question by tracing carbon-containing molecules through a series of movements and chemical changes inside animals. At each stage in these processes they answer Three Questions about what is happening: The Matter Movement Question, the Matter Change Question, and the Energy Change Question.

Below, we use the anchoring phenomenon of child growth as an example of how students learn to answer the Three Questions for different animals.

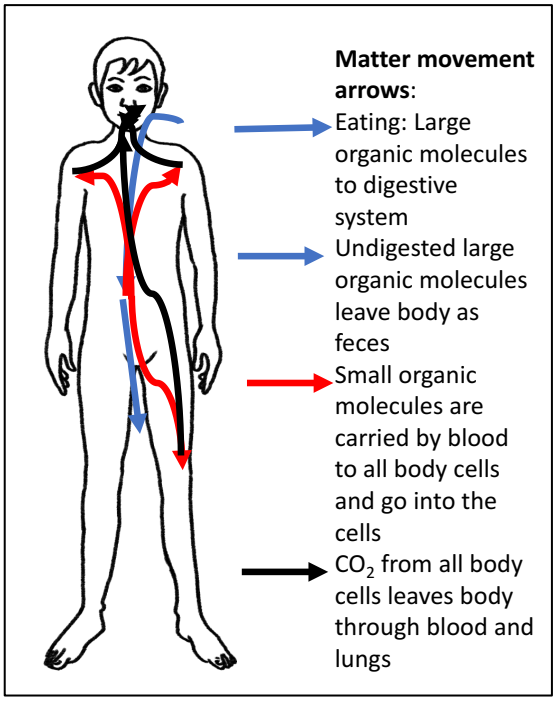
Note that, in *Carbon TIME*, crosscutting concepts serve as the "rules of grammar" for producing a scientific performance. With respect to animals growing, high quality explanations should attend to the following rules that are implied by crosscutting concepts. Explanations should attend to:

- *Scale* by explaining events and phenomena at the appropriate scale (see more in the structure and function bullets below).
- *Systems and system models* and *energy and matter* by following rules for tracing matter and energy through systems and system models. For example, neither energy nor matter should be created or destroyed as it moves into, through, or out of a system.
- *Structure and function* by linking structures and functions in explanations at each scale.
    - Macroscopic scale (tracing matter and energy through processes occurring in organs and organ systems)
    - Cellular scale (tracing matter and energy into and out of cells as cellular functions are carried out)
    - Atomic-molecular scale (tracing matter and energy through chemical processes—digestion, cellular respiration, and biosynthesis—involving molecules with different structures and properties)

The Matter Movement Question: Tracing Molecules Through Body Systems and Cells

Students learn to tell the following story of how carbon-containing molecules move through body systems and cells.

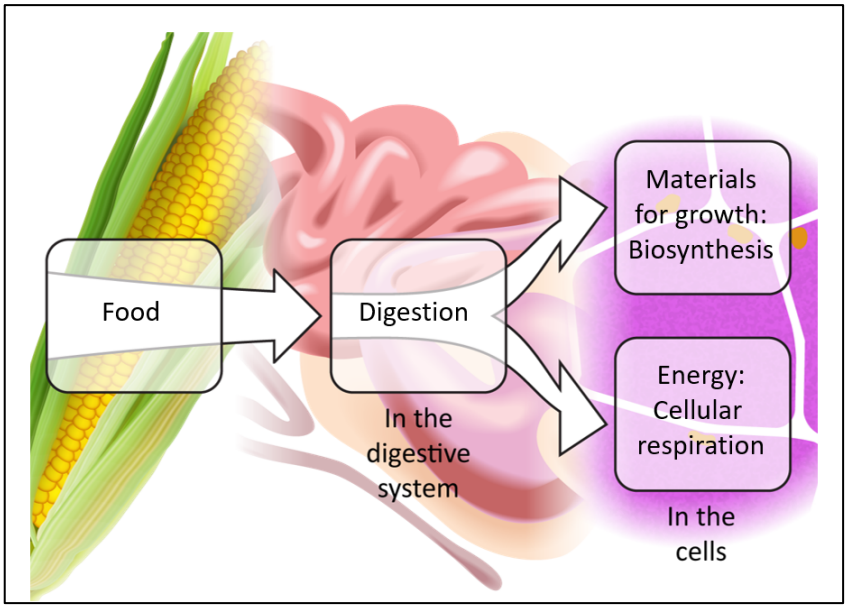
- Carbon atoms enter animals' bodies as part of large organic molecules—carbohydrates, fats, and proteins—in food.
- Some large organic molecules that animals eat are never digested and leave animals' bodies as feces, but they are not the ones that help animals to grow, move, and function.
- Digested small organic molecules (monomers) containing carbon atoms move out of animals' digestive systems and into all the cells of their bodies. Cells use these molecules to do the work that enables animals to grow, move, and function.
- All cells produce carbon dioxide that ultimately leaves animals through their respiratory systems.



The Matter Change and Energy Change Questions: Explaining How Animals Use Organic Molecules to Grow, Move, and Function

Matter movement is an essential part of the story, but not the whole story. To answer the driving question, students learn to explain chemical changes that occur inside animals:

- *Digestion.* Large organic molecules (polymers) are broken down into small organic molecules (monomers) in animals' digestive systems. Both large and small organic molecules have chemical energy stored in their C-C and C-H bonds.
- *Biosynthesis and growth.* Animals grow when their cells grow and divide through the process of biosynthesis—combining small organic molecules from food to make the large organic molecules needed for cells' structure and function.



- *Cellular respiration—energy to move and function.* Animal cells get the energy they need to move and function by combining sugars and other small organic molecules with oxygen, releasing energy when high-energy C-C and C-H bonds are replaced by lower-energy bonds in carbon dioxide and water.

How Much Detail?

Biology textbooks go into lots of details not included in the brief account above—about animals' body systems, about cellular structure and function, and about macromolecules and metabolic processes. But our learning progression research has shown that there is an important tradeoff here—many students get lost in the details and never learn a basic coherent story that answers the driving question. The *Next Generation Science Standards* take a clear position on this tradeoff; a coherent story based on principles such as matter and energy conservation is more important than the details. Consult the Unit Sequence tab to decide how much detail is appropriate for your students.

Unit Sequence

Before beginning the *Animals Unit*, you need to decide what to teach and importantly, what not to teach! Use this page to choose the unit sequence that's most appropriate for your students.

- Some activities are **REPEATING ACTIVITIES (⊂⊃). Omit these activities if students have already completed them in another unit (unless you'd like students to repeat them as review).**
- Other activities are **TWO-TURTLE ACTIVITIES** (), which place a higher demand on students. **Decide whether the higher demand required by these activities will be useful or distracting for *your students***. The *Carbon TIME* Turtle Trails document provides further info about choices for making units more or less demanding, depending on your students' needs.

Unless otherwise noted in the table below, all activities in the unit should be taught.

***Animals Unit* Sequence and Decisions Table**

Lesson	Activity Sequence	Feature	Make a Decision
1 (60 min)	1.1 Animals Unit Pretest (20 min)		
	1.2 Expressing Ideas and Questions About Animals (40 min)		
2 (2 hr 5 min)	2.1 Zooming Into Plants, Animals, And Decomposers (40 min)		These activities are exactly the same as equivalent ones in *Plants* and *Decomposers Units*. **Do not repeat these activities in multiple units unless students need a review.** Also, in Activity 2.1, the "Cells: The Building Blocks" reading is optional.
	2.2 Molecules Cells Are Made Of (45 min)		
	2.3 Molecules In Cells Quiz (20 min)		
	2.4 Questions About Animals (30 min)		
3 (2 hr 40 min)	3.1 Predictions and Planning About Mealworms Eating (35 min)		
	3.2 Observing Mealworms Eating (60 min over 2 days)		
	3.3 Evidence-Based Arguments About Mealworms Eating (50 min)		
4 (1 hr 20 min)	4.1 Molecular Models For Cows Moving and Functioning (45 min)		The molecular modeling part of Activity 4.1 is the same as the molecular modeling for cellular respiration in the *Plants* and *Decomposers Units*. **Do not repeat unless for review.**
	4.2 Explaining Cellular Respiration (40 min)		There are multiple scaffolds you can choose from to use with Activity 4.2 including the cellular respiration PPT, the Three Questions Checklist, example explanations, and a reading. Choose options that fit for your class at this time.
5 (1 hr 20 min)	5.1 Tracing Cows Growing (40 min)		
	5.2 Molecular Models For Cows Growing (40 min)		Activity 5.2 is exactly the same as molecular modeling for biosynthesis in the *Plants* and *Decomposers Units*. It's also a 2-turtle activity. **Consider skipping 5.2 if you've already taught it in another unit or if it's too advanced for your class.**
	5.3 Explaining Digestion (40 min)		In Activities 5.3 and 5.4, you can choose from among similar scaffolding tools as those listed for Activity 4.2
	5.4 Explaining Biosynthesis (40 min)		
6 (2 hr)	6.1 Explaining Other Examples of Animals Growing, Moving, and Functioning (50 min)		Activity 6.1 has explanations about 3 different animals. **Consider a jigsaw format with different students becoming experts on different animals and then sharing/comparing.**
	6.2 Comparing Animals And Flames (50 min)		In Activity 6.2, students will compare flames and animals.
	6.3 Functions Of All Animals (50 min)		In Activity 6.3, students will develop an explanation that applies to all animals.
	6.3 Animals Posttest (20 min)		

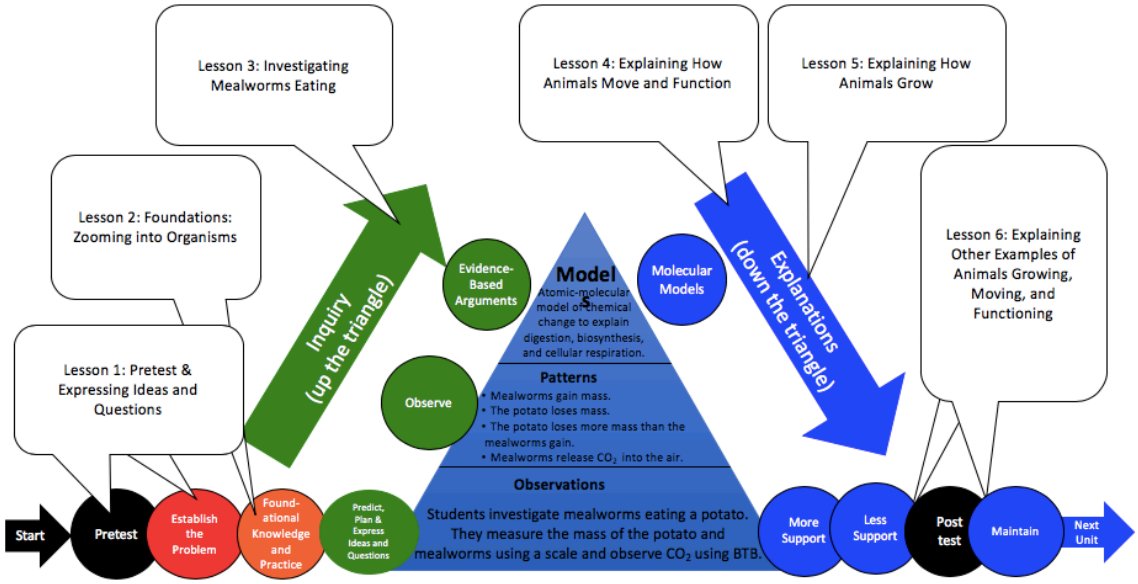
IM & Storyline

Here, we present two ways to think about how lessons are sequenced in the *Animals Unit*. The Instructional Model, immediately below, emphasizes how students take on roles of questioner, investigator, and explainer to learn and apply scientific models they can use to answer the driving question. Further below, the Unit Storyline Chart highlights the central question, activity, and answer that students engage with in each lesson of the *Animals Unit*.

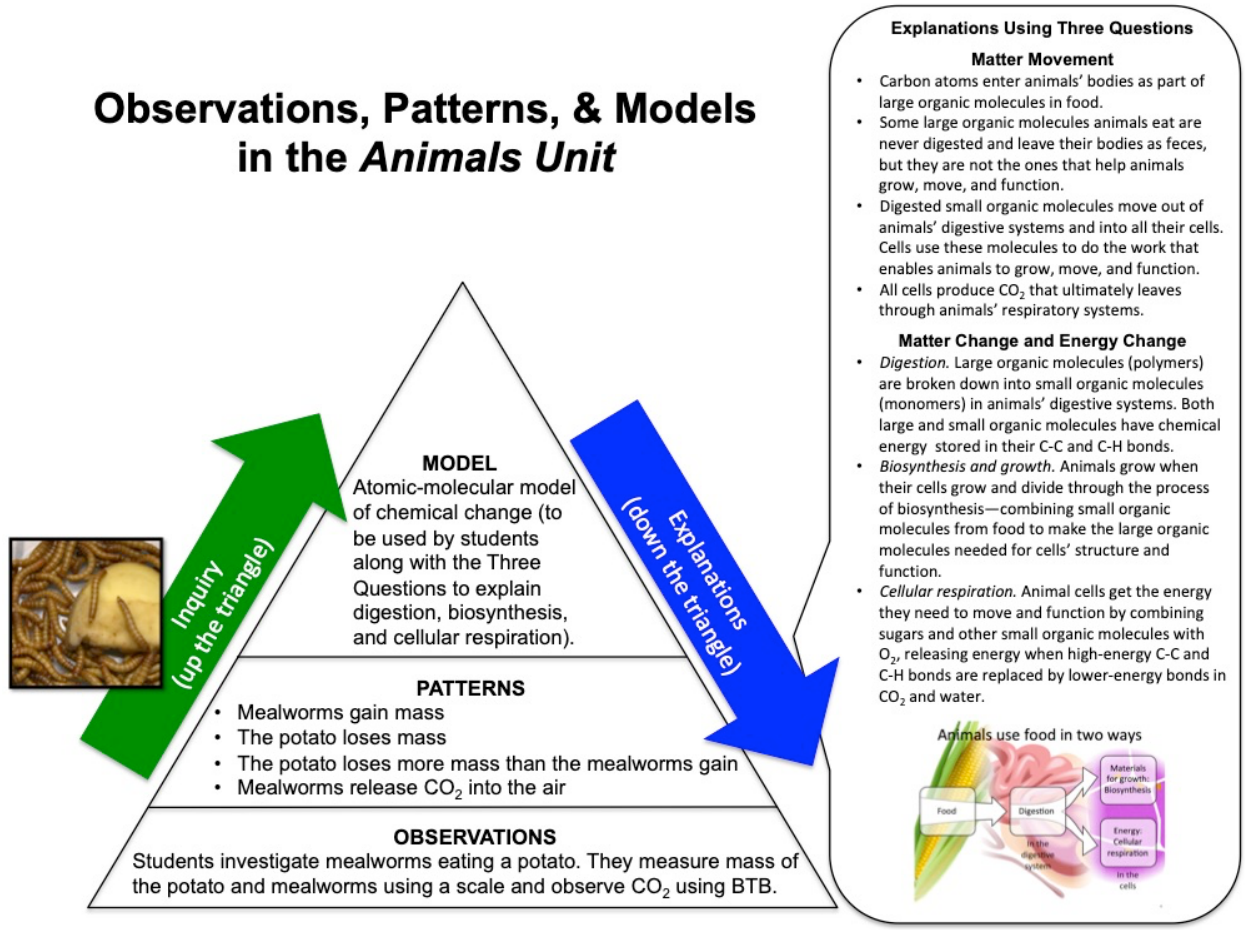
Instructional Model

Like all *Carbon TIME* units, this unit follows an instructional model (IM) designed to support teaching that helps students achieve mastery at answering the driving question through use of disciplinary content, science practices, and crosscutting concepts. To learn more about this design, see the *Carbon TIME* Instructional Model.

The *Animals* Unit



The core of the *Carbon TIME* IM is the Observation, Patterns, Models (OPM) triangle, which summarizes key aspects to be attended to as the class engages in unit inquiry and explanation. The OPM triangle for the *Animals Unit*, shown below, articulates the key observations students make during the unit investigation, the key patterns they identify through analyzing their investigation data, and the central scientific model that can be used to answer the unit's driving question. During the inquiry portion of the unit (Lesson 3), the class moves from making observations to identifying patterns, eventually using these patterns to make evidence-based arguments. During the explanation portion of the unit (Lessons 4, 5, 6), the class learns the atomic-molecular model, makes connections across scales, and uses the atomic-molecular model to explain how animals grow, move, and function. Across the unit, classroom discourse is a necessary part of 3-dimensional *Carbon TIME* learning. The Carbon TIME Discourse Routine document provides guidance for scaffolding this discourse in lessons.

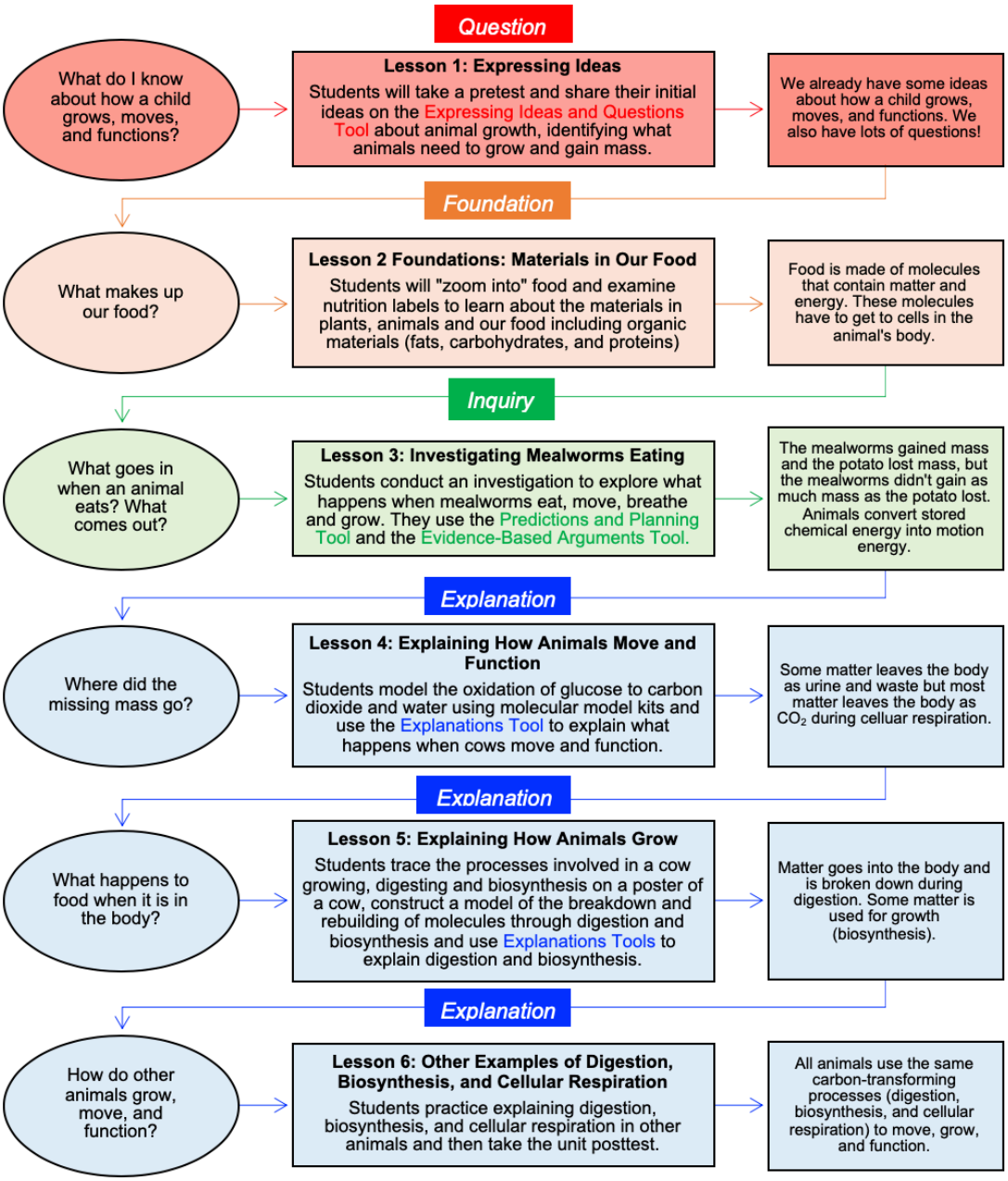


Observations, Patterns, Models, and Explanations in the Animals Unit

Unit Storyline Chart

Another way to familiarize yourself with the sequence of lessons in the *Animals Unit* is with the Unit Storyline Chart depicted below. The Unit Storyline Chart summarizes a unit phenomenon-based driving question associated with each lesson, what classes will do in each lesson to address the question, what conclusions they will come to, and how they will transition to a subsequent lesson.

Download PDF of Unit IM and Storyline Chart



Unit Goals

The tables below show goals for this unit in two forms. A table showing specific target performances for each activity is followed by a list of the *Next Generation Science Standards (NGSS)* addressed by this unit.

Target Performances for Each Activity

All *Carbon TIME units* are organized around a common purpose: *assessing and scaffolding students' three-dimensional engagement with phenomena.* Every *Carbon TIME* activity has its specific expectation for students' three-dimensional engagement with phenomena, what we call its

Download PDF of Unit Target Performances

target performance. Each activity also includes tools and strategies that teachers can use to asses and scaffold the target performance in rigorous and responsive ways.

The target performances for each activity in the *Animals* unit are listed in the table below.

Activity	***Target Performance***
Lesson 1 – Pretest and Expressing Ideas and Questions (students as questioners)	
Activity 1.1: *Animals* Unit Pretest	Students show their initial proficiencies for the overall unit goal: Questioning, investigating, and explaining how animals move and change matter and energy as they live, move, and grow.
Activity 1.2: Expressing Ideas and Questions about How Animals Grow	Students ask and record specific questions about changes in matter and energy in response to the unit driving question.
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 Animals	Students describe structures and functions that all animals share and pose questions about mealworms to prepare for their upcoming investigation.
Lesson 3 – Investigating Mealworms Eating (students as investigators and questioners)	
Activity 3.1: Predictions and Planning about Mealworms Eating	Students develop hypotheses about how matter moves and changes and how energy changes when mealworms eat, move, and grow and make predictions about how they can use their investigation tools—digital balances and BTB—to detect movements and changes in matter.
Activity 3.2: Observing Mealworms Eating	Students record data about changes in mass and BTB when mealworms eat, move, and grow and reach consensus about patterns in their data.
Activity 3.3: Evidence-Based Arguments about Mealworms Eating	Students (a) use data from their investigations to develop evidence-based arguments about how

Activity	***Target Performance***
	matter moves and changes and how energy changes when mealworms eat, move, and grow, and (b) identify unanswered questions about matter movement and matter change that the data are insufficient to address.
Lesson 4 –Explaining How Animals Move and Function	
Activity 4.1: Molecular Models for Cows Moving and Functioning: Cellular Respiration	Students use molecular models to explain how carbon, oxygen, and hydrogen atoms are rearranged into new molecules in a cow's cells.
Activity 4.2: Explaining How Cows Move and Function: Cellular Respiration	Students explain how matter moves and changes and how energy changes during cellular respiration in a cow's cells (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).
Lesson 5 – Explaining How Animals Grow (students as explainers)	
Activity 5.1: Tracing the Processes of Cows Growing: Digestion and Biosynthesis	Students "zoom in" to the structure and function of a cow's organ systems and cells, tracing atoms and energy.
Optional Activity 5.2: Molecular Models for Cows Growing: Digestion and Biosynthesis	Students use molecular models to explain how polymers are broken into monomers during the process of digestion and monomers are linked into polymers during biosynthesis.
Activity 5.3: Explaining How Cows Grow: Digestion	Students explain how matter moves and changes and how energy changes during digestion in a cow (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).
Activity 5.4: Explaining How Cows Grow: Biosynthesis	Students explain how matter moves and changes and how energy changes during biosynthesis in a cow's cells (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).
Lesson 6 – Explaining Other Examples of Animals Growing, Moving, and Functioning (students as explainers)	
Activity 6.1: Explaining Other Examples of Animals Growing, Moving, and Functioning	Students develop integrated accounts of how other animals (salmon, mealworms, dolphins) grow, move and function through the processes of digestion, cellular respiration, and biosynthesis.

Activity	*Target Performance*
Activity 6.2: Comparing Animals and Flames	Students compare how matter moves and changes and how energy changes in ethanol burning vs. a child growing, moving and functioning (connecting macroscopic observations with atomic-molecular models and using the principles of conservation of matter and energy).
Activity 6.3: Functions of All Animals	Students develop integrated accounts of how all animals grow, move and function through the processes of digestion, cellular respiration, and biosynthesis.
Activity 6.4: Animals Unit Posttest	Students show their end-of unit proficiencies for the overall unit goal: Questioning, investigating, and explaining how animals move and change matter and energy as they live, move, and grow.

Next Generation Science Standards

The *Next Generation Science Standards* (*NGSS*) performance expectations that middle and high school students can achieve through completing the Animals Unit are listed below. To read a discussion of how the *Carbon TIME* project is designed to help students achieve the performances represented in the NGSS, please see Three-dimensional Learning in *Carbon TIME*.

High School

- HS. From Molecules to Organisms: Structures and Processes. HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
  http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes
- HS. Matter and its Interactions. HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
  http://www.nextgenscience.org/hsps1-matter-interactions
- HS. Matter and its Interactions. HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
  http://www.nextgenscience.org/hsps1-matter-interactions
- 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.
  http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes
- HS. From Molecules to Organisms: Structures and Processes. HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
  http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes

- HS. Ecosystems: Interactions, Energy, and Dynamics. HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
  http://www.nextgenscience.org/hsls2-ecosystems-interactions-energy-dynamics

Middle School

- MS. Matter and its Interactions. MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.
  http://www.nextgenscience.org/msps1-matter-interactions
- MS. Matter and its Interactions. MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
  http://www.nextgenscience.org/msps1-matter-interactions
- MS. Matter and its Interactions. MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
  http://www.nextgenscience.org/msps1-matter-interactions
- MS. From Molecules to Organisms: Structures and Processes. MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
  http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes

Materials

Recurring Resources

- Animals Matter Tracing Tool
- Assessing Animals Matter Tracing Tool
- (Optional) Big Idea Probe: What Happens to the Fat?
- (Optional) Assessing the Big Idea Probe: What Happens to the Fat?
- Cow 11 x 17 Poster
- Learning Tracking Tool for Animals
- Assessing the Learning Tracking Tool for Animals
- Questions, Connections, Questions Reading Strategy
- Using Big Idea Probes
- Three Questions Handout
- Three Questions 11x17 Poster
- BTB Color Handout
- Digestion and Biosynthesis of Carbohydrates 11 x 17 Poster
- Digestion and Biosynthesis of Fat 11 x 17 Poster
- Digestion and Biosynthesis of Protein 11 x 17 Poster
- Molecule 11 x 17 Poster
- Metabolic Pathways Poster: http://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma/General_Information/metabolic_pathways_poster.pdf
- Molecular Models 11 x 17 Placemat (1 per pair of students)
- Molecule Diagram 11 x 17 Poster (1 per class)
- Three Ways to Represent Glucose 11 x 17 Poster (1 per class)
- Forms of Energy Cards (1 set per pair of students)

Materials You Provide:

Activity 1.1: Animals Unit Pretest (20 min)

- pencils (1 per student, for paper version)
- computer with an Internet connection (1 per student, for online version)

Activity 1.2: Expressing Ideas and Questions about How Animals Grow (40 min)

- sticky notes (1 per student)
- time-lapse video of child growing, such as https://www.youtube.com/watch?v=OLTfq6JjPus&t=1s

Activity 2.3: Molecules in Cells Quiz (20 min)

- pencils (1 per student)

Activity 2.4: Questions about Animals (30 min)

- (From previous lesson) 1.2 Expressing Ideas and Questions Tool for Animals Growing
- Time-lapse video of mealworms eating a carrot: http://www.youtube.com/watch?v=xRYE0JjHYoQ

Activity 3.1: Predictions and Planning about Mealworms Eating (35 min)

- (From previous lesson) Students' ideas and questions they shared in Activity 1.2 Expressing Ideas and Questions about How Animals Grow
- (From previous lesson) 1.2 Expressing Ideas and Questions Tool for Animals Growing

Activity 3.2: Observing Mealworms Eating (60 min over 2 days)

- bromothymol blue (BTB) solution (less than 1 cup per group of four students)
- digital balance (1 per group of four students)
- mealworms (10-15 grams; this may be as few as 10-15 jumbo mealworms to as many as 100-150 small mealworms per group of four students)
- plastic Petri dish (1 per group of four students)
- sealable, 9.5 cup container (1 per group of four students)
- small container to hold mealworms (1 per group of four students)
- thick slice of potato (food for mealworms) (1 per group of four students)
- (From previous lesson) 3.1 Predictions and Planning Tool for Mealworms Eating with student answers

Activity 3.3: Evidence-Based Arguments about Mealworms Eating (50 min)

- (From previous lesson) 3.2 Mealworms Investigation Class Results 11 x 17 Poster (or Spreadsheet)
- (From previous lesson) 3.2 Observing Mealworms Eating Worksheet

Activity 4.1: Molecular Models for Cows Moving and Functioning: Cellular Respiration (45 min)

- (From previous lesson) Students' unanswered questions they shared in Activity 3.3 Evidence-Based Arguments about Mealworms Eating
- (From previous lesson) 3.3 Evidence-Based Arguments Tool for Mealworms Eating
- molecular model kit (1 per pair of students)
- scissors (1 per pair of students)
- twist ties (at least 12 per pair of students)

- video of a cow moving, such as here: https://youtu.be/onWzeDElz6w

Activity 4.2: Explaining How Cows Move and Function: Cellular Respiration (40 min)

- (From previous lesson) 3.3 Evidence-Based Arguments Tool for Mealworms Eating

Activity 5.1: Tracing the Process of Cows Growing: Digestion and Biosynthesis (40 min)

- pennies (5 per pair of students)
- nickels (2 per pair of students)
- video of a cow growing, such as here: https://www.youtube.com/watch?v=LWJN7li120ch

Activity 5.2: Molecular Models for Cows Growing: Digestion and Biosynthesis (40 min)

- scissors (1 per pair of students)
- removable or re-stick tape (1 dispenser per pair of students)

Activity 5.3: Explaining How Cows Grow: Digestion (40 min)

- (From previous lesson) 3.3 Evidence-Based Arguments for Mealworms Eating

Activity 5.4: Explaining How Cows Grow: Biosynthesis (40 min)

- (From previous lesson) 3.3 Evidence-Based Arguments for Mealworms Eating

Activity 6.1: Explaining Other Examples of Animals Growing, Moving, and Functioning (50 min)

- (From previous lesson) 1.2 Expressing Ideas and Questions Tool for Animals Growing
- (From previous lesson) 3.2 Mealworms Eating Class Results 11 x 17 Poster (or Spreadsheet)
- (From previous lesson) 3.3 Evidence-Based Arguments Tool for Mealworms Eating

Activity 6.2: Functions of All Animals (50 min)

- computers (1 per pair of students, for option 2 in step 6)
- blank posters (1 per pair of students or small group, for option 3 in step 6)

Activity 6.4: Animals Unit Posttest (20 min)

- pencils (1 per student, for paper version)
- computers with an Internet connection (1 per student, for online version)

Materials Available on the Website:

Activity 1.1: Animals Unit Pretest (20 min)

- Animals Unit Pretest (1 per student or online)
- Assessing the Animals Unit Pretest

Activity 1.2: Expressing Ideas and Questions about How Animals Grow (40 min)

- 1.2 Expressing Ideas and Questions about How Animals Grow PPT
- 1.2 Expressing Ideas and Questions Tool for Animals Growing (1 per student)
- 1.2 Assessing the Expressing Ideas and Questions Tool for Animals Growing
- 1.2 Animals Storyline Reading: Learning from the Work of Hans Krebs (1 per student)

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

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

Activity 2.2: Questions about Animals (30 min)

- 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)

Activity 2.3: Questions about Animals (30 min)

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

Activity 2.4: Questions about Animals (30 min)

- 2.4 Mealworms Factsheet Reading (1 per student or pair of students)
- 2.4 Questions about Animals PPT

Activity 3.1: Predictions and Planning about Mealworms Eating (35 min)

- 3.1 Predictions and Planning about Mealworms Eating PPT
- 3.1 Predictions and Planning Tool for Mealworms Eating (1 per student)
- 3.1 Assessing the Predictions and Planning Tool for Mealworms Eating (1 per class)
- Mealworms Eating Video

Activity 3.2: Observing Mealworms Eating (60 min over 2 days)

- 3.2 Observing Mealworms Eating Worksheet (1 per student)
- 3.2 Grading the Observing Mealworms Eating Worksheet
- 3.2 Observing Mealworms Eating PPT
- 3.2 Mealworms Investigation Class Results 11 x 17 Poster (1 per class)
- 3.2 Mealworms Investigation Class Results Spreadsheet (1 per class)
- Mealworms Eating Video

Activity 3.3: Evidence-Based Arguments for Mealworms Eating (20 min)

- 3.3 Evidence-Based Arguments Tool for Mealworms Eating (1 per student)
- 3.3 Assessing the Evidence-Based Arguments Tool for Mealworms Eating
- 3.3 Evidence-Based Arguments Tool for Mealworms Eating PPT

Activity 4.1: Molecular Models for Cows Moving and Functioning: Cellular Respiration (45 min)

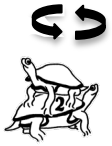
- 4.1 Molecular Models for Cellular Respiration Worksheet (1 per student)
- 4.1 Grading the Molecular Models for Cellular Respiration Worksheet
- 4.1 Molecular Models for Cow Cellular Respiration PPT

Activity 4.2: Explaining How Cows Move and Function: Cellular Respiration (40 min)

- 4.2 Explanations Tool for Cow Cellular Respiration (1 per student)
- 4.2 Explaining How Cows Move and Function: Cellular Respiration PPT
- 4.2 Grading the Explanations Tool for Cow Cellular Respiration
- 4.2 How do Animals Get the Energy They Need to Move? Reading (1 per student)
- (Optional) Example Animal Explanations Handout (1 per student or per group)

Activity 5.1: Tracing the Processes of Cows Growing: Digestion and Biosynthesis (40 min)

- 5.1 Tracing the Processes of Cows Growing: Digestion and Biosynthesis PPT
- 5.1 Tracing the Process for Cow Growing: Digestion and Biosynthesis Directions (1 per student or pair of students)
- 5.1 Tracing Atoms and Energy in Animals Worksheet (1 per student)
- 5.1 Grading the Tracing Atoms and Energy in Animals Worksheet



Activity 5.2: Molecular Models for Cows Growing: Digestion and Biosynthesis (40 min)

- 5.2 Molecular Models for Cows Growing: Digestion and Biosynthesis PPT
- 5.2 Polymers for Cutting Handout (1 copy for every four students)
- 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)

Activity 5.3: Explaining How Cows Grow: Digestion (40 min)

- 5.3 Explaining How Cows Grow: Digestion PPT
- 5.3 Explanations Tool for Cow Digestion (1 per student)
- 5.3 Grading the Explanations Tool for Cow Digestion
- (Optional) 5.3 How do Digest Food? Reading (1 per student)
- (Optional) Example Animal Explanations Handout (1 per student or per group)

Activity 5.4: Explaining How Cows Grow: Biosynthesis (40 min)

- 5.4 Explaining How Cows Grow: Biosynthesis PPT
- 5.4 Explanations Tool for Cow Biosynthesis (1 per student)
- 5.4 Grading the Explanations Tools for Cow Biosynthesis
- (Optional) 5.4 How do Animals Grow? Reading (1 per student)
- (Optional) Example Animal Explanations Handout (1 per student or per group)

Activity 6.1: Explaining Other Examples of Animals Growing, Moving, and Functioning (50 min)

- 6.1 Explaining Other Examples of Animals Growing and Moving PPT
- 6.1 Other Animals Reading: Dolphins
- 6.1 Other Animals Reading: Mealworms
- 6.1 Other Animals Reading: Salmon
- 6.1 Dolphins Worksheet
- 6.1 Mealworms Worksheet

- 6.1 Salmon Worksheet
- 6.1 Grading Dolphins Worksheet
- 6.1 Grading Mealworms Worksheet
- 6.1 Grading Salmon Worksheet

Activity 6.2: Comparing Animals and Flames (50 min)

- 6.2 Comparing Animals and Flames PPT
- 6.2 Comparing Animals and Flames Worksheet (1 per student)
- 6.2 Grading the Comparing Animals and Flames Worksheet

Activity 6.3: Functions of All Animals (50 min)

- 6.3 Functions of All Animals PPT
- 6.3 Functions of All Animals Worksheet (1 per student for option 1 in step 3)
- 6.3 Grading the Functions of All Animals Worksheet

Activity 6.4: Animals Unit Posttest (20 min)

- Grading the Animals Unit Posttest
- Animals Unit Posttest (online or paper version)