

Scientific Inquiry, Episode 1

Teacher's Guide

Grade Level: K-2

Curriculum Focus: Science

Lesson Duration: 1-2 class periods

Program Description

Protecting Our Earth (6 min.)—See how to protect our planet from pollution.

Matter (6 min.)—Discover everyday examples of matter and explore how matter changes from one form to another.

Sound (7 min.)—Examine how sounds are created and learn how we measure noise.

Onscreen Questions

- What is one way you can reduce waste?
 - What is matter?
 - How does sound travel?
-

Lesson Plan

Student Objectives

- Describe ways in which people affect the environment.
- Discover how pollution harms plants and animals.
- Demonstrate ways to reduce, reuse, and recycle waste at school.

Materials

- *Scientific Inquiry, Episode 1* program
- Latex or plastic gloves, 1 pair per student
- Garbage bags
- Poster board, 1 sheet per student group
- Pencils, erasers, and rulers
- Crayons or markers
- Computer with Internet access (optional)

Procedures

1. Discuss pollution and the ways in which humans negatively affect the environment. Ask the students: What is pollution? What kinds of human activities create pollution? A good way to introduce this topic is to watch "Protecting the Earth," a segment in *Scientific Inquiry, Episode 1*.
2. After watching the segment, ask students to describe examples of litter or pollution they have experienced. How does litter and pollution affect plants and animals? Talk about problems that may occur when trash is not properly disposed of.
3. Take the class to the playground, lunch area, or another enclosed school area where trash is often found. Divide students into groups of three or four. Give each group a garbage bag and each student a pair of protective gloves, have the students spend about 20 minutes collecting trash.
4. Then bring the class to a contained area outside the classroom and hold up samples of what they collected. **NOTE: Be sure you and the students do not remove protective gloves yet.** Discuss the types of things that were found. Which could have been recycled or reused? Discuss ways some trash items could have been avoided in the first place. (Example: Instead of buying small bags of chips, a family could purchase a large bag and pack chips in a reusable container everyday.)
5. Return to the classroom to discuss what students have learned about the trash they found at school. Reiterate easy ways to help reduce the amount of waste people create. Have students remain in their groups and ask them to discuss pollution and ideas for reducing, reusing, and recycling waste.
6. Then have each group create a poster presentation that shows ways in which students, teachers, and others at school can reduce, reuse, and recycle waste. Each poster should include at least two facts about pollution and two ways to reduce, recycle, or reuse waste at school. Encourage students to be creative and make colorful posters. Students may find the following Web sites helpful:

<http://www.epa.gov/recyclecity/>
<http://www.epa.gov/kids/index.htm>
7. Have students present their posters to the class. Arrange for volunteers to present their posters to other classrooms and talk about ways to reduce, reuse, and recycle waste at school. Hang the finished posters in visible areas around the school to show others how your students suggest preserving our natural resources and protecting our environment.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class and group discussions; fully participated in the collecting-trash activity; and designed a creative and informative poster presentation with their group that met all of the criteria (at least two facts about pollution and two ways to reduce, recycle, or reuse waste).

- **2 points:** Students participated in class and group discussions; somewhat participated in the collecting-trash activity; and designed an adequate and somewhat informative poster presentation with their group that met most of the criteria (one fact about pollution and one way to reduce, recycle, or reuse waste).
- **1 point:** Students participated minimally in class and group discussions; did not participate in the collecting-trash activity; and did not help their group design a poster or as a group designed an incomplete and somewhat informative poster presentation that met only one aspect of the criteria (one fact or no facts about pollution and one or no way to reduce, recycle, or reuse waste).

Vocabulary

exhaust

Definition: Waste gasses that are sent out from an engine

Context: Cars, trucks, and buses create exhaust, a common type of pollution.

pollution

Definition: Harmful or poisonous substances that dirty the air, water, or land

Context: Pollution can be dangerous to plants and animals, including people.

recycle

Definition: To convert waste into a form in which it can be reused

Context: One way of making less trash is to recycle papers and plastics.

waste

Definition: An unusable or unwanted substance or material

Context: We can take simple steps to help reduce waste and reuse goods.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Science as Inquiry: Understandings about scientific inquiry
- Life Science: Organisms and environments; Populations and ecosystems; Interdependence of organisms

- Science in Personal and Social Perspectives: Populations, resources, and environments; Personal and community health; Environmental quality; Natural resources

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>

This lesson plan addresses the following national standards:

- Life Skills – Working With Others: Displays effective interpersonal communication skills; Contributes to the overall effort of a group
- Health – Knows environmental and external factors that affect individual and community health
- Technology: Understands the nature of technological design
- Science – Life Science: Understands relationships among organisms and their physical environment

Support Materials

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DVD Content

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How To Use the DVD

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Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

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Curriculum Units – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

Standards Link – Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources – This screen gives the technical support number and Web site address.

Video Index

I. Protecting Our Earth (6 min.)

Humans create a lot of waste that is harmful to the environment. Reducing, reusing, and recycling are some ways to keep our planet cleaner and healthier.

II. Matter (6 min.)

Everything that has mass and takes up space is called matter. Some matter can change forms, like dough to bread or clay to pottery.

III. Sound (7 min.)

Vibrations create sound waves that humans and other animals can hear. Elephants and dolphins communicate using sound that is very high or low pitched and it can't be heard by human ears.

Curriculum Units

1. Reducing Pollution

Pre-viewing question

Q: What are some causes of pollution?

A: Answers will vary.

Post-viewing question

Q: Why is it important to reduce pollution?

A: Answers will vary but may include the idea that pollution harms plants, animals, and fish, and that all living things need clean water to survive.

2. Reduce, Reuse, Recycle

Pre-viewing question

Q: What is the result of leaving lots of trash in one big heap?

A: Answers will vary.

Post-viewing question

Q: What is one way you can reduce waste?

A: Answers will vary but may include using cloth instead of paper towels, glass instead of plastic cups; recycling newspapers, foil, plastic, and glass; or using less water when we brush our teeth.

3. Changing Food Forms

Pre-viewing question

Q: How are some of your favorite foods made?

A: Answers will vary.

Post-viewing question

Q: What is matter?

A: Answers will vary.

4. Making Pottery

Pre-viewing question

Q: What happens if you heat an object?

A: Answers will vary.

Post-viewing question

Q: How does matter can change form?

A: Answers will vary.

5. Music to Our Ears

Pre-viewing question

Q: What are your favorite and least favorite sounds?

A: Answers will vary.

Post-viewing question

Q: How does sound travel?

A: Answers will vary.

6. Animals Can Talk

Pre-viewing question

Q: How do animals communicate?

A: Answers will vary.

Post-viewing question

Q: What is unique about the sounds that elephants and dolphins make?

A: Answers will vary but students may say that elephants make higher- or lower-pitched sounds when they are excited, surprised, or ready to attack, and that dolphins emit clicks that are too high pitched for humans to hear and use the returning bounce of the sound waves to locate objects or food.

Scientific Inquiry, Episode 3

Teacher's Guide

Grade Level: 6

Curriculum Focus: Science

Lesson Duration: 2–3 class periods

Program Description

Planets and Stars (6:29) – Tour the universe to learn more about planets and stars.

End of Dinosaurs (6:00) – Explore two theories behind the mass dinosaur extinction.

How Plants Grow (6:25) – Get a firsthand glimpse of the incredible journey plants must undertake to live.

Built to Fly (3:00) – Learn about the unique physical characteristics that allow birds to fly.

Onscreen Questions

- How did the sun form?
 - Why do some scientists think the dinosaurs became extinct?
 - What is photosynthesis?
 - What is one adaptation birds have that helps them fly?
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Lesson Plan

Student Objectives

- Research and examine current theories behind the mass extinction of dinosaurs.
- Write an essay defending one extinction theory.

Materials

- *Scientific Inquiry, Episode 3* program
- Paper
- Pencils and erasers
- Print resources with information about dinosaur extinction
- Computer with Internet access

Procedures

1. Talk about the extinction of the dinosaurs. A good way to introduce this topic is to view the segment "End of Dinosaurs" in *Scientific Inquiry, Episode 3*. Discuss the two major extinction theories talked about in the program, the intrinsic volcanic eruption theory and the extrinsic meteorite theory.
2. Divide students into groups of two or three and have them use the video, print materials, and the Internet to research the two theories. Each group should be able to answer the following about both theories:
 - What is the theory?
 - According to this theory, describe what happened to the dinosaurs.
 - Who developed this theory and when? (If known)
 - What evidence supports this theory?
 - What are the major differences between the two theories?

The following Web sites have good information about both theories:

- <http://hoopermuseum.earthsci.carleton.ca/impacts/index.htm>
 - <http://web.ukonline.co.uk/a.buckley/dino.htm>
 - <http://www.ucmp.berkeley.edu/diapsids/extincttheory.html>
 - <http://www.enchantedlearning.com/subjects/dinosaurs/>
3. After conducting their research, have the groups share what they found; allow time to discuss and reflect on both theories. Ask the class: What is the most compelling evidence for either theory? Which theory seems more accurate and why?
 4. Next have each student write a one-page essay about what they think caused the mass extinction. Essays should be well organized, legible, and based on the facts and information that students found during their research. Give students time in class and as a homework assignment to write their essays.
 5. Once they have finished their essays, allow volunteers to share what they wrote with the class. Hold a discussion about the students' ideas about the dinosaur extinction. Which theory did most students agree with?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class and group discussions; used research materials independently and wisely; answered the research questions thoughtfully and intelligently; wrote legible, well-organized essays based on their research that demonstrated they knew the subject matter very well.
- **2 points:** Students participated in class and group discussions; used research materials with little teacher supervision; generally answered the research questions; wrote somewhat

legible, well-organized essays based on their research that demonstrated a basic understanding of the subject matter.

- **1 point:** Students participated minimally in class and group discussions; were unable to use research materials without supervision; were unable to answer the research questions without a good deal of help; wrote illegible, incomplete, or disorganized essays that were not based on their research or that demonstrated a lack of understanding of the subject matter.

Vocabulary

crater

Definition: The depression formed by a meteorite or a bowl-shaped depression at the mouth of a volcano

Context: Scientists discovered a crater more than 110-miles wide off the coast of the Yucatan Peninsula in Mexico.

dinosaur

Definition: Any of a group (*Dinosauria*) of extinct, chiefly terrestrial carnivorous or herbivorous reptiles of the Mesozoic era

Context: Some scientists believe that a volcanic eruption caused a lava flow that killed all the dinosaurs on Earth.

extinction

Definition: The condition or process of becoming extinct; the act of dying out

Context: Five major extinctions have occurred in Earth's history.

meteorite

Definition: A stony or metallic mass of matter that has fallen to the Earth's surface from space

Context: The Hoba iron meteorite in Namibia is the largest meteorite known on Earth.

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- Earth and Space Science: Earth's history; Changes in earth and sky

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This lesson plan addresses the following national standards:

- Geography – Physical Systems: Knows the physical processes that shape patterns on Earth's surface
 - Geography – Uses of Geography: Understands how geography is used to interpret the past
 - Science – Life Science: Understands relationships among organisms and their physical environment
 - Science – Nature of Science: Understands the nature of scientific knowledge; Understands the nature of scientific inquiry
-

Support Materials

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Video Index

I. Planets and Stars (6 min.)

Stars are common in the universe, but are planets? Examine our solar system's celestial bodies and see how the sun was born – and how it will die.

II. End of Dinosaurs (6 min.)

Travel to Namibia in Africa to see how a 10-mile-wide asteroid may have led to the extinction of the Earth's non-avian dinosaurs.

III. How Plants Grow (6 min.)

Plants hold the record for being the oldest, and most widely spread, living things on Earth. Take a look at their life cycles, adaptations, and ability to make their own food.

IV. Built to Fly (3 min.)

There's more to flight than having wings and feathers. Discover the many physical features that allow birds to take to the skies.

Curriculum Units

1. Moon Gazing

Pre-viewing question

Q: Do you know of any other planets that have moons?

A: Answers will vary.

Post-viewing question

Q: What makes Saturn's moon Titan unique?

A: It is the only moon with a dense atmosphere.

2. A Middle-Aged Star

Pre-viewing question

Q: What is the sun, and how old is it?

A: This ordinary star is five billion years old.

Post-viewing question

Q: What will happen when the sun expands into a red giant star?

A: As it expands, the planets closest to the sun will be consumed. Hot winds will blast the outer planets, dispersing Jupiter's gas and destroying Saturn's rings. Finally blown out, the sun will then consume itself, shrinking back into a white dwarf star the size of Earth.

3. Pangaea Separates

Pre-viewing question

Q: How many continents does Earth have?

A: Today Earth has seven continents – Africa, Antarctica, Asia, Australia, Europe, North America, and South America.

Post-viewing question

Q: What evidence shows that South America and Africa were once joined?

A: In the program, the evidence cited includes the identical basalt rocks found on both continents and the fact that their shorelines fit together. Fossil and mitochondrial DNA evidence are also mentioned.

4. Asteroid Strike!

Pre-viewing question

Q: In what ways do plants and animals depend on the sun?

A: Answers will vary.

Post-viewing question

Q: What happened when the asteroid hit Earth?

A: The impact of the strike – equal to the world's entire nuclear arsenal exploding a thousand times over – sent out a fireball that engulfed the planet. Enormous fires raged for months, destroying everything in their path. Such an impact also would have triggered earthquakes and volcanoes. Dust and ash from the volcanoes would have plunged the Earth into darkness. The nitrogen, sulfur, and oxygen in the atmosphere would have combined to form acid rain.

5. Plant Diversity

Pre-viewing question

Q: How many plant species do you think exist on Earth?

A: Answers will vary.

Post-viewing question

Q: What are some ways plants have adapted to their environment?

A: Answers will vary, but the examples given in the program are cacti, which need very little water to survive and have stems that can store it, and rain forest leaves, which are often large so they can

soak up as much sunlight as possible and have channels and waxy surfaces so the rain can run off quickly.

6. Chlorophyll's Many Role

Pre-viewing question

Q: What do you think separates plants from animals?

A: Answers will vary.

Post-viewing question

Q: How do chilly temperatures affect plants?

A: In deciduous trees, colder weather triggers the plant to grow a corky membrane between the branch and the leaf. This membrane cuts off the flow of nutrients to the leaf, so the chlorophyll left in the leaf dies. As the chlorophyll dies, the green pigments fade away revealing the brilliant reds, oranges, and yellows of autumn.

7. Taking Flight

Pre-viewing question

Q: Have you ever wished you could fly like a bird?

A: Answers will vary.

Post-viewing question

Q: How do birds soar and glide?

A: They hold their wings steady, catching a ride on rising currents of warm air called thermals. When the thermal cools and stops rising, birds glide downward until they enter another warm current.

Scientific Inquiry, Episode 2

Teacher's Guide

Grade Level: 3–5

Curriculum Focus: Science

Lesson Duration: 2 class periods

Program Description

The Sun and Its Planets (6:36) – Take a journey through the cosmos and learn about the sun and the inner and outer planets.

Changes in Weather and Climate (6:29) – Investigate the difference between weather and climate.

The Rain Forest (3:46) – Explores biodiversity in to Peru's Manu Biosphere Reserve.

Plate Tectonics (2:40) – Learn about Pangaea and the theory of plate tectonics.

Onscreen Questions

- What are the inner planets?
 - What causes rain?
 - What are two characteristics of a rain forest?
 - What is the theory of plate tectonics?
-

Lesson Plan

Student Objectives

- Learn the meaning of the term “rain forest.”
- Discover the importance of protecting tropical rain forests.
- Make mobiles depicting unique animals and plants found in the Amazon rain forest.

Materials

- *Scientific Inquiry, Episode 2* program
- Large index cards, 6 per student
- Wire hangers, 1 per student
- String

- Glue and tape
- Hole puncher
- Scissors
- Pencils, erasers, and rulers
- Crayons or markers
- Print resources with information about and images of the Amazon rain forest and the Manu Biosphere Reserve
- Computer with Internet access (optional)

Procedures

1. Hold a discussion about the Manu Biosphere Reserve and the importance of preserving the Amazon tropical rain forest. A good way to introduce this topic is to show the segment "The Rain Forest" in *Scientific Inquiry, Episode 2*. After watching the segment, talk about what students learned. What does a tropical rain forest look like? How does a rain forest differ from other types of forests? What kinds of plants and animals live there? Why is it important to preserve rain forests?
2. Tell students that they are going to explore life in the Amazon rain forest and create mobiles. To make the mobiles, students will need to find information about six unique plant or animal species, or a combination thereof. On one side of each index card provided, have them include an image of a plant or animal they have researched. On the other side of the card they should write the following information:
 - Name of plant or animal
 - Where it lives in the rain forest
 - For animals: predators and prey
 - For plants: the needs of the plant and animals that depend on it
 - Possible threats to this species
 - Two interesting or unusual facts about this plant or animal

Tell students that they will repeat this process for all six plants or animals. Allow them to cut the cards into different shapes, like the shapes of the plants or animals. Encourage creativity in the project as long as the information is easy to read and the images are clear and colorful. In addition to encyclopedias, magazines, and other print resources you may have, the following Web sites have information about the Manu Biosphere Reserve and the Amazon rain forest that might be useful:

- <http://www.mayuc.com/manu.html>
- <http://gorp.away.com/gorp/location/latamer/peru/manubio.htm>
- <http://www.manu-wildlife-center.com>

- <http://rain-tree.com/index.html>
 - <http://www.worldwildlife.org/wildplaces/amazon/index.cfm>
 - <http://www.blueplanetbiomes.org/rainforest.htm>
3. After completing their cards, students will need to punch holes at the top of each and attach them to the wire hangers with string and glue or tape. Ask volunteers to share their finished mobiles with the class and discuss what they learned. Ask students: What are possible threats to these plants and animals? Why is it important to protect and preserve the rain forest?
 4. Display the mobiles in the classroom so that students may look at them during their free time.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class and group discussions; demonstrated solid understanding of the topic; used research materials independently and wisely; created unique and colorful mobiles that met the stated criteria.
- **2 points:** Students participated in class and group discussions; demonstrated understanding of the topic; used research materials with little teacher supervision; created somewhat unique and colorful mobiles that met most of the stated criteria.
- **1 point:** Students participated minimally in class and group discussions; demonstrated little or no understanding of the topic; were unable to use research materials without teacher supervision; created incomplete mobiles or mobiles that met little to none of the stated criteria.

Vocabulary

ecology

Definition: The science of the relationships between organisms and their environment

Context: During time spent with the squirrel monkeys, Dr. Mitchell figured out their place in the rain forest's intricate ecology.

ecosystem

Definition: An ecological community that functions as a unit with its environment

Context: Many ecosystems throughout the world, including the rain forest, have been damaged or destroyed.

rain forest

Definition: A dense, evergreen forest occupying a tropical region with heavy annual rainfall

Context: Covering about four-and-a-half million acres, the Manu Biosphere Reserve is the largest and most undisturbed rain forest in the world.

species

Definition: A group of related organisms capable of interbreeding

Context: The greatest diversity of animal species is found in a tropical forest.

predator

Definition: An organism that lives by preying on other organisms

Context: The sharp spines of the cactus protect its young from predators.

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 - Geography – Places and Regions: Understands the physical and human characteristics of place
 - Geography – Uses of Geography: Understands global development and environmental issues
 - Science – Life Science: Understands relationships among organisms and their physical environment
-

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Video Index

I. The Sun and Its Planets (7 min.)

Without the sun, life on Earth could not exist. Learn why ours is the only planet in the solar system known to support life and what scientists know about the inner and outer planets.



II. Changes in Weather and Climate (7 min.)

Weather on Earth is constantly changing as conditions in the atmosphere, on land, and on water change. Discover how clouds make rain and why some places are too wet, others are too dry.

III. The Rain Forest (4 min.)

The rain forest is a unique ecosystem that supports a wide variety of life on Earth. Find out how it plays a vital role in helping plants and animals in their daily survival.

IV. Plate Tectonics (3 min.)

Scientists believe the continents were once a single landmass that forces within Earth split apart. Explore plate tectonics and how it continues to shape the planet.

Curriculum Units

1. A Life-Giving Source

Pre-viewing question

Q: How does the sun make life on Earth possible?

A: Answers will vary.

Post-viewing question

Q: What are some characteristics of the sun?

A: Answers may include solar flares, inner core, solar wind, and auroras.

2. The Inner Planets

Pre-viewing question

Q: Do you think life exists on other planets?

A: Answers will vary.

Post-viewing question

Q: What are the inner planets?

A: Mercury, Venus, Earth, and Mars

3. The Outer Planets

Pre-viewing question

Q: What are the outer planets?

A: Saturn, Jupiter, Uranus, Neptune, and Pluto

Post-viewing question

Q: What have scientists learned about Jupiter?

A: Answers may include that Jupiter is the largest planet; that it has no solid surface, is made up of gasses, has violent storms and a red spot twice the size of Earth; and that the probe Galileo

provided data showing Jupiter's atmosphere is drier, windier, and thinner than anyone had considered.

4. Changeable Skies

Pre-viewing question

Q: What is the difference between weather and climate?

A: Answers will vary.

Post-viewing question

Q: What can affect weather and climate?

A: Answers will vary.

5. Clouds

Pre-viewing question

Q: What are clouds made of?

A: Answers will vary.

Post-viewing question

Q: What causes rain?

A: Answers should include evaporating water vapor, waves tossing salt crystals into the air, and wind and fires sending particles airborne.

6. Let It Rain

Pre-viewing question

Q: What are some different kinds of rain?

A: Answers will vary.

Post-viewing question

Q: How can rain be both good and bad?

A: Students may mention benefits that include making tropical forests lush and providing water for plants, animals, and humans. Bad effects include flooding that may cause devastation and death.

7. The Rain Forest

Pre-viewing question

Q: What are some characteristics of a rain forest?

A: Answers will vary.

Post-viewing question

Q: Why do scientists study rain forests?

A: Possible answers include learning about the plants, animals, and trees that live there, determining how each species contributes to the complex environment, and helping to preserve rain forest ecosystems.

8. Earth's Immense Internal Forces

Pre-viewing question

Q: How did the continents form?

A: Answers will vary.

Post-viewing question

Q: What is the theory of plate tectonics?

A: Answers should include that forces within Earth move continents, that continents rest on drifting plates, and that colliding continental plates can cause earthquakes or create mountain ranges.