

## Science- Grade 5

### Unit 1

### Title: Matter

#### Unit Overview

In this unit, students investigate the nature of matter. They are introduced to the phenomenon of water “disappearing” from an uncovered fishbowl over time and work to explain this Anchor Phenomenon by considering another real-world example: holding a hot cup of chocolate. Students begin to describe the properties of matter using words and measurements. Then, students investigate changes when adding or removing thermal energy to water, by describing physical changes in matter as a result of heating, cooling, and mixing. Students observe and analyze models to develop their own model of matter based on the idea that matter is made up of particles too small to be seen. Using their models, students conduct an investigation to study the loss of water from a fishbowl over time. Students will learn that matter can change physically— through mixing, changing temperature, and changing state—as well as chemically—forming new substances, and that matter is composed of very small particles that behave differently in a solid, a liquid, or a gas.

#### PA Academic Standards Science:

- 3.2.5.A1 Describe how water can be changed from one state to another by adding or taking away heat.
- 3.2.5.B2 Examine how energy can be transferred from one form to another.
- 3.2.5.B3 Demonstrate how heat energy is usually a byproduct of an energy transformation.

#### NGSS Disciplinary Core Ideas:

- PS1.A Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects. The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. Measurements of a variety of properties can be used to identify materials.
- PS1.B When two or more different substances are mixed, a new substance with different properties may be formed. No matter what reaction or change in properties occurs, the total weight of the substances does not change.

#### Core Standards Literacy

- RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

#### Content:

- Describing Matter in Words and Numbers
  - States of matter
  - Describing matter

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- Properties of matter
- Uses of matter
- Changes in Matter
  - Mixing two or more substances.
  - Causes of changes in the physical and chemical properties of matter.
  - Changing form.
  - The effect of heat on the state of matter.
- Models of Matter
  - Solid, Liquid, Gas
  - Particle size
  - Modeling particle motion

### Skills:

- Develop a model to describe that matter is made of particles too small to be seen.
- Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
- Make observations and measurements to identify materials based on their properties.
- Conduct an investigation to determine whether the mixing of two or more substances results in new substances
- Describe the observable physical properties of matter and how matter can undergo chemical and physical changes.
- Use evidence from scientific text and observations to support the explanation that small scale particles make up matter.

### Inquiry Questions: *(include factual, conceptual, debatable)*

- **Factual:**  
How is matter described, measured, and classified? In what ways does matter change? How can we tell different materials apart? How do materials change when they dissolve, evaporate, melt, mix together, or are heated? How can we model the differences between solids, liquids, and gasses?
- **Conceptual:**  
What happens to the mass of a substance when it is heated, cooled, or mixed with other substances? What is happening to the atoms when a substance changes phases? What effect does temperature have on the behavior of the particles that make up matter? How can we use models to better understand matter and the effects of temperature change?
- **Debatable:**  
To what extent does the mass of a substance change when it undergoes a change of state?

### Resources:

“Unit 1: What is Matter Made of?” *Discovery Education Grade 5 Science Techbook*, Discovery Education, <https://app.discoveryeducation.com/learn/techbook/units/c47c712e-56a0-4a5f-bbb4-267225fcf077>.

“Chemical Magic” *Mystery Science*, Mystery.org, <https://mysteryscience.com/chemistry/>.

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### Unit 2

### Title: Matter Energy & Flow

#### Unit Overview

In this unit, students use what they know about the needs of living things to build a model of an ecosystem. To develop this model, students begin by investigating the plant producers at the bottom of the food chain. Students accumulate evidence to support an argument that plants get materials they need for growth from air and water. Then, students explore food chains and food webs to build a model that describes the movement of these materials among plants, animals, decomposers, and the environment. Students will use this knowledge to design and construct a model ecosystem that represents this flow of matter and energy. Students will realize that to use these materials, animals extract energy from food, and this energy is the same energy that plants obtain from the sun.

#### PA Academic Standards Science:

- 3.1.5.A2 Describe how life on earth depends on energy from the sun.
- 3.1.5.A3 Compare and contrast the similarities and differences in life cycles of different organisms.
- 3.1.5.A5 Explain the concept of a cell as the basic unit of life. Compare and contrast plant and animal cells.
- 3.1.5.B1 Differentiate between inherited and acquired characteristics of plants and animals.
- 3.1.5.C1 Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment.
- 3.1.5.C2 Give examples of how inherited characteristics (e.g., shape of beak, length of neck, location of eyes, shape of teeth) may change over time as adaptations to changes in the environment that enable organisms to survive.
- 3.4.5.E2 Understand that there are many different tools necessary to maintain an ecosystem, whether natural or man-made.

#### NGSS Disciplinary Core Ideas:

- LS1.C: Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.
- LS2.A: Plants depend on water and light to grow. Plants depend on animals for pollination or to move their seeds around.
- LS2.B: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

#### Core Standards Literacy

- SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
- W.5.6 Adapt speech to a variety of contexts and tasks, using formal English when appropriate to task and situation

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### Content:

- Plant Needs
  - Energy sources
  - Plants get most of the materials they need to grow from air and water.
  - How matter moves through plants
- Matter Flow in Ecosystems
  - Conservation of matter
  - Feeding relationships within an ecosystem
  - How decomposers help move matter
- Energy Flow in Ecosystems
  - Energy from the sun
  - Forms of energy
  - Energy flow
  - Food webs

### Skills:

- Support an argument that plants get the materials they need for growth chiefly from air and water.
- Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

### Inquiry Questions: *(include factual, conceptual, debatable)*

- **Factual:**  
What matter do plants need to grow? What do the stem and roots do? How do plants grow? What happens to the energy that plants capture from the sun?
- **Conceptual:**  
How does matter move within an ecosystem? How does energy move within an ecosystem? How do plants use water, air, and light to fulfill their basic needs? Why do animals eat plants and other animals?
- **Debatable:**  
Can living things survive without sunlight?

### Resources:

"Unit 2: From Matter to Organisms" *Discovery Education Grade 5 Science Techbook*, Discovery Education, <https://app.discoveryeducation.com/learn/techbook/units/88bbebda-09e0-448b-ad5c-532f192e23b2>

"Web of Life" *Mystery Science*, Mystery.org, <https://mysteryscience.com/ecosystems/>.

## Unit 3

## Title: Interacting Earth's Systems

### Unit Overview

In this unit, students are presented with the problem of Earth's shrinking freshwater supply. In particular, students address the issue of recycling wastewater by distinguishing the recycling of gray water versus black

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water. To design a solution to this problem, students begin their research by developing models of how the geosphere, the biosphere, the hydrosphere, and the atmosphere interact. Next, students focus on the hydrosphere by describing the distribution of water on Earth in various reservoirs. Having discovered that the amount of water stored in surface freshwater reservoirs is extremely limited, students then obtain and combine information about how communities can use science to protect freshwater resources. Finally, students apply their strategies to a watershed in Michigan. Using data collected from the ecosystem, students design solutions for reducing pollution in this freshwater ecosystem. Throughout this unit, students will learn about the importance of water and how ecosystems are systems of organisms that rely on water and interact with their environment.

### **PA Academic Standards Science:**

- 3.2.5.A1 Describe how water can be changed from one state to another by adding or taking away heat.
- 3.3.5.A2 Describe the usefulness of Earth's physical resources as raw materials for the human made world.
- 3.3.5.A3 Explain how geological processes observed today such as erosion, movement of lithospheric plates, and changes in the composition of the atmosphere are similar to those in the past.
- 3.3.5.A4 Explain the basic components of the water cycle.
- 3.3.5.A5 Differentiate between weather and climate. Explain how the cycling of water, both in and out of the atmosphere, has an effect on climate.
- 3.4.5.A3 Describe how technologies are often combined.
- 3.4.5.B1 Explain how the use of technology can have unintended consequences.
- 3.4.5.B2 Describe how waste may be appropriately recycled or disposed of to prevent unnecessary harm to the environment.

### **NGSS Disciplinary Core Ideas:**

- ESS2.A: Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
- ESS3.C: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

### **Core Standards Literacy**

- SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

### **Content:**

- Hydrosphere and Biosphere Interactions
  - Water's impact
  - Importance of Water for Life on Earth

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- Earth's systems: geosphere, hydrosphere, atmosphere, biosphere
  - Aquatic ecosystems
- Water as a Valuable Natural Resource
  - Water on Earth
  - Distribution of water and water systems
  - Importance of conserving freshwater resources
  - Water conservation
- Protecting Earth's Resources
  - Different types of natural resources
  - Renewable and non-renewable resources
  - Recycling and resource conservation
  - Importance of protecting resources

### Skills:

- Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
- Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost and engineer a solution for problems related to water pollution.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

### Inquiry Questions: (*include factual, conceptual, debatable*)

- **Factual:**  
What are the geosphere, biosphere, hydrosphere, and atmosphere? How does Earth's biosphere interact with Earth's hydrosphere? Where does wastewater come from? What Earth processes cycle water throughout the atmosphere? How does the amount of water vary in different parts of Earth's surface?
- **Conceptual:**  
How does conserving natural resources protect the environment? Why is it important to recycle wastewater? What solutions are there to limit production of wastewater? What can we do to protect Earth's resources? What patterns can we use to describe where water is located on Earth? If water is everywhere, why do we need to recycle and conserve it? How do communities use scientific ideas to protect Earth's resources and environment?
- **Debatable:**  
To what extent is water the most important natural resource and what can be done to ensure access to clean water?

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### Resources:

“Unit 3: Interacting Earth Systems.” *Discovery Education Grade 5 Science Techbook*, Discovery Education, <https://app.discoveryeducation.com/learn/techbook/units/ce307db6-89fe-4691-bf1c-9de9e3db923f>

“Watery Planet” *Mystery Science*, Mystery.org, <https://mysteryscience.com/earth/>.

## Unit 4

## Title: Patterns Above

### Unit Overview

In this unit, students observe and explain celestial patterns. They begin their investigation by observing that students standing in the sun cast shadows on the ground. To explain this phenomenon, students begin by examining the effects of gravity and obtaining evidence to support an argument that the gravitational force exerted by Earth on objects is directed downward. Students then realize that other celestial objects also exert gravity, and the movement of objects due to gravity is responsible for many observable patterns, including the length and direction of shadows, day and night, and the movement of stars in the sky. Next, students realize that other factors, such as the relative distance of stars from Earth, can contribute to the apparent brightness of the sun compared to other stars. Finally, students consider the brightness of the sun and shadows of objects to construct a human sundial. Students will learn the effects of gravity on patterns in the sky such as the sun, moon, stars, and planets.

### PA Academic Standards Science:

- 3.3.5.B1 Provide evidence that the earth revolves around (orbits) the sun in a year’s time and that the earth rotates on its axis once approximately every 24 hours.
- 3.4.5.A1 Explain how people use tools and techniques to help them do things.
- 3.4.5.A2 Understand that a subsystem is a system that operates as part of a larger system

### NGSS Disciplinary Core Ideas:

- PS2.B: Types of Interactions: The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.
- ESS1.A The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.
- ESS1.B The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

### Core Standards Literacy

- RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

### Content:

- Effects of Gravity
  - Types of forces
  - Effect on movement of objects
  - Examples of gravity

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- Gravity and orbital revolution
- Patterns of Motion in the Sky
  - Earth's rotation
  - Movement of Earth in space causes cyclical patterns (night and day, seasons, sunrise times).
  - Changes in length and direction of shadows
- Sun and Star Brightness
  - Characteristics of stars
  - Our star the Sun
  - Technology used to observe stars

### Skills:

- Support an argument that the gravitational force exerted by Earth on objects is directed down.
- Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
- Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

### Inquiry Questions: *(include factual, conceptual, debatable)*

- **Factual:**  
What types of forces are there? How does gravity affect things on or near Earth? How would the sun appear to us if it moved farther away from Earth? How does Earth's rotation cause day and night? How does gravity affect Earth? How can we determine the distance of stars?
- **Conceptual:**  
What are some examples of gravity at work? Why does the brightness of the stars, including our sun, appear to be different? How does Earth's rotation affect what objects we can view in space? What clues can we use to explain Earth's rotation? Why are different Constellations visible at different seasons of the year? What cycles and patterns are there in the movement of the sun and stars?
- **Debatable:**  
Would the solar system as a whole exist without the presence of gravity?

### Resources:

"Unit 4: Patterns in the Night Sky." *Discovery Education Grade 5 Science Techbook*, Discovery Education, <https://app.discoveryeducation.com/learn/techbook/units/1e4897c1-7d41-4e42-a01a-f1bf1a49a9cd>.

"Spaceship Earth." *Mystery Science*, Mystery.org, <https://mysteryscience.com/astronomy/>.