NYC Department of Education

GRADE 4

Supplemental Guiding Document: Curriculum Gaps

Acknowledgments

Amy M. Basile
Executive Director, STEM

Greg Borman
Director of Science

Nadya Awadallah
Citywide Instructional Lead, Elementary Science

Elementary Science Leadership Team

Lisa Barales, Richard Bebenroth, Benjy Blatman, Constance Clark, Sara Gottlieb, Jean Hourihane, Erick Kruse, Emmy Matias-Leonard, Lydia Pierides, Debra Prout, Shakira Provasoli, Joaquin Rodriguez, Jeanne Salchli, JoEllen Schuleman, Sharon Seitz, Travis Sloane, Marie E. Suchan, Karen Urruttia-Orme, Rose Valerio, Lesia Wilder, Graham White

52 Chambers Street, New York, NY 10007

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OVERVIEW

This document is designed to provide guidance for New York City grade 4 teachers and science specialists as the New York City Department of Education moves from the New York City K-5 Science Scope and Sequence 2015-2016 (based on the New York State Elementary/Intermediate Core Curriculum) to the New York City Pre-K-8 Science Scope and Sequence 2018 (based on the New York State P-12 Science Learning Standards) in the 2018-2019 school year.

While transitioning from the New York City K-5 Science Scope and Sequence 2015-2016 to the New York City PK-8 Science Scope and Sequence 2018, grade 4 students will continue to take the New York State Grade 4 Elementary-Level Science Test based upon the New York City K-5 Science Scope and Sequence, 2015-2016. This module bridges the gap between what grade 4 students need to know according to the former New York City K-5 Science Scope and Sequence 2015-2016 and the New York City PK-8 Science Scope and Sequence 2018.

The suggested pacing schedule included in this module is proposed to help grade 4 classroom teachers and science specialists implement the Supplemental Grade 4 Guiding Document: Curriculum Gaps.

The module is broken down into four chapters, with the first three chapters based on earth, life and physical science disciplines. The fourth chapter focuses on the New York State Grade Four Performance Test, the hands-on part of the New York State Grade 4 Elementary-Level Science Test. Each chapter includes one to three lessons that follow the 5E instructional model of Engage, Explore, Explain, Elaborate, and Evaluate. Some lessons are longer than others and therefore may be divided into one to three sessions.

Each session is 45 minutes.

SUGGESTED PACING SCHEDULE 2018-2019

CURRICULUM	PACING	LENGTH
Amplify Unit 1: Energy Conversions ○ Addendum to Amplify: Using a battery as a power source. In Lesson 1.5 or 3.1 add a battery as an additional power source during the lesson.	Sept.- Nov.	10-12 weeks
Amplify Unit 2: Vision and Light	Dec-Feb	10-12 weeks
4th Grade Curriculum Supplemental Unit (taught in preparation for the New York State Grade 4 Science Exam) Review of New York State Science Learning Standards from the New York State K-5 Science Scope and Sequence 2015-2016 • Chapter 1 Earth Science ○ Lesson 1 Properties of Water and the Water Cycle (4 sessions) • Chapter 2 Life Science ○ Lesson 1 Plant Structure and Function (1 session) ○ Lesson 2 Physical and Behavioral Adaptations for Animal Survival (3 sessions) ○ Lesson 3 The Role of Plants and Animals in Their Environment (3 sessions) • Chapter 3 Physical Science ○ Lesson 1 Properties of Magnetism (2 sessions) ○ Lesson 2 Magnetic Force (1 session) ○ Lesson 3 Electrical Current and Flow (2 sessions) ● See addendum to Amplify Unit 1 ○ Lesson 4 Insulators and Conductors (1 session) • Chapter 4 Science Performance Test ○ Lesson 1 Measurement- Linear (2 sessions) ○ Lesson 2 Magnetism and Electricity (1 session) ○ Lesson 3 Forces and Motion (Ball and Ramp) (1 session)	March-May	10-12 weeks
Amplify Unit 3: Earth's Features	May- June	5 weeks
Amplify Unit 4: Waves, Energy and Information* **		Optional

***Most schools will not have adequate time to complete Amplify Unit 4: Waves, Energy and Information. If your school has time, begin teaching Amplify Unit 4: Waves, Energy and Information.

CHAPTER 1 EARTH SCIENCE

Lesson 1: Properties of Water and the Water Cycle

CHAPTER 2 LIFE SCIENCE

Lesson 1: Plant Structure and Function
Lesson 2: Physical and Behavioral Adaptations for Animal Survival
Lesson 3: The Role of Plants and Animals in their Environments

CHAPTER 3 PHYSICAL SCIENCE

Lesson 1: Properties of Magnetism
Lesson 2: Magnetic Force
Lesson 3: Electrical Current and Flow
Lesson 4: Insulators and Conductors

CHAPTER 4 SCIENCE PERFORMANCE TEST

Lesson 1: Measurement
Lesson 2: Magnetism and Electricity
Lesson 3: Forces and Motion

CHAPTER 1 EARTH SCIENCE

Lesson 1: Properties of Water and the Water Cycle

Topic: Properties of Water and the Water Cycle
Date:
Subject/Grade level: Science/Grade 4
Materials: ● water cycle diagram with word bank ● science notebook ● Terrarium Observation Chart (included), one per student ● materials for terrarium (one set per three students): ○ water ○ 100 mL beaker or graduated cylinder (to measure volume) ○ transparent, lidded, wide-mouth containers for terrariums (the large plastic containers from pretzels/cookies/candy work well as will any deep container that you can fit your hand in.) ○ any material to separate the soil from the pebble layer (Fine mesh such as window screening, coffee filters, landscape fabric or cheese cloth allows water to flow but does not allow soil to fall through to the pebbles below.) ○ soil ○ pebbles ○ small indoor plants ● materials for teacher demonstration ○ bowl ○ plastic wrap ○ ice ● Water Cycle Entry Rubric Anchor Charts: ● Water Cycle Anchor Chart (teacher created) Media Resources: ● The Great Aqua Adventure Crash Course Kids Video (Video) https://drive.google.com/file/d/1G54YD6TwB-bngp5xYAJxMcuXyo7fzIph/view ● Water Cycle Powerpoint (PowerPoint) ● "Garden In A Bottle" (one per student) article adapted from https://www.boredpanda.com/sealed-bottle-garden-david-latimer/ (Reading)

Optional Resources:

- Water Cycle Response Sheet

Key Vocabulary:

- accumulation
- condensation
- evaporation
- groundwater
- precipitation
- runoff HYPERLINK "https://www.boredpanda.com/sealed-bottle-garden-david-latimer/"

NYSED Standards:

Standard 4 The Living Environment Key Idea 6
6.2c Heat energy from the Sun powers the water cycle

Standard 4 Physical Science Key Idea 2
2.1c Water is recycled by natural processes on Earth. (2.1c)

- evaporation: changing of water (liquid) into water vapor (gas)
- condensation: changing of water vapor (gas) into water (liquid)
- precipitation: rain, sleet, snow, hail
- runoff: water flowing on Earth's surface
- groundwater: water that moves downward into the ground
- accumulation: the quantity of something that has gradually gathered or been acquired

Science and Engineering Practices	Crosscutting Concepts
● Constructing explanations ● Developing and using models	● Systems and system models ● Energy and matter: Flows, cycles, and conservation ● Stability and change

Lesson Objective(s):

Students demonstrate how water is recycled as a natural process on Earth.

- I can demonstrate how water is recycled as a natural process on Earth.

Differentiation strategies to meet the needs of diverse learners:

- English Language Learners (ELL) students:
  - Utilize KWL Water Cycle Anchor Chart.
  - Organize students in mixed ability groups.
  - Use the teacher modified diagram of the water cycle (to be colored and labeled with the support of a provided word bank).

- Students that need more support:
  - Use the teacher modified diagram of the water cycle (to be colored and labeled with the support of a provided word bank).
  - Review PowerPoint to reinforce concepts.

- Students that need more challenge:
  - Design a controlled experiment relating to the terrarium.
  - Create a short story depicting how a drop of water might travel through the terrarium.

ENGAGE (session 1 - 45 minutes)

Teacher poses the question for a Think-Pair-Share: Is water always visible?
Students share responses. (5 minutes)

In a teacher led discussion, the class activates prior knowledge of the states of matter. (5 minutes)

Students observe a teacher demonstration (students observe the movement of water as it changes states): (10 minutes)

- Pour hot water into bowl.
- Cover the bowl with plastic wrap.
- Place ice on plastic wrap.
- Students discuss this model.

Note: As an alternative, this activity could be conducted at table groups.

Teacher poses the question: How does water travel on Earth? (Investigative Question)
Students create a "KWL Water Travels" chart in their notebooks and add information to it through a class discussion around the question. (10 minutes)

Students then watch prior a water cycle video. The Great Aqua Adventure Crash Course Kids Video (5 minutes)

- The Great Aqua Adventure Crash Course Kids Video (Video)

While showing the video, teacher pauses to promote discussion and encourage student note taking around the key vocabulary words (evaporation, condensation, precipitation, runoff, accumulation, groundwater) to conceptualize the processes of the Water Cycle. Teacher explicitly highlights the key vocabulary words and charts terms as definitions are constructed.

Present PowerPoint on Water Cycle (optional) "Grade 4 Water Cycle"

Students respond to the following in their science notebook (Exit Ticket): (5 minutes)

- Describe the three states of matter for water.
- What is the source of energy that powers the water cycle?

EXPLORE (session 2 - 45 minutes; session 3 - 45 minutes)

Session 2
Students draw a fully labeled diagram of the water cycle, which includes the use of arrows to show the sequence. This diagram also helps identify each process within the water cycle system. (15 minutes)

Students participate in a shared reading of a news article about the oldest known terrarium, adapted from https://www.boredpanda.com/sealed-bottle-garden-david-latimer/ (10 minutes)

Students discuss and answer (in their science notebooks) the following questions: (10 minutes)

- What might condensation and precipitation look like in the terrarium?
- How is Mr. Latimer's terrarium a model of Earth's water cycle?
- How do we know the water in the terrarium has been recycled?
- What water cycle processes are occurring inside Mr. Latimer's jar that allow the plants to grow and thrive?

Teacher elicits a discussion of the materials needed to create a terrarium like the one Mr. Latimer has.

Class develops a materials list.

Exit Ticket - Students answer the following prompt/question:

Compare the terrarium with the water cycle model you saw in class. How does water travel? (10 minutes)

Session 3
Students work in small groups to build a terrarium: (45 minutes)

1. Select a large plastic container for the terrarium.
2. Place gravel (about one inch) on the bottom of the container.
3. Cut a piece of soil separator material and place it on top of the gravel.
4. Add enough soil to create a two or three inch layer in the container (Be sure to leave enough space above for the plants to grow.)
5. Dig holes to plant the plants in the terrarium.
6. Add 60 mL of water to the terrarium and cover. (Note: amount of water may vary depending on the size of the container.)
7. Place terrarium in a sunny spot in the classroom.

*** Save and maintain the terrarium as a means for reviewing plant structure and function later in the year.

EXPLAIN (5 minutes of the next four sessions)

Students observe their terrariums over the next four sessions. Students draw diagrams of the terrarium and describe it using the water cycle science vocabulary words on the Terrarium Observation Chart (included with this lesson plan).

Note: Students may record observations on any day, but all four should be accomplished within two weeks.

ELABORATE (final session 15 minutes after the four observations are completed)

After the Terrarium Observation Chart is complete, teacher reviews the concepts of evaporation, condensation, precipitation based on the Terrarium Observation Chart. Teacher also reviews the terms accumulation, groundwater and runoff.

EVALUATE

- Students respond in science notebook (draw and write). What does the terrarium teach us about water and the water cycle? (Final session)

ASSESSMENT OPPORTUNITIES

Formative:

- Think-Pair-Share: Is water always visible? (session 1)
- KWL chart review (session 1)
- Labeled diagram of the water cycle to show sequence (session 2)
- Terrarium Observation Chart (session 3)
- Exit ticket - Students respond to: Describe the three states of matter for water. What is the source of energy that powers the water cycle? (session 1)
- Exit Ticket - Students respond to: Compare Mr. Latimer's terrarium to the model you saw in class. How does water travel? (session 2)

Summative:

- Students respond in science notebook (draw and write). What does the terrarium teach us about water and the water cycle? (final session)

Name: _____ Class: _____ Date: _____

Terrarium Observation Chart

Directions - Ask yourself these questions and record your observations: What is happening in the terrarium? (draw and write). On which part of the terrarium do you see water? Is there anything new happening in the terrarium? Any other observations (draw and write)?

OBSERVATIONS		
DATE	**ILLUSTRATION**	**DESCRIPTION**

Garden in A Bottle

“Thriving since 1960, my garden in a bottle: Seedling sealed in its own ecosystem and watered just once in 53 years”

By DAVID WILKES FOR THE DAILY MAIL (ADAPTED)
PUBLISHED: 05:45 EST, 24 January 2013 | UPDATED: 04:41 EST, 25 January 2013

David Latimer first planted his bottle garden in 1960 and last watered it in 1972 before tightly sealing it shut 'as an experiment'. The hardy spiderwort plants inside have grown to fill the entire 10-gallon container--surviving entirely on recycled air, nutrients and water.

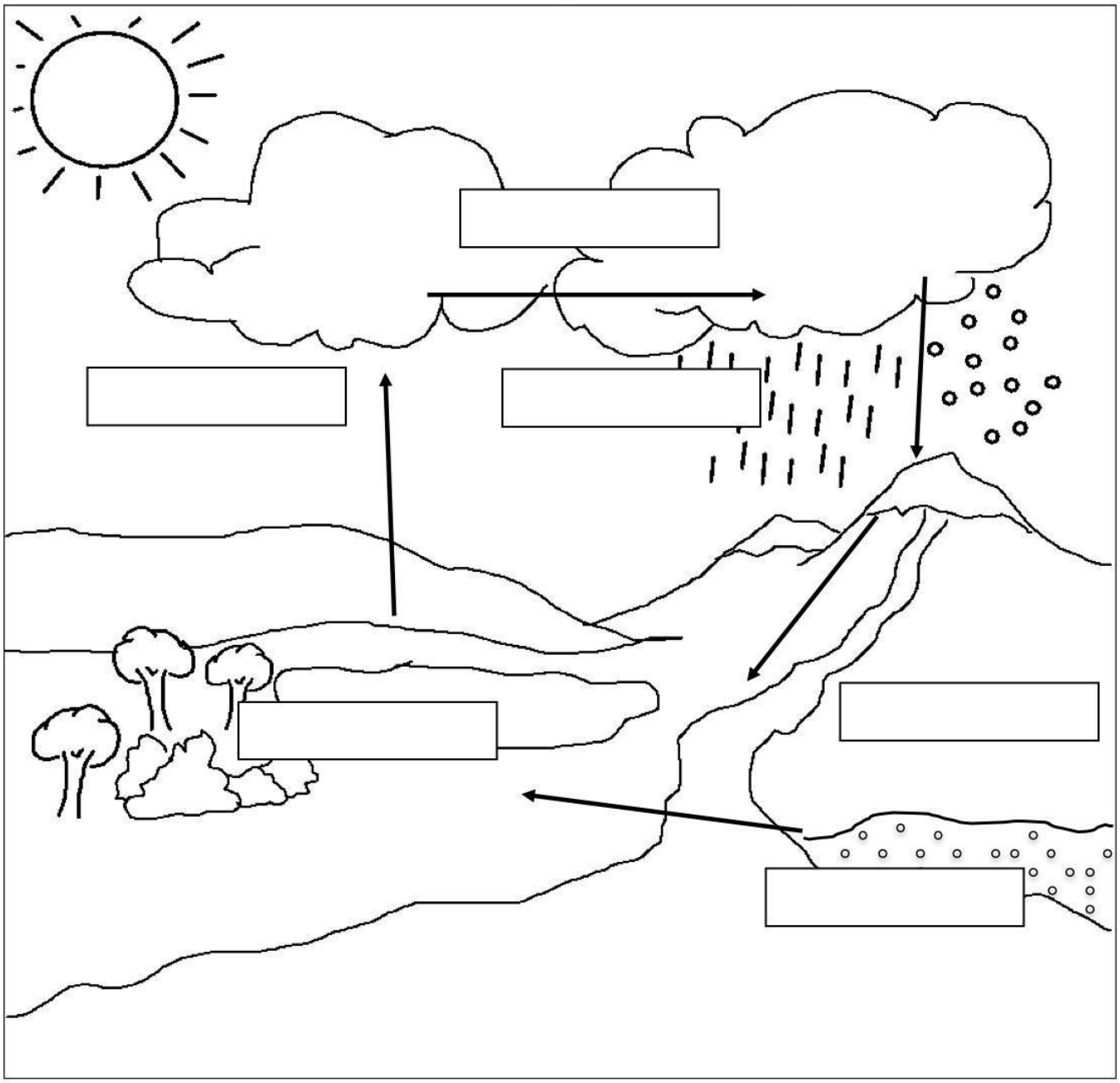
To look at this flourishing mass of plant life you’d think David Latimer was a green-fingered genius. Truth be told, however, his bottle garden – now almost in its 53rd year – hasn’t taken up much of his time. In fact, on the last occasion he watered it Ted Heath was Prime Minister and Richard Nixon was in the White House.

For the last 40 years it has been completely sealed from the outside world. But the indoor variety of spiderworts within has thrived, filling its globular bottle home with healthy foliage.

Yesterday Mr. Latimer, 80, said: “It’s six feet from a window so it gets a bit of sunlight. It grows towards the light so it gets turned around every so often so it grows evenly. Otherwise, it’s the definition of low-maintenance. I’ve never pruned it, it just seems to have grown to the limits of the bottle.”

Name_____Class_____Date_____

Directions- Use the word bank to identify the parts of the water cycle.



Word Bank

Accumulation	Condensation	Evaporation
Groundwater	Precipitation	Runoff

Name: _____ Class: _____ Date: _____

Water Cycle Science Notebook Entry Rubric

Question: What does the terrarium teach us about water and the water cycle?

I can ...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
draw a detailed diagram.	I included a detailed diagram of the terrarium that included labels for all of the following vocabulary words. ● evaporation ● condensation ● precipitation ● runoff ● accumulation ● groundwater	I included a diagram of the terrarium that included labels for most of the following vocabulary words. ● evaporation ● condensation ● precipitation ● runoff ● accumulation ● groundwater	I included a diagram of the terrarium that included labels for two of the following vocabulary words. ● evaporation ● condensation ● precipitation ● runoff ● accumulation ● groundwater	I did not include a diagram.
write an explanation of the water cycle.	My answer includes a detailed explanation of how water evaporates, condenses, precipitates, runs off, and accumulates.	My answer includes an explanation of how water evaporates, condenses, precipitates, runs off, and accumulates.	My answer partially explains how water evaporates, condenses, precipitates, runs off, and accumulates.	I did not write an explanation of the water cycle.

CHAPTER 2 LIFE SCIENCE

Lesson 1: Plant Structure and Function

Topic: Plant Structure and Function
Date:
Subject/Grade level: Science/Grade 4
Materials: ● Plant Structure and Function Matching Game Cards (one set for each group of students) ● chart paper ● scissors ● science notebooks ● Plant Structure Science Notebook Entry Rubric ● Plant Structure Poster Group Rubric Media Resources: ● Time Lapse of Sunflower from Seed to Flower: https://www.youtube.com/watch?v=Z-iPp6yn0hw (video) Optional Resources: ● glue sticks ● colored pencils ● clay ● string ● cardboard ● science trade books on plants ● terrariums from water cycle lessons Key Vocabulary: ● flower ● fruit ● function ● leaves ● root ● seed ● stem ● structure

NYSED Standards:

Standard 4 The Living Environment Key Idea 3
3.1b Each plant has different structures that serve different functions in growth, survival, and reproduction.

- roots help support the plant and take in water and nutrients
- leaves help plants utilize sunlight to make food for the plant
- stems, stalks, trunks, and other similar structures provide support for the plant
- some plants have flowers
- flowers are reproductive structures of plants that produce fruit which contains seeds

Science and Engineering Practices	Crosscutting Concepts
● Analyzing and Interpreting Data ● Obtaining, Evaluating, and Communicating Information	● Structure and Function

Lesson Objective(s):

Students identify a plant's six main structures and their functions.

- I can identify a plant's six main structures and their functions.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Strategically group students to allow for peer support.
  - Create science glossary.

- Students that need more support:
  - Strategically group students to allow for peer support.
  - Allow students to use their initial drawings and create diagrams with the structures labeled. (Any missing structures should be added by the student.)

- Students that need more challenge:
  - Create a model of a plant using common household materials (examples include: clay, string, cardboard, etc.).

ENGAGE session 1 (5 minutes)

View the short video, Time Lapse of Sunflower from Seed to Flower. Introduce the video to the students and direct students to focus on what they see happening while thinking about the question, How do plants grow from seed to flower?

Students draw the plant they observed in the video (at any stage of its development) and think about what structures in the plant allow it to grow and thrive. Partnerships discuss their drawings and name the structures of the plants they recognize. Students generate questions about what they observed in the video to be recorded on a class chart.

EXPLORE (session 1 - 10 minutes)

Teacher poses the question: How do the structures of the plant help it grow and thrive?
Teacher creates groupings of four or six students.
Teacher introduces the Plant Structure/Function Game and distributes a set of cards to each group. Teacher instructs the students to make connections between the functions of the plants to each of the six plant structures.

Note: The cards include three non-examples (these are uses for plants but not functions of plants). Be sure to review the difference between the function of these structures and the way people may use these structures. Plant structures may have multiple functions.

EXPLAIN (session 1 - 10 minutes)

After sorting is complete, students choose one function and write a statement in their science notebooks explaining how that specific structure helps the plant to grow and thrive.

Students share their new understanding of the various structures and functions. Teacher charts these responses.

For example: Students may believe that the function of a flower is to make a room smell nice or that the function of a fruit is to provide food for animals.

ELABORATE (session 1 - 15 minutes)

Teacher organizes student groups according to the specific part of the plant they selected to write about in the previous activity. Groups collaborate to make a structure and function poster. Each group then displays it for a gallery walk.

EVALUATE session 1 (5 minutes)

After the gallery walk, teacher saves and evaluates posters using the rubric provided.

Note: The teacher may choose to use the rubric to have the students self-assess or peer assess.

ASSESSMENT OPPORTUNITIES (session 1)

Formative:

- Post-video discussion: How do plants grow from seed to flower?
- Structure/function plant drawings
- Group plant structure/function game
- Science Notebook Entry: How does that specific structure help a plant to grow and thrive?

Summative:

- Poster: Specific structure and function

Plant Structure and Function Matching Game Cards

This plant part absorbs water and nutrients.	This plant part anchors the plant to the ground and offers support.	This plant part stores food and nutrients.
This plant part offers support to the leaves, flowers and fruit.	This plant part transports nutrients from the roots to the rest of the plant.	This plant part transports the energy made by photosynthesis from the leaves to the rest of the plant.
This plant part makes food for the plant in a process called photosynthesis.	This plant part is responsible for the respiration of the plant (the exchange of oxygen and carbon dioxide).	This part of the plant releases water vapor into the atmosphere.
The primary function of this part of the plant is reproduction.	This plant part helps the seeds disperse.	This plant part protects the seeds.

This plant part produces a new plant.	This plant part provides food for animals.	This plant part makes parks look pretty.
This plant part is used to make clothing.		

 Stem	 Flower	 Seeds

 Roots	 Leaves	 Fruit

Group Members: _____

Class: _____ Date: _____

Plant Structure Poster Group Rubric

Question: How does a specific structure help a plant to grow and thrive?

We can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
identify a plant structure and provide details to explain how the structure helps the plant.	We can identify one structure and provide three details that explain how the structure helps the plant grow and thrive.	We can identify one structure and provide two details that explain how the structure helps the plant grow and thrive.	We can identify one structure and provide one detail that explains how the structure helps the plant grow and thrive.	We cannot identify a structure or provide an explanation of how the structure helps the plant grow and thrive.
include accurate information from different sources.	All our information is accurate, and includes both my prior knowledge or outside resources and content directly from the lesson.	All our information is accurate and includes content directly from the lesson.	Some of our information is accurate.	Little to no information is provided.

Name: _____ Class: _____ Date: _____

Plant Structure Science Notebook Entry Rubric
Question: How does a specific structure help a plant to grow and thrive?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
identify a plant structure and provide details to explain how the structure helps the plant.	I can identify one structure and provide three details that explain how the structure helps the plant grow and thrive.	I can identify one structure and provide two details that explain how the structure helps the plant grow and thrive.	I can identify one structure and provide one detail that explains how the structure helps the plant grow and thrive.	I cannot identify a structure or provide an explanation of how the structure helps the plant grow and thrive.
include accurate information from different sources.	All my information is accurate, and includes both my prior knowledge or outside resources and content directly from the lesson.	All my information is accurate and includes content directly from the lesson.	Some of my information is accurate.	Little to no information is provided.

Lesson 2: Physical and Behavioral Adaptations for Animal Survival

Topic: Physical and Behavioral Adaptations for Animal Survival
Date:
Subject/Grade level: Science/Grade 4
Materials: ● image of an environment ● Animal Pairs Card Sets (Exploration Card Sets) ● Physical and Behavior Adaptation Card Sets (Explanation Card Sets) ● small plates (1 per student) ● trays (1 per group) ● bird foods (suggested items) ○ gummy worms ○ seeds ○ plastic bugs ○ leaves ● bird beaks (suggested items) ○ chopsticks ○ toothpicks ○ tongs ○ clothespins ● Animal Adaptation Entry Notebook Rubric ● science notebooks Media Resources: ● Study Jams: Animal Adaptations http://studyjams.scholastic.com/studyjams/jams/science/animals/animal-adaptations.htm (video) ● Science Background Information (optional): "Physics of Animal Behavior" http://www.birds.cornell.edu/education/educators/physics/elementary/beaks (article) "Adaptations: Check This Out!" http://projectbeak.org/adaptations/start.htm (website) Key Vocabulary: ● behavioral adaptation ● physical adaptation ● camouflage

- environment
- hangout
- hibernate
- inherited
- migrate
- mimicry

NYSED Standards:

Standard 4 The Living Environment Key Idea 3
3.1c In order to survive in their environment, plants and animals must be adapted to that environment.

- animal adaptations include coloration for warning or attraction, camouflage, defense mechanisms, movement, hibernation, and migration

Science and Engineering Practices	Crosscutting Concepts
● Analyzing and Interpreting Data ● Obtaining, Evaluating, and Communicating Information	● Structure and Function

Lesson Objectives(s):

Students describe what an adaptation is, identify differences between physical and behavioral adaptations, and describe how animal adaptations developed over time.

- I can describe what an adaptation is.
- I can identify differences between physical and behavioral adaptations.
- I can describe how animal adaptations developed over time.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Use Photo Cards (card set from lesson)
  - Rewatch Study Jams: Animal Adaptations (video)
  - Provide sentence Frames
  - Provide strategic partnerships
  - Create Vocabulary Cards

- Students that need more support:
  - Provide strategic partnerships
  - Reduce number of activity stations (session 2)

- Students that need more challenge:
  - Increase expectation of the number of activity stations complete. (session 2)

ENGAGE (session 1 - 10 minutes)

Teacher displays the image of an environment and tells students that environment refers to surroundings, the area around a living thing. Teacher ask students to turn to a partner and discuss what kinds of plants or animals would be well-suited or live successfully in the environment shown in the image. (Students may suggest butterflies, insects, birds, wildflowers, grasses, etc.)

Note to teacher: An environment refers to an organism's surroundings and has two components: living and nonliving. An ecosystem is a functional unit that includes both the living and nonliving components, but also how organisms interact with each other in the environment.

Students share out their thoughts. Teacher tells students that when a livng thing is well-suited to its environment, we say that it is "adapted" to its environment. It can successfully survive in a particular place.

Teacher asks students to identify the enviroment in the image (a meadow) and asks students to name other kinds of environments (oceans, deserts, forest, etc.) with which they are familiar. (Note: we are referring to these places as environments and not ecosystems because we are not discussing the interactions between organisms.)

EXPLORE (session 1 - 25 minutes)

Teacher divides students into supportive partnerships or collaborative groups. Students use the five sets of Exploration Card Sets to compare and contrast adaptations of similar animals that live in different places or environments. (Photo Card examples: sea turtle and snapping turtle; pelican and albatross; frog and toad; gecko and anole; grizzly bear and polar bear.)

After students have had time with the cards, the teacher posts the question: Are the

adaptations presented by the cards similar or different? Students record their comparisons and observations in their science notebooks.

The following sentence frames provide additional support for students:

"The _____ and the _____ have similar adaptations because they both_____."
"The _____ and the _____ have different adaptations because one has _____, and the other has _____."

EXPLAIN (session 2 - 45 minutes)
Teacher conveys the following:

- many animals develop adaptations in order to survive in different kinds of environments.
- an adaptation usually occurs slowly over time and is something that an individual organism inherits; an adaptation is not simply a response to the environment
- adaptations can be sorted into two categories: physical and behavioral.

Teacher tells students that they will now learn more about adaptations by watching a video and posts two questions: What are some examples of physical adaptations? What are some examples of behavioral adaptations?

Teacher encourages students to think about these focus questions as they watch the video: Study Jams: Animal Adaptations.

After the video, the teacher asks students to share some examples of physical and behavioral adaptations that they saw in the video. If necessary, the teacher summarizes the following key points:

- A physical adaptation is a physical feature of an organism that has changed over time. This could be a body part or a pattern on the animal's body. Patterns include camouflage (something that protects an animal from attack by making the animal difficult to see in the area around it) or mimicry (when one organism resembles another organism either for defense to gain other advantages). These physical adaptations, also called structural adaptations, are inherited and passed from one generation to the next.
- A behavioral adaptation is something an organism does to survive. Two

examples are hibernation and migration. Hibernation is when an animal spends the winter sleeping or resting to conserve energy when food is scarce. Migration is when an animal moves from one area to another and back again at different times of the year, usually to find food. These behavioral adaptations are inherited and passed from one generation to the next.

Teacher divides students into supportive partnerships or collaborative groups. Students use the Explanation Card Sets at different activity stations to further understand animal adaptations. The teacher can either have all groups work on each of the stations or allow each group to choose two out of the three stations. Students record their responses and observations for each activity in their science notebooks.

Activity Stations

Activity 1: Behavioral or Physical Adaptation?
Students sort pictures of animals by behavioral adaptation or physical adaptation. Students record responses in their notebooks to justify why each animal was placed in each category. Some examples of physical adaptations: skunks have white stripes that stand out from their black fur to serve as a warning to predators to keep their distance. They also emit an odor to defend themselves against predators. Giraffes have very long necks to reach food in tall savannah trees. Their long legs allow them to run up to 35 miles per hour to outrun danger. Some examples of behavioral adaptations: bats normally sleep during the day in shelters, like caves and empty buildings. This allows them to hide from predators while also getting their sleep. Elephants will roll in mud to fend off parasites and biting insects. When the mud dries, elephants rub themselves against a hard surface, removing most of the parasites.

The following sentence frames provide additional support for students:

"This picture shows a behavioral adaptation because _____."
"This picture shows a physical adaptation because _____."

Activity 2: Hibernating, Migrating, or Hanging out?
Students sort pictures of animals into one of three categories: hibernate, migrate, or hang out. Hang out refers to animals that stay (or hang out) in their environment; they do not hibernate or migrate to another area. Examples: bears hibernate in winter, which helps them survive when food is hard to find. Skunks hang out because they can easily

find food in their environment.

The following sentence frames provide additional support for students:

"This animal hibernates because _____."
"This animal migrates because _____.
"This animal hangs out because _____."

Activity 3: Camouflage or Mimicry?
Students sort pictures of animals into categories of camouflage or mimicry and explain why those animals fall into each category. Examples: lady bird spiders look a lot like lady birds (another name for lady bugs) and appear harmless to potential prey. Flatfish like flounders rest at the bottom of the sea and blend right in with the sand. Some moths and butterflies have large eye spots. By mimicking huge eyes, they appear much larger to predators.

The following sentence frames provide additional support for students:

"This picture shows camouflage because _____."
"This picture shows mimicry because _____."

Teacher encourages partnerships/groups to share some of their observations.

ELABORATE (session 3 - 30 minutes)

Teachers reviews previous sessions by asking students:
What is an animal adaptation?
(Anticipated student response: It is an inherited feature--either physical or behaviorial--that helps an animal to survive and reproduce in its habitat.)

Additional optional questions include:
What physical feature does a...
...monkey have to live in a tree? ...shark have to live in water? ...frog have to live on land and in water? ...snake have to live in a desert? ...bird have to live in a tree and in the air?

The teacher tells students that they will become birds for the next investigation: Which "beak" works with which type of food? The teacher explains that each group (of four,

preferably) will get a tray of food. Each student (bird) will receive a plate that serves as their "bird stomach" and a tool--either chopsticks, a toothpick, tongs, or a clothespin to serve as their "beak." Each student will work with only one of the tools to pick up one piece of food at a time and place it on their plate (stomach)." Students may not use a free hand.

Directions for the investigation:

- Teacher places a cup of seeds on the tray, and students have 30 seconds to "eat" them.
- Each student counts and records the number of seeds they "ate."
- Students discuss which of the "beaks" worked best to gather seeds, as well as what might happen if a bird did not get enough food?
- Teacher removes the seeds from the plates and follows the same procedure for each other type of food: plastic bugs, gummy worms, and leaves.

Teacher guides class discussion around the following questions:

- What did you learn about beaks?
- Which beaks were the best for which types of food?
- What does the type of food the bird eats tell you about where it may live or hunt?

Possible Writing Extension: Why are beaks so different?

Science Background Information (optional):
"Physics of Animal Behavior"
http://www.birds.cornell.edu/education/educators/physics/elementary/beaks
(article)
"Adaptations: Check This Out!" http://projectbeak.org/adaptations/start.htm
(website)

EVALUATE (session 3 - 15 minutes)

Students choose one animal and identify and describe two or more of the animal's adaptations, making sure to identify whether the adaptation is physical and/or behavioral, and how the adaptation(s) help the animal survive in its environment. Students record this in their science notebooks.

ASSESSMENT OPPORTUNITIES

Formative:

- Science notebook writing: similarities and differences in adaptations. (session 1)
- Student discussion: physical and behavioral adaptations. (session 2)
- Small group discussion during sorting activities. (session 2)
- Student notebook writing: various types of adaptations. (session 2)
- Direct teacher observation of student activity. (session 3)
- Student writing: beak effectiveness. (session 3)

Summative:

- Student notebook response: identify and describe two or more adaptations (physical and/or behavioral) that help a selected animal survive in its environment. (session 3)

Name: _____ Class: _____ Date: _____

Animal Adaptations Science Notebook Entry Rubric

Question: How do specific adaptations help an animal to survive in its environment?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
identify two or more adaptations an animal has that helps it survive.	I can correctly identify more than two adaptations.	I can correctly identify two adaptations.	I can correctly identify less than two adaptations, or the adaptations identified do not match the animal.	I did not correctly identify any adaptations, or the adaptations identified do not match the animal.
explain how an adaptation helps an animal survive in its environment.	I can correctly explain how all adaptations identified help an animal survive in an expert manner. (ex. how one adaptation can be both physical and behavioral and how one adaptation can help an animal survive in multiple ways)	I can correctly explain how the two adaptations identified help an animal survive in its environment, including whether the adaptation is physical, behavioral, or both.	I can correctly identify how one adaptation identified helps an animal survive in its environment, including whether the adaptation is physical, behavioral, or both.	I did not correctly explain how any adaptations identified help an animal survive in its environment.

Environment Image (meadow)

Exploration Card Sets

Are the adaptations similar or different?

sea turtle

Explore Card Set

Are the adaptations similar or different?

Snapping turtle

Explore Card Set

Are the adaptations similar or different?

pelican

Explore Card Set

Are the adaptations similar or different?

albatross

Explore Card Set

Are the adaptations similar or different?

frog

Explore Card Set

Are the adaptations similar or different?

toad

Explore Card Set

Are the adaptations similar or different?

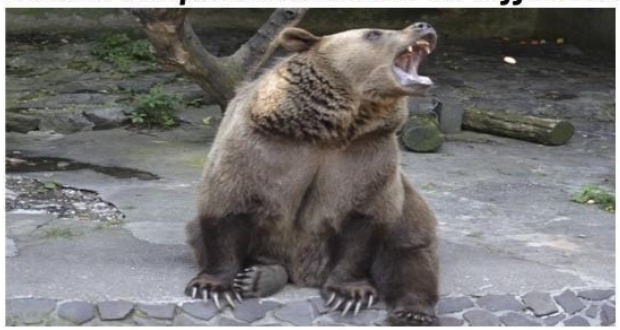
anole

Explore Card Set

Are the adaptations similar or different?

gecko

Explore Card Set

Are the adaptations similar or different?  grizzly bear **Explore Card Set**	***Are the adaptations similar or different?***  polar bear **Explore Card Set**

Explanation Card Sets

Behavioral or Physical Adaptation?

elephant

Explanation Card Set 1

Behavioral or Physical Adaptation?

giraffe

Explanation Card Set 1

Hibernating, Migrating, or Hanging out?

bear

Explanation Card Set 2

Hibernating, Migrating, or Hanging out?

skunk

Explanation Card Set 2

Behavioral or Physical Adaptation?

deer

Explanation Card Set 1

Behavioral or Physical Adaptation?

squirrel

Explanation Card Set 1

Camouflage or Mimicry?

butterfly

Explanation Card Set 3

Camouflage or Mimicry?

Lady bird spider

Explanation Card Set 3

Camouflage or Mimicry?

owl

Explanation Card Set 3

Camouflage or Mimicry?

moth

Explanation Card Set 3

Camouflage or Mimicry?

caterpillar

Explanation Card Set 3

Camouflage or Mimicry?

flatfish

Explanation Card Set 3

Lesson 3: The Role of Plants and Animals in their Environments

Topic: The Role of Plants and Animals in their Environments
Date:
Subject/Grade level: Science/Grade 4
Materials: ● red, brown, green, and yellow paper - 4 pieces (one set per class) ● energy ball student labels ● Food Chain/Web Organism Cards (one set per group) ● Organism Information Cards (one set per group) ● Student Food Chain Recording Sheets (one per student) ● Food Web Template (teacher answer key, teacher with organisms, blank) ● Food Web Instruction Card (one per group) ● Food Chains and Webs Analysis (one per student) ● Food Chains and Webs Analysis Exemplar (one per table) ● large construction paper or poster ● colored pencils or crayons ● glue sticks ● Food Chains and Webs Summative Assessment Rubric (one per student) ● science notebooks Anchor chart: ● Producers, Consumers, and Decomposers (class created) ● Herbivores, Carnivores, and Omnivores (class created) Media Resources: ● Fabulous Food Chains: Crash Course Kids #7.1 https://www.youtube.com/watch?v=MuKs9o1s8h8 (video) ● Optional: Sheppard Software Producers/Consumers Game http://www.sheppardsoftware.com/content/animals/kidscorner/games/producersconsumersgame.htm (game) ● Study Jams: Food Webs http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/food-webs.htm (video) ● Sheppard Software Food Chains Game http://www.sheppardsoftware.com/content/animals/kidscorner/games/foodchaingame.htm (game) Optional Resources: ● vocabulary cards ● Student Food Chain Recording Sheet

- Student Food Chain Recording Sheet (modified)
- tablets or computers for students

Key Vocabulary:
- carnivore
- consumer
- decomposer
- ecosystem
- food chain
- food web
- herbivore
- omnivore
- predator
- prey
- producer

NYSED Standards:

Standard 4 The Living Environment Key Idea 6
Plants and animals depend on each other and their physical environment.

Science and Engineering Practices	Crosscutting Concepts
● Asking questions (science) and defining problems (engineering) ● Developing and using models ● Obtaining, evaluating, and communicating information	● Patterns ● Systems and system models ● Energy and matter: Flows, cycles, and conservation

Lesson Objective(s):

Students can classify organisms as producers, consumers and decomposers; identify and illustrate the flow of energy in an ecosystem; create models of producers, consumers, and decomposers and describe their role in a food chain and food web; and identify the relationship between predator and prey.

- I can classify organisms as producers, consumers and decomposers.
- I can identify and illustrate the flow of energy in an ecosystem.
- I can create models of producers, consumers, and decomposers and describe their role in a food chain and food web.
- I can identify the relationship between predator and prey.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Create strategic partnerships for sorting activity.
  - Use student science notebooks.
  - Use modified notebook pages to provide structure for students.
  - Use vocabulary cards.

- Students that need more support:
  - Create strategic partnerships for sorting activity.
  - Allow students to use Sheppard Software Food Chains Game.
  - Use optional notebook pages to provide structure for students. (attached)
  - Reduce the number of organisms in the food web activity.
  - Use modified version of optional Food Chain Planning Sheet.

- Students that need more challenge:
  - Increase the number of organisms in food chains created in session 1.
  - Allow students to add additional organisms of their choice for the Food Webs final activity

ENGAGE (session 1 - 25 minutes)

Teacher posts discussion questions on board or chart paper for students. Students answer questions in their notebooks and then turn and talk to their table partners and agree upon one answer to share with the class.

Discussion questions:

- Think back to the phenomenon related to Tokay geckos from our previous unit.
- How do we know when something is living?
- What do plants and animals need to live and thrive?

Teacher charts the seven characteristics of all living things or organisms. (Note: In order for it to be living it must adhere to all seven characteristics.)

- consume energy*
- respirate (breathe)
- excrete waste*
- grow and develop
- move
- reproduce
- respond to stimuli

*essential for the overarching concepts covered in this lesson

Teacher validates ideas and leads a discussion to complete list.

Energy Ball Activity:
Teacher prepares ahead: crumple a piece of red paper into a ball (consumer-carnivore), wrap brown paper around it so the inside ball is completely covered (consumer-omnivore), follow with green (producer), and finally, yellow paper (the sun). This energy ball models the transfer of energy through a food chain.

Directions:

- Teacher chooses four students to stand side by side in a line in front of the class and hands an energy ball to the first student. Teacher directs students to pass the ball along the line with each person removing the outermost sheet of paper. The last person should hold on to the crumpled red paper ball.
- Teacher explains that the ball represents energy. Teacher distributes labels to identify the first person as the sun, the second as sunflower seeds, the third as chipmunk and the fourth as a red tail hawk. Teacher returns the energy ball to the "sun" and has the students pass it along again as teacher explains that energy comes from the sun; the leaves of the sunflower plant use the sun's energy to make their own food; the chipmunk eats the sunflower seeds, getting energy stored in the seed as food; and the red tailed hawk eats the chipmunk, getting energy from the chipmunk. Teacher emphasizes that the living parts of this

arrangement—the plants and animals—form what is called a food chain. Food provides living things with the energy they need to live their lives.

Teacher tells students that each organism in the food chain has a role. Plants are called producers because they make or produce their own food. All of the animals in the food chain are consumers because they eat or consume other living organisms for energy.

Teacher calls on another student to represent decomposers (but doesn't yet use the word) and asks the class: What happens when anything in the food chain dies? The teacher may wish to guide students to an understanding that we are not stepping on dead things day in and day out, so something must happen to all the dead plants and animals out there. Teacher reinforces that decomposers (pointing to the new student) are organisms that get energy from breaking down dead plants and animals and animal waste. This breaking down into smaller parts returns nutrients to the environment.

As an option, the teacher may reinforce producer, consumer, and decomposer by projecting the Sheppard Software Producers/Consumers Game for the whole class to play.

As a class, create an anchor chart listing producers, consumers, and decomposers from the energy ball and video.

EXPLORE (session 1 - 20 minutes)

Student groups use their prior knowledge to sort a set of Food Chain/Web Organism Cards into three groups: producers, consumers, and decomposers. Groups create three to five simple food chains (modify for advanced students) and students record in science notebooks. Each group presents one of their food chains for the class to evaluate. (Teacher should evaluate for inaccuracies.)

Note: Students do not have access to the actual Animal Information Cards, therefore there might be small errors as to what exactly an organism eats. It is not necessary to correct those errors if they make general sense. Due to the nature of the activity, there could be some variation in answers based on student perspective. For example, garter snakes are not large enough to eat chipmunks, but a student might argue that it could eat a baby chipmunk. As an additional example, adult elephants are not often prey, however, baby elephants are.

EXPLAIN (session 2 - 45 minutes)

Teacher shows the video Fabulous Food Chains: Crash Course Kids #7.1 and reviews the following science vocabulary words: producer, consumer, decomposer, food chain.

Teacher focuses discussion around the questions: Why do we eat? What do we eat? Teacher records answers and introduces the following science vocabulary words: herbivore, carnivore, omnivore, predator, and prey.

Teacher distributes the Organism Information Cards. Students use the cards to generate their own definitions of herbivore, omnivore, and carnivore in their notebooks.

As a class, then create an anchor chart listing herbivore, carnivore, omnivore.

Students open their notebooks to the food chain page they created in the previous lesson.

Teacher uses the following question prompts to lead the students through the following activity:

- Does your food chain start with berries? If yes, stand up.
- Is the consumer eating the berries a chipmunk? If yes, remain standing; if not sit down and state which organism was eating the berries.
- Is the consumer that eats the chipmunk the hawk ? If yes, remain standing; if not sit down and state which organism ate their chipmunk.

Teacher explains that many organisms eat the same thing. Teacher reinforces the concept that a food chain only shows one flow of energy within an ecosystem, while a food web shows how food chains within an ecosystem are interconnected. Food webs really better represent the interactions among organisms.
Teacher presents the Video: Study Jams: Food Webs

Teacher models a simple food web on chart paper or as a projection. Teacher uses the Food Web Template without the arrows and adds the arrows with student input while facilitating a discussion of relationships.

ELABORATE (session 3 - 25 minutes)

Teacher distributes a large sheet of paper or poster board and colored pencils/markers to each group of students. Teacher directs students to use the food chains in their notebooks and the Organism Information Cards. Groups create a food web, using as many of the organisms from the ecosystem as possible. Teacher reminds students to draw the arrows in the direction that the energy is flowing.

Students respond in their notebooks to explain if an animal can be both predator and prey. Students supply evidence to support their claims. Teacher facilitates a class discussion.

EVALUATE (session 3 - 20 minutes)

Students use the group's food web to independently complete the Food Chain and Web Analysis Sheet. Students think critically about the roles and interactions among organisms, classify the organisms and understand how each organism obtains energy in a food chain/web.
Teacher collects all pencils and provides colored writing tool and an exemplar of the Food Chain and Web Analysis. Students self correct their work.
Note: There are no predators for the hawk and coyote in the list of organisms for this activity.

Students reflect on their learning and answer the questions:
What might happen if you removed a producer, consumer, or decomposer from your food web? How would it impact the ecosystem? Be specific in your answer.

ASSESSMENT OPPORTUNITIES

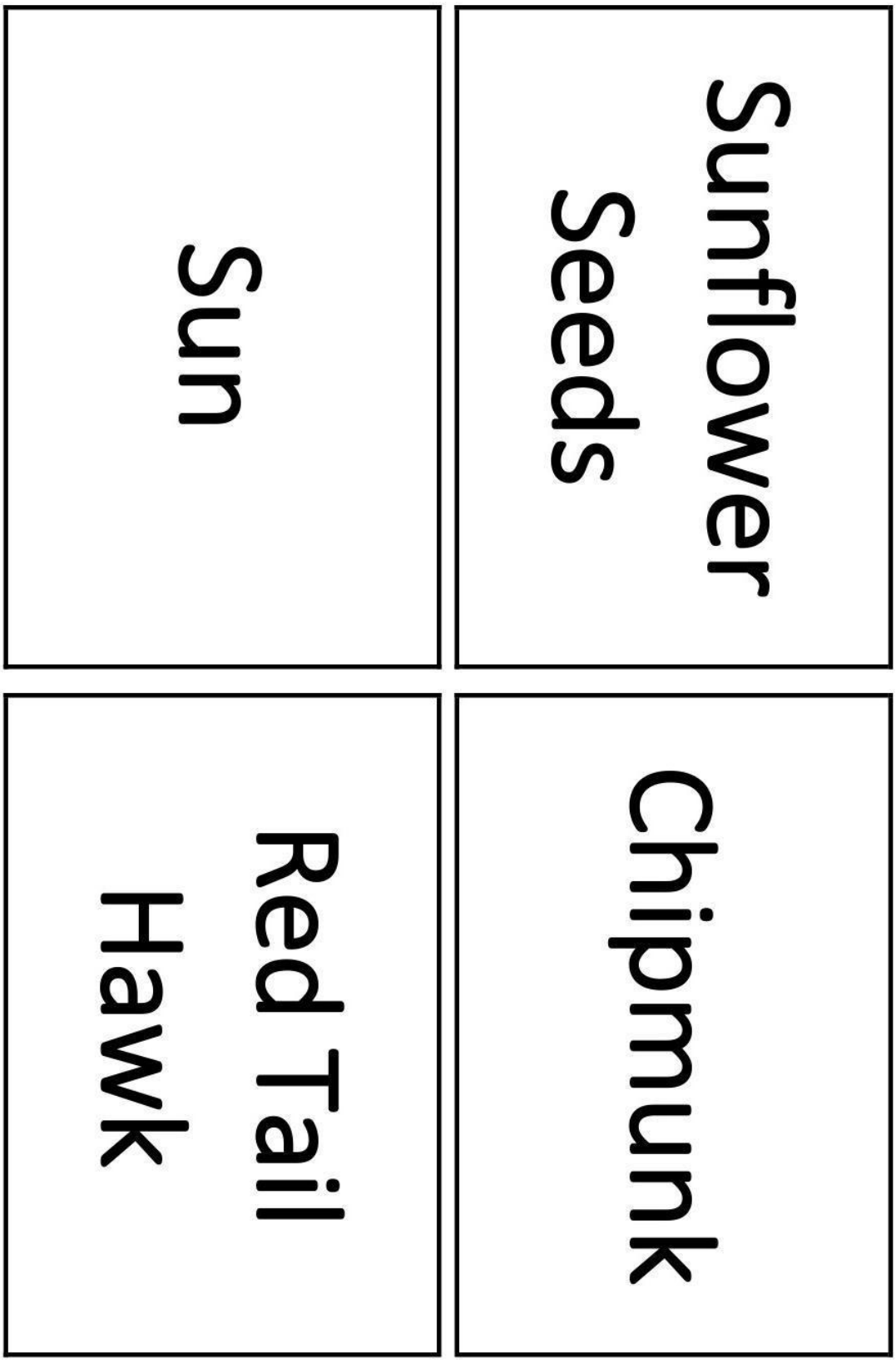
Formative:

- Students' correctly complete Food Chain Sort (session 1)
- Food Chain formations (session 2)
- Predator/Prey response question (session 2)
- Food web posters (session 3)

Summative:

- Food Chain and Web Analysis Sheet including final question (What might happen if you removed a producer, consumer, or decomposer from your food web? How would it impact the ecosystem?) (session 3)

Energy Ball Student Labels



Decomposer

Carnivore – an animal that only eats other animals (red tailed hawk)	Consumer – an organism that gets energy from food
Decomposer – an organism that gets energy from dead/decaying organisms	Energy – the fuel needed for living organisms to live and thrive

Food chain – model of energy flow between living organisms	Food web – model of multiple energy flows (food chains) between living organisms

Vocabulary Cards 2

Herbivore – an animal that only eats plants (example: grasshopper)

Omnivore – an animal that eats both plants and other animals (example: chipmunk)

Organism – any living thing (plants, fungi, animals)

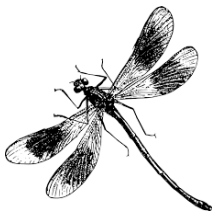
Predator – an animal that hunts other animals

Prey – an animal that is hunted by other animals

Producer – an organism that makes its own food (only green plants)

Food Chain and Web Organism Cards

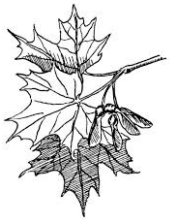
Dragonfly



Coyote

Red Tailed Hawk

Leaves



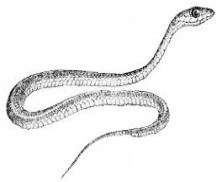
Fungi

Chipmunk

Berries

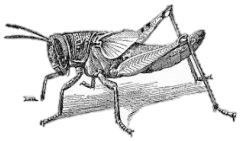
Eastern Bluebird

Garter Snake



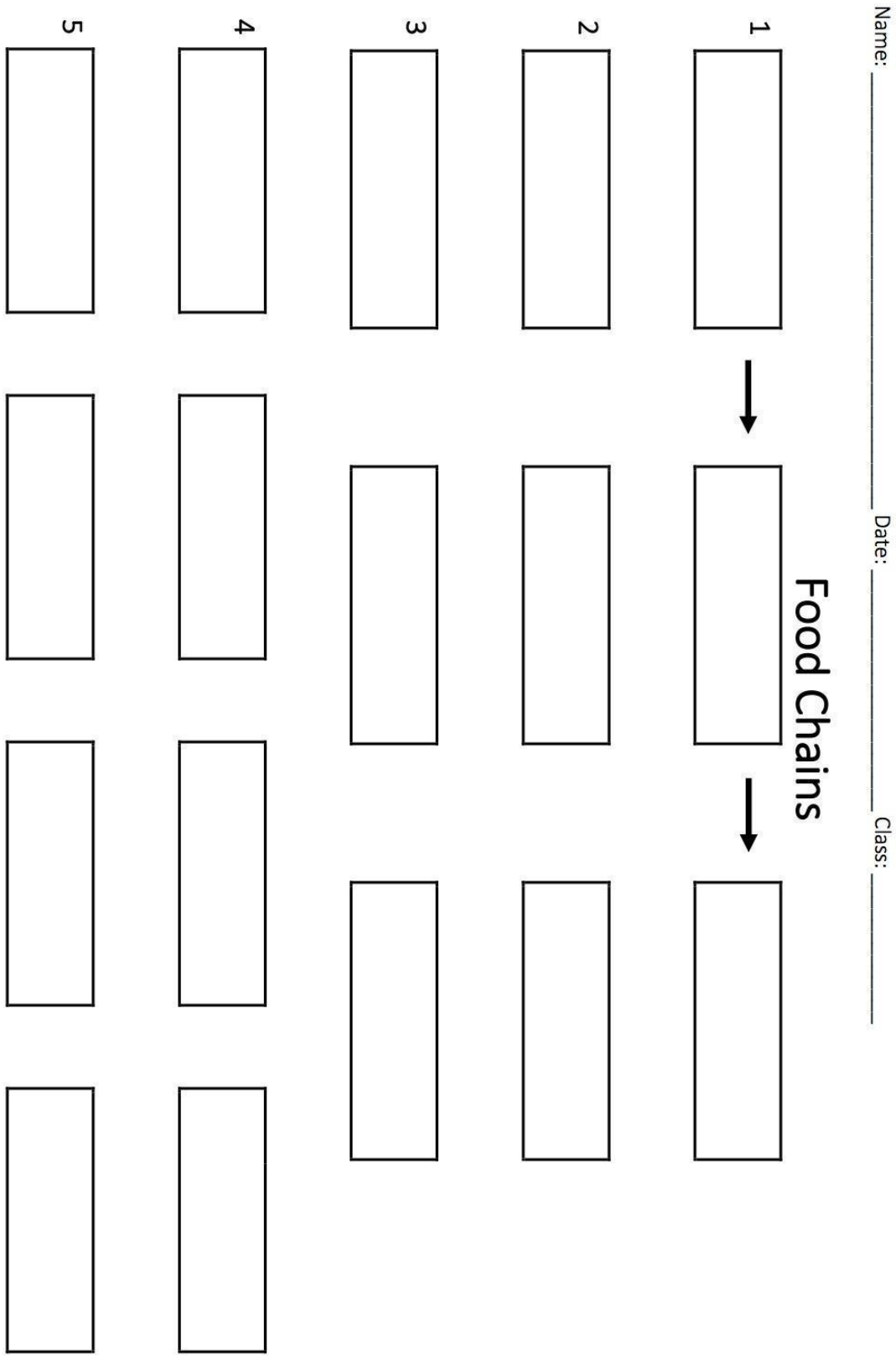
Sunflower Seeds

Grasshopper

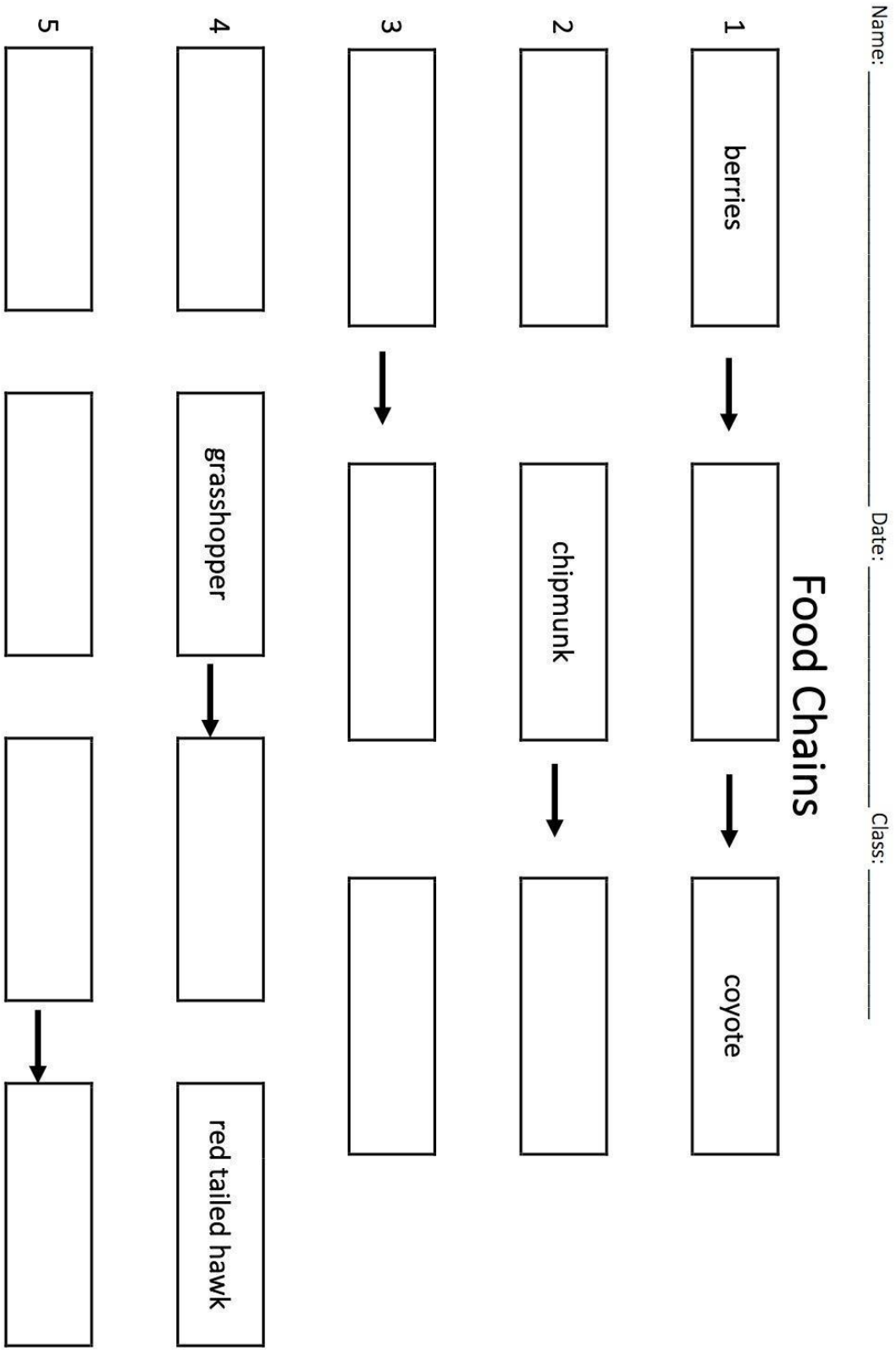


Raccoon

Student Food Chain Recording Sheet (A)



Student Food Chain Recording Sheet (B)



Organism Information Cards page 1

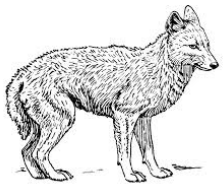
Dragonfly

Classifying
Consumer:
Predators
Predator ☑ Prey ☑

What it eats: smaller insects

What eats it: chipmunk, Eastern bluebird, garter snake, raccoon

Coyote

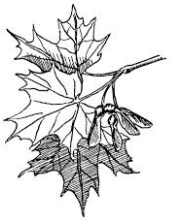


Classifying
Consumer:
Omnivore
Predator ☑ Prey ☑

What it eats: fruit, leaves, seeds, birds, rodents, snakes

What eats it: grizzlies, wolves

Leaves



Classifying
Consumer:
Producer
Predator ☒ Prey ☒

What it eats: N/A

What eats it: chipmunk, coyote, grasshopper, raccoon

Fungi

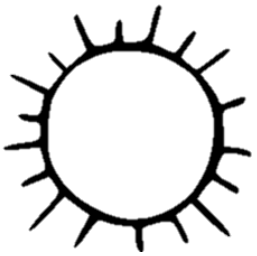
Classifying
Consumer:
Decomposer
Predator ☒ Prey ☒

What it eats: N/A

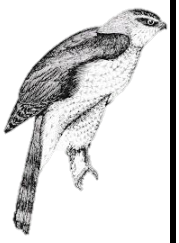
What eats it: chipmunk, grasshopper, raccoon

Sun

Source of energy for most living things/organisms on earth.



Red Tailed Hawk



Classifying Consumer: Carnivore
Predator ☑ Prey ☒

What it eats: birds, chipmunks, small birds, snakes

What eats it: N/A

Chipmunk

Classifying Consumer: Omnivore
Predator ☑ Prey ☑

What it eats: fungi, fruit, leaves, seeds, insects

What eats it: red tailed hawks, coyotes, snakes, raccoons

Berries

Classifying Consumer: Producer
Predator ☒ Prey ☒

What it eats: N/A

What eats it: chipmunk, coyote, Eastern bluebird, raccoon

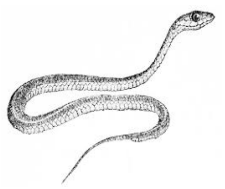
Eastern Bluebird

Classifying Consumer: Omnivore
Predator ☑ Prey ☑

What it eats: fruit, seeds, insects

What eats it: red tailed hawks, coyotes, raccoons

Garter Snake



Classifying Consumer:
Carnivore
Predator ☑ Prey ☑

What it eats: insects, small rodents

What eats it: red-tailed hawks, coyotes, raccoons

Raccoon

Classifying Consumer:
Omnivore
Predator ☑ Prey ☑

What it eats: fungi, fruit, leaves, seeds, birds, insects, small rodents, snakes

What eats it: coyotes

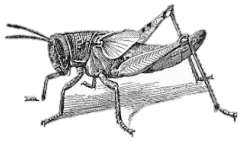
Sunflower Seeds

Classifying Consumer:
Producer
Predator ☒ Prey ☒

What it eats: N/A

What eats it: chipmunk, coyote, Eastern bluebird, raccoon

Grasshopper

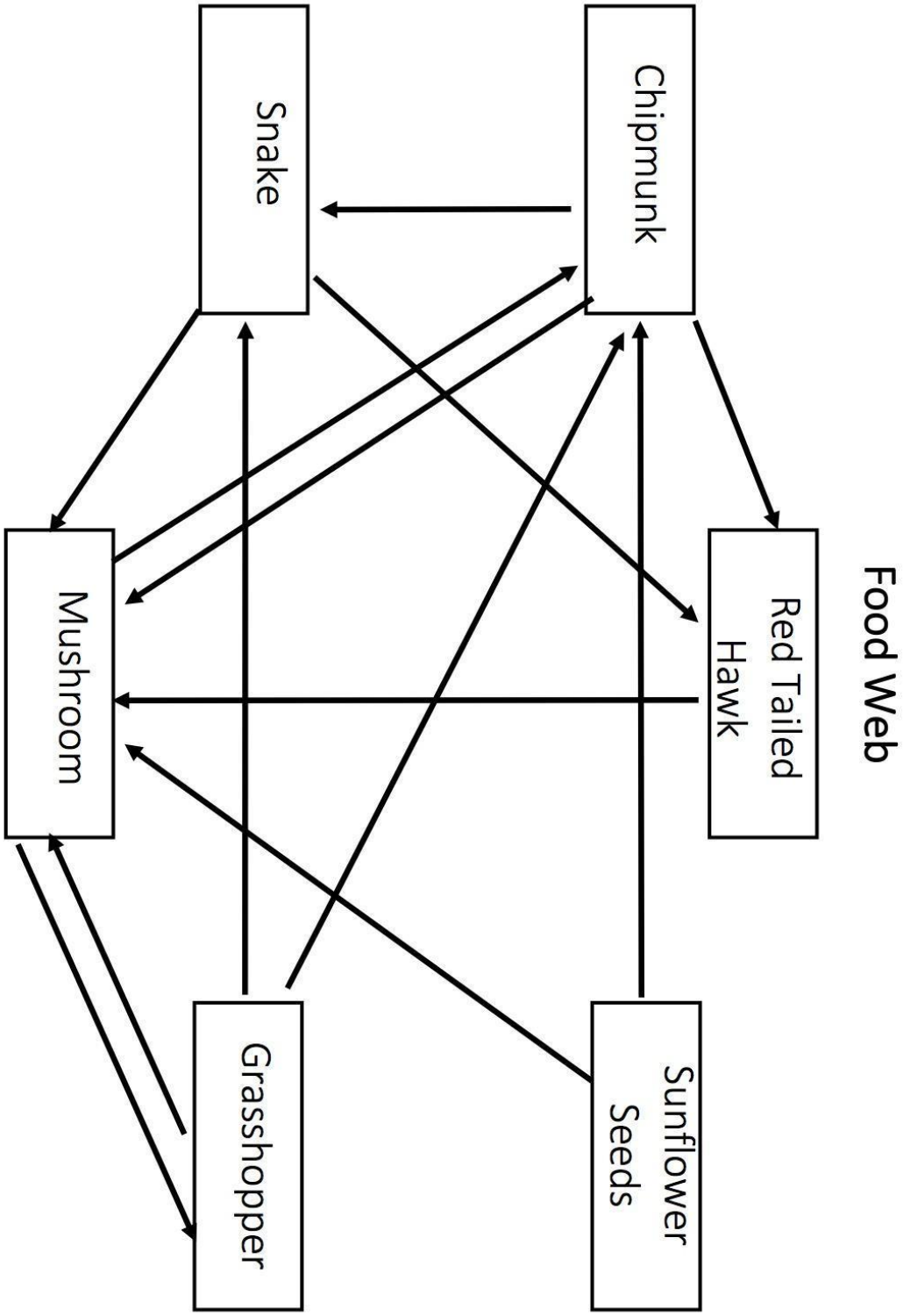


Classifying Consumer:
Producer
Predator ☒ Prey ☑

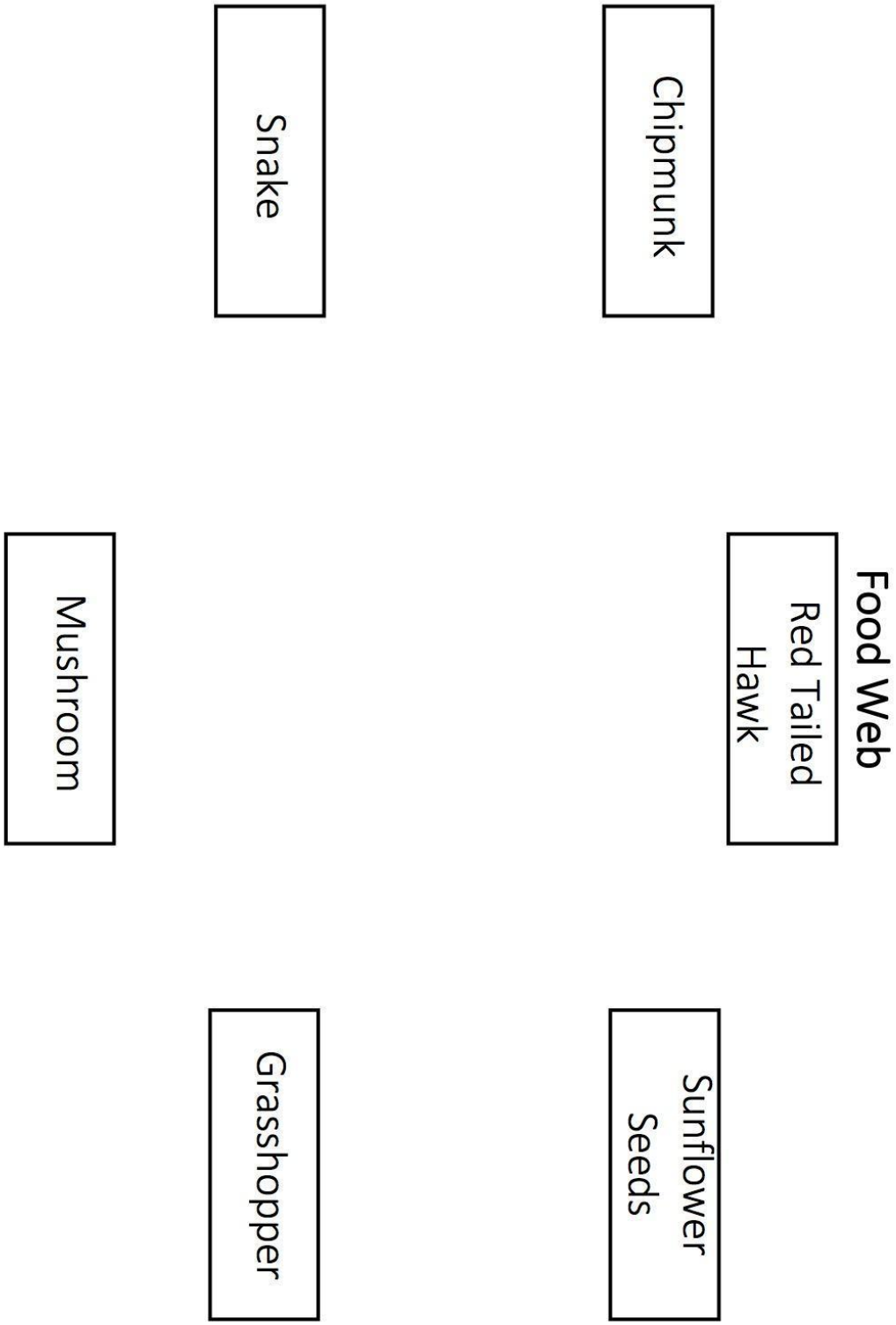
What it eats: fungi, leaves

What eats it: chipmunk, Eastern bluebird, garter snake, raccoon

Food Web Template 1



Food Web Template 2



Food Web Template 3

Food Web

Directions for Food Webs:

Using the food chains in your notebook and the Organism Information Cards, work as a group to create a food web that uses as many organisms as possible. Remember to draw the arrows in the direction that energy is flowing. When finished, each student answers the following question in their notebook using claim and evidence statements.

Q: Can animals be both predator and prey? Provide evidence to support your claim.

Directions for Food Webs:

Using the food chains in your notebook and the Organism Information Cards, work as a group to create a food web that uses as many organisms as possible. Remember to draw the arrows in the direction that energy is flowing. When finished, each student answers the following question in their notebook using claim and evidence statements.

Q: Can animals be both predator and prey? Provide evidence to support your claim.

Name: _____ Date: _____ Class: _____

Food Chain and Web Analysis								
	Role in Food Chain		Consumer Relationships		How Energy is Obtained			
Organism	Producer	Consumer	Predator	Prey	Carnivore	Omnivore	Herbivore	Decomposer
Berries	✓							
Chipmunk		✓	✓	✓		✓		
Coyote		✓	✓			✓		
Dragonfly		✓	✓	✓	✓			
Eastern Blue Bird		✓	✓	✓		✓		
Garter Snake		✓	✓	✓	✓			
Grasshopper		✓		✓			✓	
Leaves	✓							
Mushroom								✓
Raccoon		✓	✓	✓		✓		
Red Tail Hawk		✓	✓					
Sunflowers Seeds	✓							

Note: place a checkmark in all appropriate boxes. An organism can have more than one box checked. Only use your food web as a reference.

Food Chain and Web Analysis Student Page

Name: _____ Date: _____ Class: _____

Food Chain and Web Analysis									
	Role in Food Chain		Consumer Relationships		How Energy is Obtained				
Organism	Producer	Consumer	Predator	Prey	Carnivore	Omnivore	Herbivore	Decomposer
Berries								
Chipmunk								
Coyote								
Dragonfly								
Eastern Blue Bird								
Garter Snake								
Grasshopper								
Leaves								
Mushroom								
Raccoon								
Red Tail Hawk								
Sunflowers Seeds								

Note: place a checkmark in all appropriate boxes. An organism can have more than one box checked. Only use your food web as a reference.

Name: _____ Class: _____ Date: _____

Food Chains and Webs Summative Assessment Rubric

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
complete the analysis identifying all the components of a food web.	Student completes the food chain and web analysis with 90% accuracy. ex. all organisms used add up to 32, and student correctly identifies 29 or more out of 32	Student completes the food chain and web analysis with 80% accuracy. ex. all organisms used add up to 32 checks, and student correctly identifies 26-28 out of 32	Student completes the food chain and web analysis with 70% accuracy. ex. all organisms used add up to 32 checks, and student correctly identifies 22-25 out of 32	Student completes the food chain and web analysis with 90% accuracy. ex. all organisms used add up to 32 checks, student correctly identifies up to 21 out of 32
identify what happens when either a producer, consumer, or decomposer is removed from the food web and explain its impact on an ecosystem.	Student identifies organism removed and identifies three or more accurate impacts on immediately connected organisms or can explain how it impacts the ecosystem as a whole. ex. student removes leaves and explains how the grasshopper's population would decrease and how this impacts snakes and snakes' predators. ex. student removes the chipmunk and correctly extrapolates how this impacts all the producers, consumers and decomposers.	Student identifies organism removed and identifies two accurate impacts on immediately connected organisms. ex. student removes the chipmunk and explains how the berries would increase and therefore how the chipmunk's predator population would decrease. ex. student removes the chipmunk and explains how the raccoon population would decrease and therefore the raccoon predator population would decrease. ex. student removes the chipmunk and explains how the berries would increase and therefore there is more food for raccoons.	Student identifies organism removed and identifies one accurate impact on an immediately connected organism. ex. student removes the chipmunk and explains how the berries would increase. ex. student removes the chipmunk and explains how the raccoon population would decrease.	Student identifies organism removed and/or identifies one impact on an immediately connected organism but does provide an explanation or provides an inaccurate one. ex. student removes the snake and states the grasshopper population would increase. ex. student removes the snake and states the grasshopper population would decrease because there are less leaves.

CHAPTER 3 PHYSICAL SCIENCE

Lesson 1: Properties of Magnetism

Topic: Properties of Magnetism
Date:
Subject/Grade level: Science/Grade 4
Materials: ● different types of magnets ○ donut magnets ○ horseshoe magnets ○ bar magnets ● baggies of test objects (one baggie per group) ○ penny ○ nickel ○ rock/pebble ○ items made of plastic, rubber, wood ○ piece of aluminum foil ○ other magnets ● Test Object Chart 1 (one per student) ● Properties of Magnetism Notebook Entry Rubric ● science notebooks Anchor Charts: ● Test object list (teacher created) ● Interactive Vocabulary Anchor Chart (teacher created) Media Resources: ● The ABCs of Magnets https://www.youtube.com/watch?v=qIMv6QIBfQE (video) Optional Resources: ● Magnetism Interactive Vocabulary Chart ● sentence frames Key Vocabulary: ● attract ● iron ● magnet ● magnetic field ● magnetism ● north pole ● repel ● south pole ● steel

NYSED Standards:

Standard 4 The Physical Setting Key Idea 5
5.1e Magnetism is a force that may attract or repel certain materials.

Science and Engineering Practices	Crosscutting Concepts
● Asking questions and defining problems ● Constructing explanations and designing solutions ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	● Systems and system models ● Energy and matter: Flows, cycles, and conservation

Lesson Objective(s):

Students explore the properties of magnets by testing objects that attract or repel magnets.

- I can identify what materials are attracted to magnets (iron and steel).
- I can identify the force interactions between magnets.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Provide sentence frames.
  - Create personal word walls.
  - Use strategic partnerships.
  - Begin their evaluation/reflection by illustrating their thinking using the concept wall and anchor charts to demonstrate their understanding.
  - Use a graphic chart to record predictions, display sentence frames and visual vocabulary cards and support peer discussion.

- Students that need more support:
  - Provide students with graphic organizers to record predictions, display sentence frames and visual vocabulary cards and support peer discussion.
  - Use strategic partnerships.

- Students that need more challenge:
  - Write an explanation about why magnets attract certain metals and not all metals.

ENGAGE (session 1 - 10 minutes)

Teacher shows students a variety of magnets and assesses the students' prior knowledge using these guiding questions: What do you know/notice about these objects? How have you used magnets before? What questions do you have about magnets?

Students respond to the questions either in their notebooks, on a concept web, on a KWL chart, through a carousel brainstorm, in a circle map, or using any other structure that quickly reveals prior knowledge to the teacher.

EXPLORE (session 1 - 40 minutes)

Students work in partnerships to explore the general properties of magnetism using two bar magnets and only objects that are attracted to magnets (ex. paper clips, pins or any other steel objects). Teacher instructs students to draw and label their observations around magnet/magnet and magnet/object interactions in their science notebooks.

As students work, teacher circulates around room and identifies exemplar work that illustrates key vocabulary and instructs those student to redraw their work on copy paper or a large sticky note. Teacher then asks those students to post their illustrations on the Interactive Vocabulary Chart and centers the discussion around each key vocabulary word--for example: repel, attract, magnetic force, etc. Students adjust and revise their notebook illustrations as appropriate during the discussion.

Note: Teacher labels the north and south poles on any magnet illustrations and emphasizes that like poles repel or push away and opposite poles attract or stick together.

Teacher next provides students with additional test objects to observe and predict if they will be attracted to a bar magnet. (Note: Teacher collects one of the bar magnets from each group so the group is left with one magnet.)

Teacher distributes Test Object Chart 1 and reviews the names of each object, identifying the material it is made of, and hangs up a test object list. Students test each object in small groups and record data on their Test Objects Chart 1.

Teacher explains to students that they will use their notebook entries and Test Objects Chart to complete a Magnetism Interactive Vocabulary Chart.

EXPLAIN (session 2 - 15 minutes)

Teacher reviews the previous lesson by instructing students to share the results from their Test Objects Chart 1. Students discuss findings as a class and respond to the following questions:

- What did you notice about the objects that were attracted to a magnet? (objects made of

iron, which includes steel.)
- What is the difference between not being attracted and being repelled? (repelling involves pushing away while lack of attraction does not).
- What surprised you? Why?

Using claim and evidence statements, students then respond to the question at the bottom of their Test Object Chart 1 sheet: "What materials are attracted to magnets?"

Note: Teacher assesses student comprehension of the specific content standard that magnets are attracted to any object containing iron, including steel.

ELABORATE (session 2 - 10 minutes)
Students view a short segment of The ABCs of Magnets (minutes 2:13-2:46)
Teacher asks students what new information they learned from the video and how this helps to explain magnetic attraction.

Teacher instructs students to add any new information to their Interactive Vocabulary Chart and/or notebooks.

EVALUATE (session 2 - 10 minutes)

Teacher instructs students to use what they learned from the video and the investigations and observations to answer the following question in their science notebook: What is a good use for a magnet? Explain why. Be sure to include the properties of a magnet that make it useful in this case.

ASSESSMENT OPPORTUNITIES

Formative:
- Student notes about magnet noticings (session 1)
- Interactive Vocabulary Chart Student Illustrations (session 1 and 2)
- Students Test Object Chart 1 with claim and evidence statements (session 1 and 2)

Summative:
- Student notebook response to:
    - What is a good use for a magnet? (session 2)

Name: _____ Class: _____ Date: _____

Test Objects Chart-1

Test Object	Material	Attracted	Not Attracted	Repel

QUESTION: What materials are attracted to magnets?

Claim:_____

_____

_____

Evidence:_____

_____

Magnetism: Interactive Vocabulary Chart

Illustration	Vocabulary
	Attract
	Repel
	North/South Pole

Name: _____ Class: _____ Date: _____

Properties of Magnetism Notebook Entry Rubric

Question: What is a true use for a magnet?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
identify a true use for a magnet.	I can name one or more accurate uses for a magnet, directly connect how magnets are used, and thoroughly explain the properties of magnets as evidence.	I can name one accurate use for a magnet, partially connect how magnets are used, and explain the properties of magnets as evidence.	I can name one accurate use for a magnet, connect one example for how magnets are used, and partially explain the properties of magnets as evidence.	I can name one accurate use for a magnet, but cannot connect how magnets are used or explain the properties of magnets as evidence.
use scientific vocabulary.	I consistently use new science vocabulary correctly within class discussion as well as in my writing.	I often use new science vocabulary correctly within class discussion as well as in my writing.	I sometimes use new science vocabulary during discussion as well as in my writing.	I may occasionally use new science vocabulary.

Lesson 2: Magnetic Force

Topic: Magnetic Force

Date:

Subject/Grade level: Science/Grade 4

Materials:

- a variety of magnets per group (such as donut magnets, horseshoe magnets and bar magnets)
- box small paper clips (one per class)
- pennies
- ruler (one per group)
- water bottle with water and paper-clip inside and lid on the top.
- Properties of Magnets Notebook Entry Rubric
- science notebooks
- prompts for assessment

Media resources:

- The Science Behind Magnets: How do they work? - Stuff to blow your kid's mind #2. https://www.youtube.com/watch?v=MZtTVsIOA9c (video)

Optional Resources:

- extra magnets of varied size and strength
- box large paper clip
- sentence frames

Key Vocabulary:

- gravity
- magnetism
- magnetic field
- magnetic force

NYSED Standards:

Standard 4 The Physical Setting Key Idea 5
5.2a The forces of gravity and magnetism can affect objects through gases, liquids, and solids.
5.2b The force of magnetism on objects decreases as distance increases.

Science and Engineering Practices	Crosscutting Concepts
• Asking questions and defining problems • Developing and using models	• Systems and system models • Energy and matter: Flows, cycles, and

● Planning and carrying out investigations ● Constructing explanations and designing solutions ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	conservation ● Stability and change

Lesson Objective(s):

Students investigate the relationship between the force of a magnet and its distance from an object. Students investigate the properties of magnets through solids, liquids, and gases.

Students/I can:

- predict the relationship between the force of a magnet and its distance from an object
- predict the relationship between the force of a magnet through solids, liquids, and gases.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Provide students with sentence frames.
  - Use strategic partnerships
  - Illustrate their thinking using a concept wall and anchor charts to demonstrate their understanding before students begin their evaluation/reflection.

- Students that need more support:
  - Illustrate their thinking using a concept wall and anchor charts to demonstrate their understanding before students begin their evaluation/reflection.
  - Use strategic partnerships.

- Students that need more challenge:
  - Use large paper clips.
  - Explore with different sized magnets.

ENGAGE (session 1 - 10 minutes)

Teacher demonstrates the relationship between force and an object's distance from a magnet by modeling with paper clips and a magnet. (This can be done by placing three paper clips at different distances and then moving the magnet toward the paper clips. The closest paper clip will attract the magnet.)

Teacher elicits student noticings in a whole group discussion. Teacher asks, Why did the first paper clip attract to the magnet while the other two did not attract to the magnet? How could we

get the other paper clips to attract to the magnet?

EXPLORE (session 1 - 20 minutes)

Partners observe, test and measure the distance of a magnet's magnetic field, using magnets, paper clips, and rulers to represent a model. They collect and record their data in their notebooks.

To create the model, students tape a ruler on the desk, then place a paper clip next to the ruler at the '0' end and another magnet at the '12' end. Next, students slowly slide the magnet toward the paper clip, noting when the attraction occurs. The distance between the paper clip and the magnet represents the invisible magnetic field.

Teacher defines magnetic field. (A magnetic field is a picture that we use as a tool to describe how the magnetic force is distributed in the space around and within something magnetic.)

Students draw a labelled illustration of the model and make the magnetic field visible using squiggly lines. This illustration will show how the magnetic force is distributed in the space around the magnet. The investigation also demonstrates how a magnet functions through air, which is a gas.

Students explore how magnets function through liquid. Using the pre-filled bottles with water and a paper clip inside, students use the magnet to move the paper clip from the bottom of the bottle to the top of the bottle. Students draw a labelled illustration of the investigation.

Students explore how magnets function through solids by trying to move a paper clip through their notebook or through a table. Students draw a labelled illustration of the investigation.

EXPLAIN session 1 (15 minutes)

Teacher uses the following question prompts to promote partnership discussion among students:

- At what distance did the magnetic force pull the paper clip to the magnet?
- How would you describe the force of the magnet and paper clip through a gas (air), liquid (water), and solid (notebook or table)?

ELABORATE session 2 (5 minutes)

Teacher shows portion of video The Science Behind Magnets: How do they Work? - Stuff to Blow Your Kid's Mind #2. (play until 3:30)

Teacher facilitates a discussion

EVALUATE session 2 (25 minutes)

Students respond to the following prompts. (Teachers may create an exit ticket as an option)

- How does a magnetic force change if the distance between the magnet and an object is increased?
- How did the magnetic force change through a solid, liquid and the air/gas?
    - Use your observations and data to provide evidence.
- What force takes over when the magnetic force is no longer present? Explain your answer and use evidence from your notebook and observations.

Students share opinions with partners and discuss.

ASSESSMENT OPPORTUNITIES

Formative:

- Group discussion about relationship between force and distance from a magnet (session 1)
- Students complete notebook writings and drawings (session 2)

Summative:
Question prompts

- How does the magnet force change if the distance between two objects is increased?
- How did the magnetic force change through a solid, liquid and the air/gas? What force takes over when the magnetic force is done?

Name: _____ Class: _____ Date: _____

Magnetic Force Notebook Entry Rubric

Question: What are the properties of the magnetic force?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
Explain the connection between distance of an object and the force of a magnet.	I can demonstrate and explain how the distance of an object is affected by the force of a magnet and record the distance.	I can demonstrate and explain that the distance of an object affects the force of a magnet.	I can demonstrate and provide a simple explanation on how magnets attract objects from a distance.	I can demonstrate how magnets attract objects.
Use new scientific vocabulary (magnet, magnetic field, force, matter, iron, gravity).	I regularly and clearly use accurate vocabulary correctly within class discussion and in my writing.	I use accurate vocabulary correctly most of the time within class discussion and in my writing.	I sometimes use accurate vocabulary during discussion and in my writing.	I rarely use accurate vocabulary during discussion or in my writing.
Explain why a magnet can move a paper clip through a solid, a liquid (water) and a gas (air).	I can clearly explain why a magnet can move a paper clip through a solid, a liquid and a gas with writing and drawings in my notebook.	I can partially explain why a magnet can move a paper clip through a solid, a liquid and a gas with writing and drawings in my notebook.	I can minimally explain why a magnet can move a paper clip through a solid, a liquid and a gas with writing and drawings in my notebook.	I did not explain why a magnet can move a paper clip through a solid, a liquid and a gas with writing and drawings in my notebook.

Lesson 3: Electrical Current and Flow

Topic: Electrical Current and Flow
Date:
Subject/Grade level: Science/Grade 4
Materials: ● bag (one per group) containing: ○ flashlight bulb (1.5 volt) ○ bulb holder ○ two 6-inch pieces of insulated wire (or alligator clips) (use the wire stripper to remove ½ inch of insulation ○ battery (size D; also called D cell) ○ battery holder ● additional wires/alligator clips (two per group) ● solar cell ● switch ● wire stripper ● Schematic Model Circuit Notebook Sheet (one per student) ● Building a Simple Circuit (one per student) ● Circuit and Schematic Assessment Rubric ● science notebooks Anchor Charts: ● Schematic Model Circuit Notebook Sheet (Note: teacher may prepare ahead of time or project a larger version of the notebook sheet) Media Resources: ● Explaining the Electrical Circuit https://www.youtube.com/watch?v=VnnpLaKsqGU (video) Optional Resources: ● motors ● switches ● additional bulbs ● Sentence Frames ● Word Bank

Key Vocabulary:

- bulb
- circuit
- component
- closed circuit
- current
- electrical receiver
- electrical source
- electricity
- open circuit
- simple circuit

NYSED Standards:

Standard 4 The Physical Setting Key Idea 4
4.1e Construct and diagram an electrical circuit.

Science and Engineering Practices	Crosscutting Concepts
• Developing and Using Models • Constructing explanations and designing solutions • Obtaining, evaluating, and communicating information	• Systems and system models • Energy and matter: Flows, cycles, and conservation

Lesson Objective(s):

Students create a simple circuit using a light bulb, wire, and battery and make a bulb light up. They draw a diagram of the circuit, write an explanation about how electricity flows from the battery to the light bulb, and analyze and describe why causes the bulb to lights and what causes the bulb not to light.

Students/I can

- I can create a simple circuit using a bulb, wire, and a battery and make a bulb light up.
- I can diagram a simple circuit and write an explanation about how electricity flows from a battery to a light bulb.
- I can analyze and describe what causes a bulb to light or not to light.
- I can model current flow and direction in a circuit.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
    - Provide students with sentence frames.
    - Create strategic partnerships.
    - Begin their evaluation/reflection by illustrating their thinking using anchor charts to demonstrate their understanding. (templates)
    - Replay video to reinforce concepts.

- Students that need more support:
    - Students use anchor charts to demonstrate their understanding. (templates)
    - One to one coaching and small group support.
    - Use glossary with visuals (teacher created).
    - Provide table templates to organize information (teacher created).
    - Replay video to reinforce concepts

- Students that need more challenge:
    - Write a short narrative tracing the path of electricity in a simple circuit.
    - Build advanced circuits adding in more components.

ENGAGE (session 1 - 10 minutes)

Teacher distributes the materials bags and instructs students to lay the materials out on the table. Teacher asks students if they recognize the items, their purpose and how to use the materials to light a bulb.

Before assembling their circuits, students draw two possible plans to light the bulb in their notebooks. Students test their plans and record whether or not the bulb lights. Students draw their plans on a class chart.

Teacher facilitates a discussion centered around the following questions:

- Where should you connect the wires to the light bulb?
- How do we know that electricity is flowing in the circuit? (Anticipated student response: bulb lit up)
- What word is used to describe the flow of electricity? (Anticipated student response: current)

EXPLORE (session 1 - 15 minutes)

Teacher introduces the battery holder and distributes additional wires to each group. Teacher posts the Schematic Model Circuit Anchor chart and distributes Schematic Model Circuit Notebook sheets to student.

Students label the name of each component next to their matching symbol.
Teacher explains the benefit of using schematic diagrams* to represent circuits and introduces the terms: circuit, electrical source, and electrical receiver.
Students identify the battery as the electrical source and the bulb as the electrical receiver and add those labels to their sheet.

*Note: Schematics are a universal symbol system used by engineers and electricians to easily diagram complex circuits in blueprints.

Teacher distributes Building a Simple Circuit sheet. Students construct another model of a circuit using the additional components and respond to question 1-3 on their sheet. Students draw a new schematic model of their circuit on the bottom of their sheet, question 4.

EXPLAIN (session 1 - 10 minutes)

Teacher shows the video Explaining An Electrical Circuit.

Teacher facilitates a discussion using the following questions:

- How does current flow through a simple circuit?
    - (Anticipated student response: in one direction, from negative to positive, from the source to the receiver and back to the source)
- What would happen if the circuit were to have a gap or opening?
    - (Anticipated students response: current would not flow; bulb would not light)

Teacher emphasizes that an open circuit has an opening and does not allow the energy to flow and a closed circuit allows the electrons to flow from the battery through the wires to the bulb.

ELABORATE session 1 (5 minutes)

Students add the current flow to their schematic drawing (Building a Simple Circuit) using arrows to indicate the path and direction of the electrical flow. Students work in groups using their individual schematics to describe in detail how current flows through their circuit. Students share their descriptions.

Note: Students develop a more sophisticated understanding of the concept as they engage in the Energy Conversions Amplify unit. (see Amplify Energy Conversions Unit)

EVALUATE session 1 (5 minutes)

Students use Circuit and Schematic Assessment Rubric to independently assess their understanding. Students record their evidence in the first column under the “I can” statement

to support their choice. Afterwards, teachers assess students using the same rubric, yet with a writing utensil of another color.

ASSESSMENT OPPORTUNITIES

Formative:

- Teacher facilitated discussion
- Building a Simple Circuit Response Sheet
- Group current flow descriptions

Summative:

- Circuit and Schematic Assessment Rubric

Sentence Frames:

I can predict that _____ because _____.

I wonder what would happen if _____.

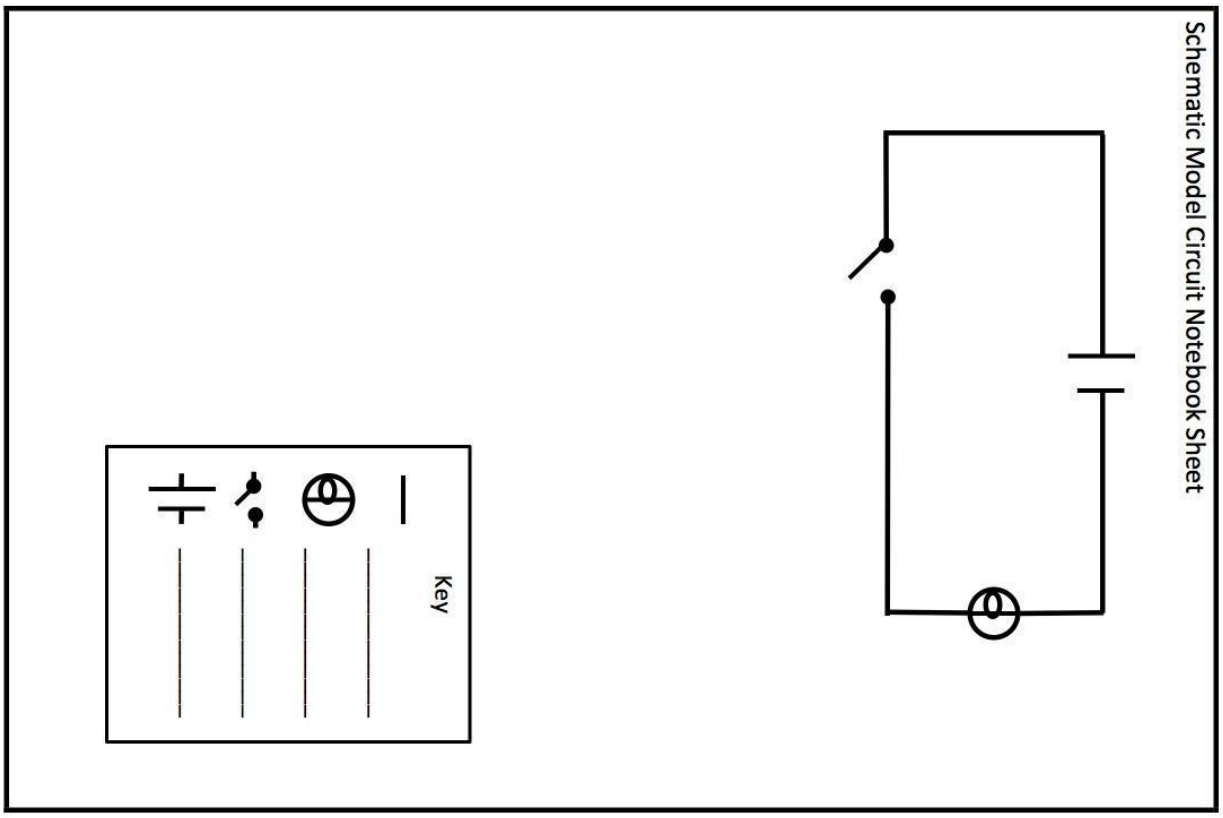
The evidence I use to support _____ is _____.

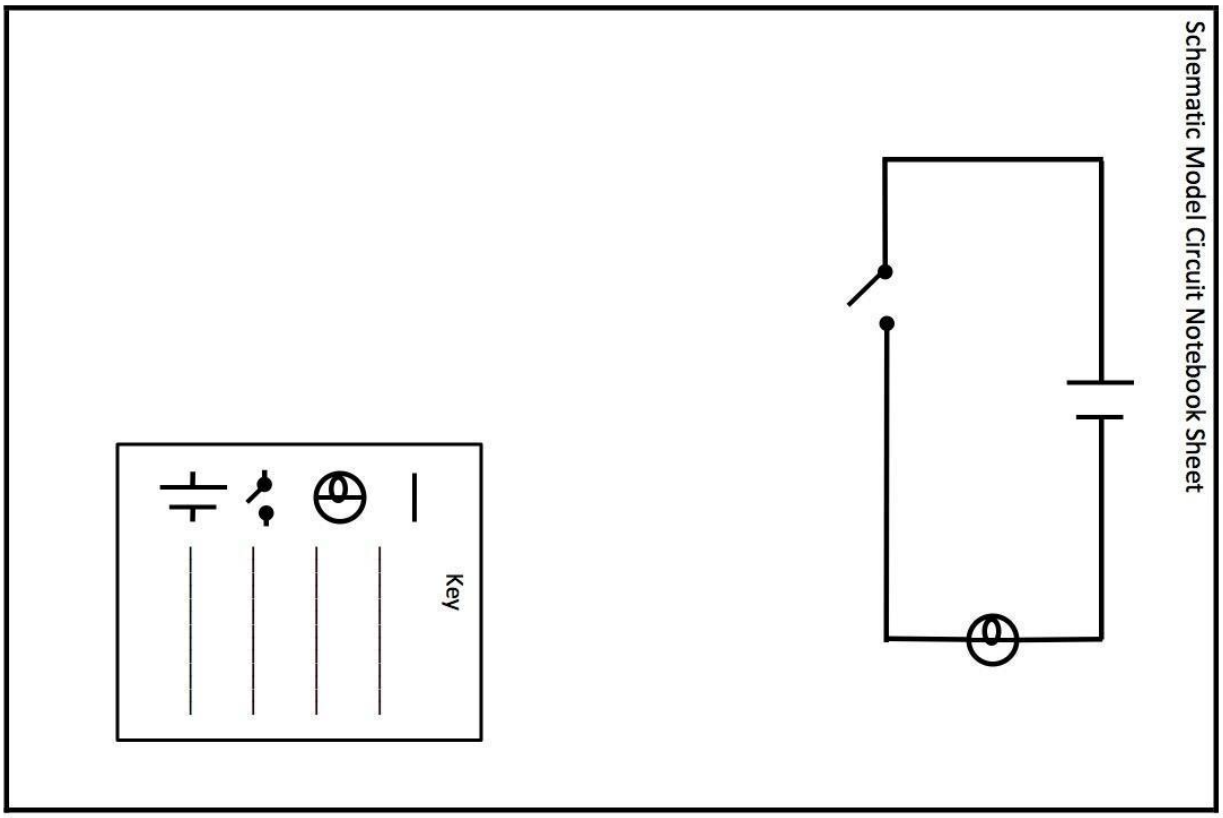
I have a question about _____.

I agree _____ because _____.

I disagree _____ because _____.

Schematic Model Circuit Notebook Sheet





Name: _____ Class: _____ Date: _____

Building a Simple Circuit

Directions: Each component in a circuit has a purpose. Identify the purpose of each component listed below by choosing electrical receiver, electrical source, or current carrier.

Component	**Purpose**
Bulb	
Battery	
Wire	

1. How many wires in your simple circuit connect to the battery and light bulb?
a. Where are they connected to make a complete circuit?

2. If you cannot "see" electricity, how do you know that it is flowing in your circuit?

3. Create a schematic diagram for your circuit in the box below. Use the symbols for bulb (receiver): battery (source): and wire: _____.

Word Bank (Supportive Differentiation Templates)

Word	Student Definition	Illustration
Word bank: bulb, circuit, component, closed circuit, current, electrical receiver, electrical source, electricity, open circuit, simple circuit		

Claim Evidence (Supportive Differentiation Templates)

Claim	Evidence
I claim that ...	

Name: _____ Class: _____ Date: _____

Circuit and Schematic Assessment Rubric

Question: How does electrical current flow through a circuit?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
use a bulb, wire, and battery to light a bulb.	I can choose the materials and explain how to create a simple circuit.	I can create a simple circuit using the materials provided.	I created a simple circuit using the materials provided, but the bulb did not light.	I was unable to create a simple circuit.
make a schematic diagram of a simple circuit and explain how electricity flows from a battery to a light bulb.	I drew a detailed schematic diagram of a simple circuit using appropriate schematic symbols and described the purpose of each component of the circuit.	I drew a schematic diagram with few details, of a simple circuit using schematic symbols and wrote a general explanation of the circuit.	I drew a simple circuit using two of the schematic symbols and wrote a simple explanation of the circuit. May have inaccuracies.	I drew a simple circuit using one schematic symbol.
Use new scientific vocabulary.	I use academic vocabulary correctly during class discussions and science notebooking.	I uses new vocabulary correctly most of the time during class discussion and science notebooking	I sometimes use new vocabulary during class discussion and science notebooking	I may occasionally use new vocabulary during either class discussion or science notebooking

Lesson 4: Insulators and Conductors

Topic: Insulators and Conductors
Date:
Subject/Grade level: Science/Grade 4
Materials: ● bags with items to build a circuit (1 per group of two or four) ○ insulated wires ○ batteries (size D; also called D-cell) ○ battery holders ○ flashlight bulbs (1.5 volts) ○ bulb holders ● bag with test objects: (1 per group of two or four) ○ plastic spoon ○ rubber band ○ iron nail ○ steel washer ○ steel clip ○ piece of wood ○ rock/pebble ● Electricity Task Card ● response sheet-Electricity: Insulators and Conductors (1 per student) ● Electricity Claim-Evidence-Response Rubric - Student to Student ● Electrical Conductors and Insulators Circuit Diagram Rubric ● science notebooks Media Resources: ● Science video- "Explaining an Electrical Circuit" https://www.youtube.com/watch?v=VnnpLaKsqGU Key Vocabulary: ● bulb ● closed circuit ● conductor ● current ● electricity ● insulator ● open circuit ● switch

NYSED Standards:

Standard 4 The Physical Setting Key Idea 4
4.1e Construct and diagram an electrical circuit.
4.1c Identify conductors and insulators in an electrical circuit.

Science and Engineering Practices	Crosscutting Concepts
● Asking questions (science) and defining problems (engineering) ● Planning and carrying out investigations ● Analyzing and interpreting data ● Constructing explanations (science) and designing solutions (engineering) ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	● Patterns ● Systems and system models ● Energy and matter: Flows, cycles, and conservation ● Stability and change

Lesson Objective(s):

Students identify conductors and insulators within an electrical circuit.

- I can identify materials that conduct electricity and materials that do not conduct electricity.
- I can identify material similarities among conductors, specifically that they are all metals.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Provide sentence frames.
  - Provide a visual of a circuit diagram.
  - Create strategic partnerships.
  - Provide one-to-one coaching and small group support.
  - Students may use a concept wall or anchor charts for support discussion and writing
- Students that need more support:
  - Students may use a concept wall or anchor charts for support discussion and writing
  - Provide one-to-one coaching and small group support.
  - Provide a glossary with visuals.
  - Provide tables to organize their information.

- Students that need more challenge:

- challenge students to design a model of a circuit using different materials

ENGAGE (session 2 - 10 minutes)

Teacher begins by showing students a video entitled "Electrical Conductivity - It's AumSum Time"

After the video, teacher turns off room light using the switch and opens a discussion about the purpose of a switch.

Teacher displays a circuit and leads students through a vocabulary introduction to name the switch, asking students where this component could fit into the circuit.
Next, the teacher displays a plastic straw and iron nail and elicits predictions from students about which of the items will light the bulb once the circuit is complete. Teacher records noticings in order to elicit the connection about which of the items is a conductor (the nail) and which one could be an insulator (the plastic straw.)

EXPLORE (session 2 - 15 minutes)

Introduce the activity.

- Students explore conductors and insulators by testing various objects to complete a circuit and light a bulb. Students record the objects that are conductors or insulators. They notice similarities among materials that conduct electricity (conductors) as well as similarities between materials that do not conduct electricity (insulators).
- Students use the collected data to write claim, evidence and reasoning statements by answering the question, "Which materials conduct electricity?"

*Teacher groups students (pairs or small groups no larger than 4) and assigns student roles. (Possible roles might include: materials manager, discussion direction, word wizard, paper professional, etc.)

EXPLAIN (session 2 - 5 minutes)

Teacher poses the questions:

- What types of objects are conductors and what types of objects are insulators?
- What similarity do all the conductors share?

Note: Teacher addresses any misconceptions about what materials are conductors, making sure that students understand that all metals conduct electricity.

Students share their findings on what objects were conductors and insulators, making sure to include session vocabulary words. Teacher creates an anchor chart to reinforce vocabulary and concepts.

ELABORATE (session 2 - 10 minutes)

Think-Pair-Share: In pairs, students test personal objects to find out what objects conduct electricity. They record their observations in their science notebooks. Students construct simple explanations of what materials are conductors and how conductors allow electricity to flow through them, while insulators do not.

EVALUATE (session 2 - 5 minutes)

Students use the lesson rubric to review their group diagrams, to self-reflect, and to assess individual understanding of lesson objective.

ASSESSMENT OPPORTUNITIES

Formative:

- Students provide examples and classify objects/materials as insulators and conductors, noting that all conductors are metals.(Session 2: Explore)
- Teacher observes and listens in on Think-Pair-Share. (Session 2: Elaborate)
- Students write claim, evidence and reasoning statements by answering the question, "Which materials conduct electricity?" (Session 2: Explore)

Summative:

- Students use the Electrical Conductors and Insulators rubric to review each other's diagrams, self-reflect, and assess individual understanding of lesson objective.(Session 2: Evaluation)

Name: _____ Class: _____ Date: _____

Electricity Claim-Evidence-Response Rubric - Student to Student

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
state a claim.	I consistently and correctly use scientific vocabulary to state a claim.	I correctly state a claim.	I state a claim, but it does not make correct connections to the task.	I state claims incorrectly.
use evidence to support a claim.	I consistently use evidence from the my experiment and other lesson sources to support a claim.	I use evidence from only my experiment to support a claim.	I provide little evidence to support a claim.	I provide unclear evidence or evidence that does not support a claim.
cite the reasoning for a claim.	I consistently cite reasoning that uses scientific vocabulary to support and extend a claim.	I cite reasoning that clearly supports a claim.	I cite reasoning that partially supports a claim.	I cite reasoning that does not support a claim.
Use new scientific vocabulary.	I regularly use new vocabulary correctly within class discussion as well as science notebooking.	I use new vocabulary correctly most of the time within class discussion and science notebooking.	I sometimes use new vocabulary correctly during discussion and/or science notebooking.	I may use new vocabulary occasionally within either discussion or science notebooking.

Name: _____ Class: _____
Date: _____

Electrical Conductors and Insulators Circuit Diagram Rubric

Question: How can we use our knowledge of conductors and insulators to design working electrical circuits?

I can...	Expert (4)	Proficient (3)	Apprentice (2)	Novice (1)
use a bulb, wire, and battery to light a bulb.	I can accurately create a simple circuit using the materials provided and clearly explain my reasoning behind the use of the materials.	I can accurately create a simple circuit using the materials provided.	I can create a simple circuit using the materials provided.	I attempted to create a simple circut, but the bulb did not light.
Diagram a simple circuit and write an explanation about how electricity flows from a battery to a lightbulb.	Can clearly and accurately create a schematic drawing of a simple circuit and write a detailed explanation using appropriate vocabulary and schematic symbols.	Can clearly and accurately create a schematic drawing of a simple circuit using schematic symbols and write an accurate explanation using vocabulary and symbols.	Can create a schematic drawing using 2 of the schematic symbols and write a simple explanation of a circuit. May have inaccuracies.	Can create a drawing of a simple circuit using one schematic symbol.
Analyze why the bulb does/doesn't light as well as problem solve a circuit.	Can clearly and accurately explain why a circuit is or is not functioning, using visual representation and written explanations with appropriate scientific vocabulary.	Can explain why a circuit is using a visual representation and written explanations with appropriate scientific vocabulary.	Can demonstrate why a circuit is functioning with a visual representation.	Can draw a circuit .

Use new scientific vocabulary	Regularly uses new vocabulary correctly within class discussion as well as within science notebooking.	Uses new vocabulary correctly most of the time within class discussion/ science notebooking.	Sometimes uses new vocabulary during discussion/ science notebooking.	May use new vocabulary occasionally within either discussion or science notebooking.

Name: _____ Class: _____ Date: _____

Electricity: Understanding Insulators and Conductors

Directions: Test the materials to indicate which are conductors or insulators. Mark an X in the correct column-conductor or insulator.

Test Object	Conducts Electricity	Does not conduct electricity	Explanation/Reasoning

Science Notebook Reflection:

How do you know if a material conducts electricity?

How do you know if a material does not conduct electricity?

What objects can be used to complete a circuit and allow the bulb to light?

What material do all conductors have in common?

Electricity Task Card

Step 1: Take a test circuit and test objects.

Step 2: Test each object one at a time by touching the end of each open wire on two separate places on the object, thereby creating a circuit.

Step 3: Observe whether the bulb lights when you place each item into the circuit.

Step 4: Mark an “X” in the correct column (Conducts Electricity or Does Not Conduct Electricity) to show what you observed for each object you tested.

Step 5: Respond to the questions at the bottom of your sheet.

Electricity Task Card

Step 1: Take a test circuit and test objects.

Step 2: Test each object one at a time by touching the end of each open wire on two separate places on the object, thereby creating a circuit.

Step 3: Observe whether the bulb lights when you place each item into the circuit.

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Step 3: Observe whether the bulb lights when you place each item into the circuit.

Step 4: Mark an “X” in the correct column (Conducts Electricity or Does Not Conduct Electricity) to show what you observed for each object you tested.

Step 5: Respond to the questions at the bottom of your sheet.

Sentence Frames:

I can predict that _____ because _____.

I wonder what would happen if _____.

The evidence I use to support _____ is _____.

I have a question about _____.

I agree with _____ because _____.

I disagree with _____ because _____.

Measurement - Linear (Performance)

Topic: Measurement - Linear (Performance)
Date:
Subject/Grade level: Science/Grade 4
Materials: ● 1 set per group ○ tray (to hold materials) ○ Linear Measurement Task Card ○ 1 standard ruler with both centimeters and inches ○ 3 cups, various sizes, teacher labeled by size #1, #2, #3 (smallest to largest) ○ 3 paper plates, various sizes labeled #1, #2, #3 ○ 1 measuring cup or beaker ○ 1 large cup of water ○ paper towels ● Measurement: Linear Task Recording Sheet (1 per student) ● markers ● chart paper ● Measuring in Centimeters Recording Sheet (1 per student) Teacher Demonstration: ● 1 standard ruler with both centimeters and inches ● 1 empty paper towel roll Anchor charts: ● Linear Measurement (teacher created) Media/Text Resources: ● How Big Is A Foot? By Rolf Myler - Text or video https://www.illustrativemathematics.org/content-standards/tasks/1313 Optional Resources: ● other measurement tools (tape measures, yardsticks, meter sticks, trundle wheel, etc...) ● Word Bank ● Sentence Frames ● Claim-Evidence (Supportive Differentiation Document) ● Checklist for Linear Measurement Task Key Vocabulary: ● beaker ● centimeter(s) ● diameter

- height
- length
- linear measurement
- milliliter
- width

NYSED Standards:

Standard 1 Mathematical Analysis Key Idea 1
Abstraction and symbolic representation are used to communicate mathematically.

Standard 1 Mathematical Analysis Key Idea 3
Critical thinking skills are used in the solution of mathematical problems.

Standard 4 The Physical Setting Key Idea 3
Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Process Skills
(ii) safely and accurately use the following tools: hand lens, ruler (metric), balance, gram weights, spring
scale, thermometer (C°, F°), measuring cups, graduated cylinder, timepiece(s)
(vi) select appropriate standard and nonstandard measurement tools for measurement activities
(vii) estimate, find, and communicate measurements, using standard and nonstandard units
(viii) use and record appropriate units for measured or calculated values
(xiii) observe, analyze, and report observations of objects and events
(xv) observe, identify, and communicate cause and effect relationships

Science and Engineering Practices	Crosscutting Concepts
• Planning and carrying out investigations • Constructing explanations (science) and designing solutions (engineering)	• Patterns • Scale, Proportion, and Quantity

Lesson objective(s):

Students accurately measure and record measurements in inches and centimeters, for height, width and diameter.

- I can accurately measure in inches and centimeters using a ruler.
- I can define the terms height, width and diameter.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Provide sentence frames.
  - Provide strategic partnerships to facilitate discussion.
  - Label all materials in child's first language and English
  - Organize students in mixed ability groups.
  - Provide scaffolds: word walls, anchor charts, everyday life materials and visuals to support them in demonstrating their understanding.

- Students that need more support:
  - Begin their evaluation/reflection by illustrating their thinking using the concept wall or anchor charts to demonstrate their understanding.
  - Provide one-to-one coaching and small group support.
  - Provide Word Bank.
  - Provide graphic organizers: Claim, Evidence and Reasoning
  - Provide Differentiation Task checklist,

- Students who need more Challenge:
  - Students can practice using other measurement tools (tape measures, yardsticks, meter sticks, trundle wheel, etc...)
  - Students can create their own measurement tools.

ENGAGE (session 1 - 10 minutes)

Teacher asks students the question: "How big is a bed?" Students engage in a "Turn and Talk." Then teacher asks the students how they would describe the size of a bed.

Teacher next reads the book by Rolf Myler or shows the video reading of the book. As students hear the story, teacher pauses at certain parts to engage students in a discussion intended to develop student awareness about the need for standardized measurement. Teacher asks the following questions and records student responses on chart paper.

- Was the bed too small/too big for the Queen? (video stop at 2:05) (Too small)
- Why do you think the bed was too small for the queen? (Accept various answers from students)
- Why did the bed later in the story fit the Queen perfectly? (The King's foot was used as standardized measurement for the Queen's bed)

EXPLORE (session 1 - 15 minutes)

Teacher tells students in the story a non-standard unit was used. Scientists need to measure accurately and must use standard units like what you find on rulers and other measurement

tools. They will be learning how to accurately measure height and diameter in inches and centimeters. Teacher holds up an empty paper towel roll and asks, What is the height of this paper towel roll? The teacher asks for a volunteer to measure the height and write the data on the whiteboard. Teacher clears up any misconceptions about height. Teacher then asks for a second volunteer to measure the diameter of the paper towel roll and write the data on the whiteboard. Teacher clears up any misconceptions about diameter. Teacher then tells students that they will work together to practice measuring height and diameter using various cups. Students are asked to pick up their materials, including one Linear Measurement Task Card and Linear Task Recording Sheets (one for each student). Teacher explains that students will measure as a group and record independently, then directs them to begin the exploration task. Teacher circulates the room providing supports through teacher questioning where necessary.

EXPLAIN session 1 (5 minutes)

After students are finished with their investigation, have a few groups share out their results. Teacher should quickly query the students about data that doesn't match up, asking, If we all had the same size cups, wh isn't all of the data the same? (Students may have used the wrong unit of measurement or didn't measurement precisely.) Ask students, Why is it importance to measure accurately and precisely? Think about our class reading, discussion, and the data you all took today. (Example: If all the students were working for the sam company creating a product that required measuring, everyone would have to measure accurately and precisely so the product would always turn out the same, no matter who was measuring.)

ELABORATE (session 1 - 10 minutes)

Students continue exploring the need for measuring with accuracy and precision by working in partners to estimate and measure the length of objects found around the classroom that are smaller and larger than a foot in size. Students record all their data on the Measuring in Feet Recording Sheet. Teacher may need to model and review estimation strategies.

EVALUATE session 1 (5 minutes)

Students write Claim, Evidence and Reasoning statements in their science notebooks that show their understanding of the necessity of using standardized units versus non-standardized units (as in the story), using their notes, data and class discussion.

ASSESSMENT OPPORTUNITIES

Summative:

- Completed journal reflections, data tables and written parts of the Linear Task Recording sheet (Session 1: Explore)

- Observations of students as they measure the height and diameter of various cups. (Session 1: Explore)
- Completed journal reflections, data tables and written parts of the Measuring in Feet Recording Sheet (Session 1: Elaborate)

Formative:

- Using their notes, data and class discussion, students write Claim, Evidence and Reasoning statements in their science notebooks that demonstrate their understanding of the necessity for standardized measurement. (Session 1: Evaluate)

Linear Measurement Task Card Step 1: Measure the inside diameter of the top of cup #1 in both inches and centimeters. Record your answers. Step 2: Measure the height of cup #1 in both inches and centimeters. Record your answers. Step 3: Pour 40 mL of water into cup #1. Step 4: Measure the height of the water in cup #1 in both inches and centimeters. Record your answers. Step 6: Repeat steps 1-4 for cups #2 and and #3.	Linear Measurement Task Card Step 1: Measure the inside diameter of the top of cup #1 in both inches and centimeters. Record your answers. Step 2: Measure the height of cup #1 in both inches and centimeters. Record your answers. Step 3: Pour 40 mL of water into cup #1. Step 4: Measure the height of the water in cup #1 in both inches and centimeters. Record your answers. Step 6: Repeat steps 1-4 for cups #2 and and #3

Word Bank (Supportive Differentiation Templates)

Word	Student Definition	Illustration
Word bank: beaker, centimeter(s), diameter, height, length, linear measurement, milliliter, width		

Name: _____ Class: _____ Date: _____

Linear Task Recording Sheet

Directions: Use the Task Card and materials to complete the charts below.

Cup #	Cup Height (in inches to the nearest ¼ inch)	Cup Height (in centimeters)	Inside Diameter (in inches to the nearest ¼ inch)	Inside Diameter (in centimeters)
Cup #1				
Cup #2				
Cup #3				

Cup #	Height of 40 mL of water (in inches)	Height of 40 mL of water (in centimeters)
Cup #1		
Cup #2		
Cup #3		

Journal Reflection Question:

Is the height of water in each of the cups the same? Why or why not? Explain.

Is the volume of water the same? Why or why not? Explain

Name: _____ Class: _____ Date: _____

Measuring in Centimeters Recording Sheet

Directions: Locate five objects in the classroom, and measure the length of three of your objects. Record the three measurements on the chart in centimeters. For the last two objects estimate their length in centimeters and record. Measure the last two objects. Compare and contrast your estimate with the actual measurement. Record the measurements on the chart.

	Objects	**Measure the length of the objects in centimeters**
Object 1		
Object 2		
Object 3		

	Estimate the length in centimeters	**Measure the length in centimeters**	**Compare and Contrast the estimate with the actual measurement**
Object 4			
Object 5			

Journal Reflection Question:

What strategy or reference did you use when estimating if an object was greater than or less than a foot? Explain your thinking in your journal. Include a diagram if it helps to explain your thinking.

Sentence Frames

I can predict that _____ because _____.

I wonder what would happen if _____.

The evidence I use to support _____ is _____.

I have a question about _____.

I agree _____ because _____.

I disagree _____ because _____.

Claim-Evidence (Supportive Differentiation Document)

Claim	Evidence
I claim that standard units of measurement are necessary.	

Name: _____ Class: _____ Date: _____

Checklist for Linear Measurement Task

Completed	To Do	Teacher/Student Comment
	I completed each part of the task.	
	I filled in each part of my data charts.	
	I wrote an answer to each of the question prompts.	
	I used scientific tools to measure correctly and carefully.	
	I read ALL of the directions on the task card.	
	I used evidence and clear reasoning to support my claims.	

CHAPTER 4 SCIENCE PERFORMANCE TEST

Lesson 1: Measurement

Topic: Measurement
Date:
Subject/Grade level: Science/Grade 4
Materials: ● 1 set per group/table ○ Liquid Measurement Task Card ○ A 100 mL beaker with clearly marked gradations ○ small pitcher of water A balance ○ A set of gram masses (two 20g, three 10g, four 5g, and 10 1g pieces for a total of 100g) ○ Five marbles ○ Two or three paper towels ● Water Displacement and Liquid Measurement Recording Sheet (1 per student) Anchor charts: ● Liquid Measurement (teacher created) Media/Text Resources: ● Aesop's Fable: The Crow and the Pitcher http://www.taleswithmorals.com/aesop-fable-the-crow-and-the-pitcher.htm Optional Resources: ● Word Bank (Supportive Differentiation Templates) ● Checklist for Measurement Task ● Sentence Frames ● Claim Evidence (Supportive Differentiation Document) Key Vocabulary: ● balance ● beaker ● difference ● displacement ● grams ● marble ● milliliter

- volume
- water

NYSED Standards:

Standard 1 Mathematical Analysis Key Idea 1
Abstraction and symbolic representation are used to communicate mathematically.

Standard 1 Mathematical Analysis Key Idea 3
Critical thinking skills are used in the solution of mathematical problems.

Standard 4 The Physical Setting Key Idea 3
Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Process Skills
(ii) safely and accurately use the following tools: hand lens, ruler (metric), balance, gram weights, spring scale, thermometer (C°, F°), measuring cups, graduated cylinder, timepiece(s)
(vi) select appropriate standard and nonstandard measurement tools for measurement activities
(vii) estimate, find, and communicate measurements, using standard and nonstandard units
(viii) use and record appropriate units for measured or calculated values
(xiii) observe, analyze, and report observations of objects and events
(xv) observe, identify, and communicate cause and effect relationships

Science and Engineering Practices	Crosscutting Concepts
• Asking questions (science) and defining problems (engineering) • Planning and carrying out investigations • Engaging in argument from evidence	• Patterns • Scale, Proportion, and Quantity • Structure and Function

Lesson objective(s):

Students can explain the terms water displacement, mass, volume, and learn to use a standard tool for measuring volume (beaker).

- I can explain the terms water displacement, mass and volume.
- I can accurately use a tool for measuring volume using the appropriate standard units.

Differentiation strategies to meet diverse learner needs:

- Supports for English Language Learners (ELL) students:
  - Provide sentence frames.
  - Provide strategic partnerships to facilitate discussion.
  - Label all materials in child's first language and English.
  - Organize students in mixed ability groups.
  - Provide scaffolds: word walls, anchor charts, everyday life materials and visuals to support them in demonstrating their understanding.

- Students that need more support:
  - Provide scaffolds: word walls, anchor charts,and visuals to support them in demonstrating their understanding.
  - Provide one-to-one coaching and small group support.
  - Provide or have students create a word bank with definitions and visuals.
  - Provide graphic organizers: Claim, Evidence and Reasoning T-Charts
  - Provide student checklists.

- Students that need more challenge:
  - Practice using other measurement tools (syringes, droppers, etc).
  - Repeat the activities using alternative liquids (rubbing alcohol, corn syrup, etc).
  - Calculate water displacement using objects that do not sink.
  - Create their own measurement tools.

ENGAGE (session 1 - 10 minutes)

Teacher read aloud the Aesop's Fable, The Crow and the Pitcher. Teacher asks:

- What was the crow attempting to do? (drink water)
- What was his method for doing this? (dropping pebbles into the water).
- How did the water finally get to a level where the crow could reach it with its beak? (dropping pebbles into the pitcher took up space and caused the water level to rise/increase).

EXPLORE (session 1 - 20 minutes)

Each group/table is equipped with various science tools and materials. The teacher can set this up before class or students can be asked to pick up the tools, materials and Liquid Measurement Task Card, and set everything up as illustrated on the Water Displacement and Liquid Measurement Recording Sheet.

Teacher asks students to look closely at the beaker. Then teacher presents the following questions and records student responses on chart paper/board:

- When you look closely at the beaker, what do you notice? (It has numbers, the number values increase as you go up the beaker, the unit of measurement is milliliters, etc.)
- What do you think a beaker is used for? (To measure water/liquids/volume.)

Teacher asks students to add 60 mL of water to the 100 mL beaker. Teacher points out that the volume of water in the beaker is 60mL. Teacher creates vocabulary chart/board and asks: What do you think the word volume means? (Volume is the amount of space the water is taking up in the beaker.) What is a milliliter? (The standard metric unit for measuring liquids.)

Teacher directs students to begin the Water Displacement and Liquid Measurement investigation. Teacher circulates the room providing help to those groups that need assistance.

EXPLAIN session 1 (5 minutes)

After students complete the investigation, the teacher asks:

- Make a connection between the fable , The Crow and the Pitcher, and the investigation. (The marbles also take up space and cause the water level to increase.)

ELABORATE session 1 (5 minutes)

Teacher asks:
- What happens when you get into a bathtub full of water? (The water level increased/went up.)
- Why does this happen? (Our body takes up space.)

EVALUATE session 1 (5 minutes)

Teacher projects journal reflection question: Use evidence from your investigation to write a scientific explanation of why the crow added rocks to the pitcher.

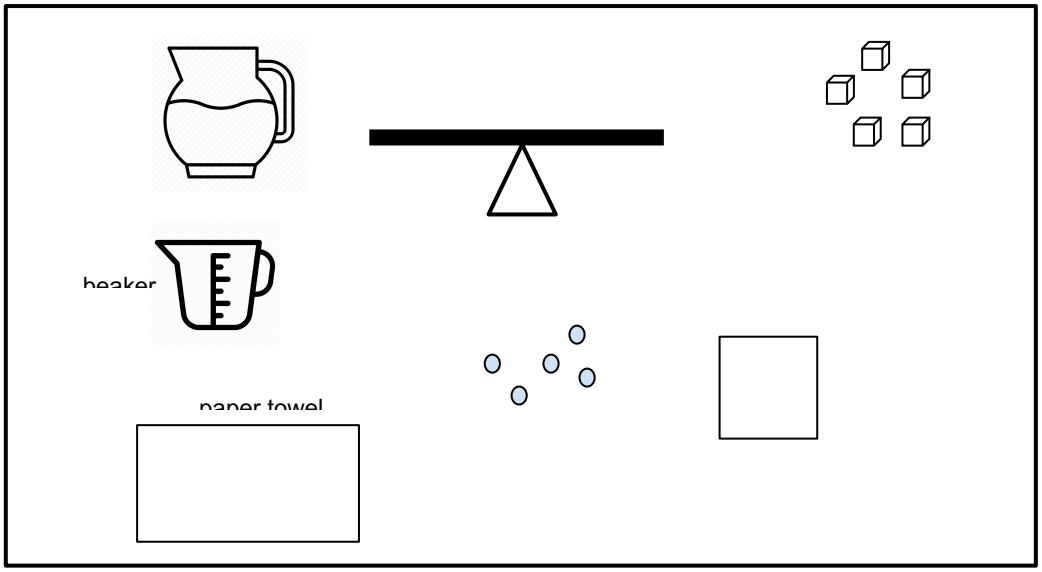
ASSESSMENT OPPORTUNITIES

Formative:
- Completed data recorded on the Water Displacement and Liquid Measurement Recording Sheet (Session 1: Explore)
- Observations of students as they measure volume with their groups. (Session 1: Explore)
- Student questioning and discussions. (Session 1: Elaborate)

Summative:
Students respond to the Journal Reflection Question in their science notebooks to demonstrate their understanding of the terms displacement, mass, and volume.

Name: _____ Class: _____ Date: _____

Water Displacement and Liquid Measurement Recording Sheet



Follow the directions on your Liquid Measurement Task Card to complete the table below.

Object	**Mass in grams (g)**
Empty Measuring Cup (beaker)	
Measuring Cup (Beaker) + Water (40mL)	
Water without Measuring Cup (Beaker)	
Water + Measuring Cup (Beaker) + Marbles	
Marbles	

Journal Reflection Question

Use evidence from your investigation to write a scientific explanation of why the crow added rocks to the pitcher.

Liquid Measurement Task Cards

Liquid Measurement Task Card INSTRUCTIONS 1. Measure and record the mass in grams of the empty beaker on the data table. 2. Add 60 mL of water to the beaker. 3. Measure and record the mass in grams of the beaker with the water inside. 4. Calculate the mass in grams of only the water. Record data on data table. 5. Place the five marbles into the beaker. Find the total mass in grams of all of the following: the water, marbles, and beaker. 6. Use your data to calculate the mass in grams of just the marbles. 7. Place all the tools back in their original position as shown in the diagram.	Liquid Measurement Task Card INSTRUCTIONS: 1. Measure and record the mass in grams of the empty beaker on the data table. 2. Add 60 mL of water to the beaker. 3. Measure and record the mass in grams of the beaker with the water inside. 4. Calculate the mass in grams of only the water. Record data on data table. 5. Place the five marbles into the beaker. Find the total mass in grams of all of the following: the water, marbles, and beaker. 6. Use your data to calculate the mass in grams of just the marbles. 7. Place all the tools back in their original position as shown in the diagram.

Word Bank (Supportive Differentiation Templates)

Word	Student Definition	Illustration
Word bank: balance, beaker, difference, displacement, grams, marbles, milliliter, volume, water		

Claim Evidence (Supportive Differentiation Document)

Claim	Evidence
Marbles take up space.	

Lesson 2: Magnetism and Electricity

Title: Magnetism and Electricity Task
Subject/Grade level: Science/Grade 4
Date:

Materials:

- one set per group/table
  - Electricity Task Card
  - Magnetism Task Card
  - Magnetism and Electricity Recording Sheet
  - pencils
  - disk-shaped magnet
  - orange paper square
  - brass paper fastener
  - 1 gram piece
  - steel binder clip
  - wooden craft stick
  - steel washer
  - aluminum foil
  - assembled circuits (using a battery, bulb, and three wires)
  - bar magnet

Anchor Charts:

- Magnetism and Electricity (teacher created)

Media/Text Resources:

- Magnetism: Crash Course Physics #32 - (min. 1:12 until min. 4:32)
  https://www.youtube.com/watch?v=s94suB5uLWw

Optional Resources:

- Sentence Frames
- Checklist for Magnetism and Electricity Task
- Word Bank (Supportive Differentiation Document)
- Claim Evidence (Supportive Differentiation Document)

Key Vocabulary:

- attract
- bar magnet
- battery
- bulb
- circuit
- conductor
- electricity

- insulator
- magnetism
- North
- repel
- South
- wires

NYSED Standards:

Standard 1 Mathematical Analysis Key Idea 3
Critical thinking skills are used in the solution of mathematical problems.

Standard 1 Scientific Inquiry Key Idea 1
S1.2 Question the explanations they hear from others and read about, seeking clarification and comparing them with their own observations and understandings.
S1.3 Develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed.

Standard 1 Scientific Inquiry Key Idea 3
S3.1 Organize observations and measurements of objects and events through classification and the preparation of simple charts and tables.
S3.2 Interpret organized observations and measurements, recognizing simple patterns, sequences, and relationships.
S3.3 Share their findings with others and actively seek their interpretations and ideas.
S3.4 Adjust their explanations and understandings of objects and events based on their findings and new ideas.

Standard 4 The Physical Setting Key Idea 3
Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Standard 4 The Physical Setting Key Idea 4
Energy exists in many forms, and when these forms change energy is conserved.

Standard 4 The Physical Setting Key Idea 5
Energy and matter interact through forces that result in changes in motion.

Process Skills
(xiii) observe, analyze, and report observations of objects and events
(xx) compare and contrast organisms/objects/events/ in the living and physical environments

Science and Engineering Practices	Crosscutting Concepts
• Asking questions (science) and defining	• Systems and system models

problems (engineering) ● Planning and carrying out investigations ● Constructing explanations (science) and designing solutions (engineering) ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	● Energy and matter: Flows, cycles, and conservation ● Stability and change

Lesson objective(s):

Students differentiate iron and steel from other metals by using a magnet and investigating the properties of magnets

- I can use magnets to attract or repel certain objects.
- I can identify objects that are magnetic and not magnetic.
- I can identify how magnetic forces operate on objects, across distances and, through materials.

Students analyze why a bulb will/will not light in an electric circuit, and identify which materials conduct electricity.

- I can explain why a bulb will not light within an electric circuit.
- I can identify objects/materials that do/do not conduct electricity.

Differentiation strategies to meet diverse learner needs:

- English Language Learners (ELL) students:
  - Provide sentence frames.
  - Create strategic partnerships to facilitate discussion.
  - Begin their evaluation/reflection by illustrating their thinking using word walls, anchor charts, everyday life materials and visuals to support them in demonstrating their understanding.

- Students that need more support:
  - Begin their evaluation/reflection by illustrating their thinking using word walls, anchor charts, everyday life materials and visuals to support them in demonstrating their understanding.
  - Provide one-to-one coaching and small group support.
  - Create a glossary with visuals.
  - Use the following graphic organizers, Word Bank, Claim, Evidence and Reasoning T-Chart and Student Checklist.

- Students that need more challenge:
  - Identify additional objects and classify them as magnetic/not magnetic, conductors/insulators.

ENGAGE (session 1 - 10 minutes)

Students are given an opportunity to reflect and recall learning from their previous study of magnetism and electricity. Students view Magnetism: Crash Course Physics #32 (starting at minute 1:12 until 4:32 - stop before magnitude force equations section of video). Teacher reviews class anchor charts relating to magnetism and electricity.

Teacher poses the question: What are some noticings/connections that you can make from your study of magnetism and electricity?

Teacher creates a student-generated vocabulary chart/board as students share noticings/connections.

EXPLORE (session 1 - 15 minutes) (Kids need the set ups, and discussion of tasks)

Teacher introduces the investigation by saying: Today we will apply our understanding of magnetism and electricity as we work in pairs/small groups. Teacher hands out task cards to each group and two sheets--the Magnetism and Electricity recording/reflection sheets--to each student.

Teacher asks students to read the task card and then work in pairs/small groups to complete both the Magnetism and Electricity recording/reflection sheets.

EXPLAIN (session 1 - 10 minutes)

Teacher note: Objects will be attracted to a magnet based on the amount of iron in the material. Steel is a metal with a high iron content.

Students gather on the rug or in a large group. They bring their completed charts and reflections from both the Magnetism and Electricity recording /reflection sheets and discuss the following questions with a partner during a Turn and Talk:

- Based on your investigation, what can you say about the objects/materials that are magnetic and what can you say about the objects that are not magnetic?
- Based on your investigation what can you say about the objects/materials that conduct electricity and what can you say about the objects that do not conduct electricity?

ELABORATE session 1 (5 minutes)

Teacher leads a whole class discussion focusing on the connection between magnetism and electricity.

- What is the connection between magnetism (a force) and electricity (energy form)?
- Students will write a claim in agreement or in dispute with Karla and Michael based on the investigation questions using their own data.

EVALUATE

Students write a culminating Claim, Evidence and Reasoning statement in agreement or in dispute with Karla and Michael based on the investigation questions in their science notebooks.

ASSESSMENT OPPORTUNITIES

Formative:

- Student data and responses from Electricity and Magnetism sheets during station work. (Session 1: Explore)
- Teacher observations as students work at Electricity and Magnetism stations. (Session 1: Explore)
- Student questioning, discussion and teacher observations. (Session 1: Explain/Elaborate)

Summative:

- Students write a culminating Claim, Evidence and Reasoning statement in agreement or in dispute with Karla and Michael based on the investigation questions in their science notebooks. (Session 1: Evaluate)

Name: _____ Class: _____ Date: _____

Magnetism

Use a magnet to test the objects listed in the below chart. Indicate which items are magnetic and which items are not magnetic by placing an X in the appropriate column.

Objects	**Magnetic**	**Not Magnetic**
Disk-shaped magnet		
Orange paper square		
Brass paper fastener		
Plastic gram piece		
Steel binder clip		
Wooden Stick		
Steel washer		
Aluminum foil		

Based on your investigation, what can you say about the objects that are magnetic? Based on your investigation, what can you say about the objects that are not magnetic?

_____

_____

_____

Michael was conducting an experiment and discovered that the following items were magnetic: disk-shaped magnet, brass paper fastener, steel washer, steel binder clip and aluminum foil. Do you agree or disagree with Michaels results? Use your data above to explain your answer.

_____

_____

_____

Name: _____ Class: _____ Date: _____

Electricity

Using the circuit, test the objects listed in the below chart. Indicate which objects conduct electricity and which objects do not conduct electricity by placing an X in the appropriate column.

Objects	**Conducts Electricity**	**Does Not Conduct Electricity**
Disk shaped magnet		
Paper Orange square		
Brass Paper fastener		
Plastic gram piece		
Steel Binder clip		
Wooden Stick		
Steel Washer		
Aluminum foil		

Based on your investigation, what can you say about objects that conduct electricity? Based on your investigation, what can you say about objects that do not conduct electricity?

_____

_____

_____

Karla was exploring with a magnet and a circuit. She placed the metal ends of each wire on either side of the magnet and noticed that the bulb in the circuit would not light. How would you explain this noticing to Karla? Use evidence from your chart to explain your reasoning.

_____

_____

_____

Electricity Task Card Step 1: Take a circuit and a bag of objects. Step 2: Place each object one at a time in between the two open wires in the circuit. Step 3: Observe whether the bulb lights when you place each item into the circuit. Step 4: Mark an "X" in the appropriate column (Conducts Electricity or Does Not Conduct Electricity). Step 5: Respond to the questions at the bottom of your sheet.	Electricity Task Card Step 1: Take a circuit and a bag of objects. Step 2: Place each object one at a time in between the two open wires in the circuit. Step 3: Observe whether the bulb lights when you place each item into the circuit. Step 4: Mark an "X" in the appropriate column (Conducts Electricity or Does Not Conduct Electricity). Step 5: Respond to the questions at the bottom of your sheet.

Magnetism Task Card Step 1: Hold the magnet like a wand next to each object. Step 2: Observe whether each object is attracted or not attracted to the magnet. Step 3: Mark an "X" in the appropriate column (Magnetic or Not Magnetic). Step 4: Respond to the questions at the bottom of your sheet.	Magnetism Task Card Step 1: Hold the magnet like a wand next to each object. Step 2: Observe whether each object is attracted or not attracted to the magnet. Step 3: Mark an "X" in the appropriate column (Magnetic or Not Magnetic). Step 4: Respond to the questions at the bottom of your sheet.

Sentence Frames:

I can predict that _____ because _____.

I wonder what would happen if _____.

The evidence I use to support _____ is _____.

I have a question about _____.

I agree with _____ because _____.

I disagree with _____ because _____.

Checklist for Magnetism and Electricity Task		
Completed	To Do	Teacher/Student Comment
	I completed each part of the task.	
	I filled in each part of my data chart.	
	I wrote an answer to each of the question prompts.	
	I used the tools correctly and carefully.	
	I read ALL of the directions on the task card.	
	I used evidence and clear reasoning to support my claims.	

Word Bank (Supportive Differentiation Document)

Word	Student Definition	Picture
Word bank: attract, repel, magnetism, bulb, North, South, insulator, conductor, circuit, wires, battery, electricity		

Claim Evidence (Supportive Differentiation Document)

Claim	Evidence
I claim that all metals conduct electricity.	
I claim that non-metal objects are not attracted to magnets.	

Lesson 3: Forces and Motion (Ball and Ramp)

Topic: Force and Motion
Date:
Subject/Grade level: Science/Grade 4
Materials: ● 1 set per station ○ Inclined Plane Task Card ○ 1 heavy marble (or larger) ○ 1 light marble (or smaller) ○ 1 ruler (for inclined planes) ○ blocks or books to raise the inclined plane to designated height ○ 1 index card (3" X 5") ○ 1 Distance Measurement Mat ● Inclined Plane: Data Sheet (one per student) ● science notebooks Anchor charts ● Force and Motion (teacher created) Optional Resources: ● miscellaneous balls/spheres ● Word Bank (Supportive Differentiation Templates) ● Claim Evidence (Supportive Differentiation Templates) ● Checklist for Force and Motion Task Key Vocabulary: ● after ● before ● decrease ● distance ● finish line ● height ● inches ● increase ● release point ● ruler ● trial
NYSED Standards: Standard 1 Mathematical Analysis Key Idea 1

Abstraction and symbolic representation are used to communicate mathematically.

Standard 1 Mathematical Analysis Key Idea 2
Deductive and inductive reasoning are used to reach mathematical conclusions.

Standard 1 Mathematical Analysis Key Idea 3
Critical thinking skills are used in the solution of mathematical problems.

Standard 1 Scientific Inquiry Key Idea 2
S2.3 Carry out their plans for exploring phenomena through direct observation and through the use of simple instruments that permit measurement of quantities such as length, mass, volume, temperature, and time.

Standard 1 Scientific Inquiry Key Idea 3
S3.2 Interpret organized observations and measurements, recognizing simple patterns, sequences, and relationships.
S3.4 Adjust their explanations and understandings of objects and events based on their findings and new ideas.

Standard 1 Engineering Design
T1.1–T1.5 Engineering design is an iterative process involving modeling and optimization to develop technological solutions to problems within given constraints.

Standard 4 The Physical Setting Key Idea 5
Energy and matter interact through forces that result in changes in motion.

Standard 6 Interconnectedness Key Idea 5
Patterns of Change - Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Standard 6 Interconnectedness Key Idea 6
Optimization - In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

Process Skills
(xiii) observe, analyze, and report observations of objects and events
(xiv) observe, identify, and communicate patterns
(xix) make predictions based on prior experiences and/or information
(xxi) identify and control variables/factors

Science and Engineering Practices	Crosscutting Concepts
• Asking questions (science) and defining problems (engineering) • Developing and using models	• Cause and Effect • Systems and System Models

● Planning and carrying out investigations ● Constructing explanations (science) and designing solutions (engineering) ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	

Lesson objective(s):

Students explore how energy and matter interact through forces that result in changes in motion, and identify patterns of change necessary for making predictions.

- I understand how energy and matter interact through forces that result in changes in motion.
- I can Identify patterns of change necessary for making predictions.

Differentiation strategies to meet the needs of diverse learners:

- Supports for English Language Learners (ELL) students:
  - Provide sentence frames.
  - Provide strategic partnerships to facilitate discussion.
  - Provide scaffolds: word walls, anchor charts, real life manipulatives and visuals to support students in demonstrating their understanding.

- Students that need more support:
  - Provide scaffolds: word walls, anchor charts, real life manipulatives and visuals to support students in demonstrating their understanding.
  - Provide one -to-one coaching and small group support
  - Provide a glossary with visuals.
  - Student-created glossary with visuals
  - Provide tables to organize information and thinking (see below). Additional supports such as word banks, graphic organizers, Claim Evidence and Reasoning T-Charts, and Student Checklist can also be used.

- Students that need more Challenge:
  - Create inclined planes with various degrees of steepness and identify the advantages and disadvantages of each design.

ENGAGE session 1 (5 minutes)

Teacher begins by asking students if they have ever been on a slide.

- Think-Pair-Share:
  - How did the height of the slide affect your movement down the slide?

- What have you done to make yourself move faster? slower?

EXPLORE (session 1 - 15 minutes)

Students now work in small groups/pairs to complete the task on the Inclined Plane Task Card.

- Students assemble an inclined plane using materials provided.
- Students use a folded index card to create an obstacle that will be struck and pushed by a marble rolled down the inclined plane.
- Prior to releasing the marble, students make predictions related to the distance the index card/obstacle will move when the marble is released (3, 6, and 12 inch mark) on the inclined plane/ruler, then record the actual distance the index card/obstacle moved on the Distance Measuring Mat provided.
- Students record their measurements on the Inclined Plane: Data Sheet, conducting three trials for each release point.

EXPLAIN session 1 (5 minutes)

- Students briefly share some of their observations with the class. Then students complete their journal reflection questions.

- How does the height or steepness of the inclined plane affect the motion of the ball?
- How does the distance the index card/obstacle moves relate to the release point of the marble?
- How will changing the mass of the marble affect the distance the index card/obstacle moves?

ELABORATE (session 1 - 15 minutes)

- Students test different variables using the same procedure followed in the Explore section above. Students reflect on the outcome of their investigations. Some possible questions/tasks to support and guide student thinking are:
  - Make a claim about how the type of ball used affects the distance the object moves.
  - Make a claim explaining how two different variables produce two different results.
  - What can you change to increase the distance the obstacle will move on the Distance Measuring Mat?

EVALUATE session 1 (5 minutes)

Students write Claim, Evidence and Reasoning statements in their science notebooks that shows their understanding of how a change in the ball's force affects its motion.

ASSESSMENT OPPORTUNITIES

Formative:

- Student data and responses from Inclined Plane: Data Sheet during station work. (Session 1: Explore)
- Student questioning, discussion and teacher observations. (Session 1: Engage/Explore)
- Teacher observations as students work at Inclined Plane stations. (Session 1: Explore)

Summative :

- Students write Claim, Evidence and Reasoning statements in their science notebooks that shows their understanding of how force affects motion. Their claim focuses on the relationship between the distance the index card/obstacle moved and the height of the release point. (Session 1: Evaluate)

Name: _____ Class: _____ Date: _____

Inclined Plane: Data Sheet

Directions: Complete the table below and then answer the questions based on your data.

Type of ball used: _____

Inclined Plane/Ramp Height	Release Point	Index Card Obstacle (Where did the index card end up?)		
		Trial 1	Trial 2	Trail 3
Height: _____ cm. (less steep)	5 centimeters			
	10 centimeters			
	15 centimeters			
Height: _____ cm. (more steep)	20 centimeters			
	25 centimeters			
	30 centimeters			

Extension Activities:

Choose one variable in your investigation. For example, test a different type of ball, create a different obstacle, change the incline height, etc. First make a prediction as to how far the obstacle will move on the Distance Measurement Mat. What do you think will happen? Then test your variable and record your data in your notebook. What did you discover?

Distance Measurement Mat
5 centimeters
10 centimeters
15 centimeters
20 centimeters
25 centimeters
30 centimeters
35 centimeters
40 centimeters
45 centimeters Finish Line

Inclined Plane Task Card

Step 1: Use your materials to create an inclined plane at least two inches in height. You can do this by raising one end of the ruler using blocks or books. The other end of the ruler lays flat on the table.

Step 2: Measure the height of your inclined plane in inches. Record the height.

Step 3: Place the Distance Measurement Mat against the end of the ruler.

(note: mat not shown in image above)

Step 4: Fold an index card in half and place it against the bottom of the ruler. See image above.

Step 5: Release the marble from the 3 inch mark aand record the distance the index card/obstacle moves on the Distance Measuring Mat. Do this three times (trials) and record your results each time.

Step 6: Repeat Step 4, releasing the marble three times (trials) each for the 6 inch,and 12 inch mark.

Journal Reflection Questions:

1. How did the height of the ruler and the release points of the marble affect the marble's speed and force? Discuss and explain.
2. How could you change the inclined plane to make the index card/obstacle move a greater distance? Discuss and explain.
3. What did you discover when you tested a variable during your extension activity? Discuss and explain.

Inclined Plane Task Card

Step 1: Use your materials to create an inclined plane at least two inches in height. You can do this by raising one end of the ruler using blocks or books. The other end of the ruler lays flat on the table.

Step 2: Measure the height of your ramp in inches. Record the height.

Step 3: Place the Distance Measurement Mat against the end of the ruler.

(note: mat not shown in image above)

Step 4: Fold an index card in half and place it against the bottom of the ruler. See image above.

Step 5: Release the marble from the 3 inch mark aand record the distance the index card/obstacle moves on the Distance Measuring Mat. Do this three times (trials) and record your results each time.

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3. What did you discover when you tested a variable during your extension activity? Discuss and explain.

Word Bank (Supportive Differentiation Templates)

Word	Student Definition	Illustration
Word bank: release point, height, ruler, distance, inches, before, after, finish line, trial, increase, decrease		

Claim Evidence (Supportive Differentiation Templates)

Claim	Evidence
I claim that ...	

Name: _____ Class: _____ Date: _____

Checklist for Force and Motion Task

Completed	To Do	Teacher/Student Comment
	I completed each part of the task.	
	I completed each part of my data charts.	
	I wrote an answer to each of the question prompts.	
	I used ALL of the tools correctly and carefully.	
	I read ALL of the directions on the task card.	
	I used evidence and clear reasoning to support my claims.	
	I was careful when placing the ball at the release point.	

Sentence Frames:

I can predict that _____ because _____.

I wonder what would happen if _____.

The evidence I use to support _____ is _____.

I have a question about _____.

I agree _____ because _____.

I disagree _____ because _____.