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MODEL CURRICULUM GRADE 4

EARTH AND SPACE SCIENCE (ESS)

Topic: Earth's Surface

This topic focuses on the variety of processes that shape and reshape Earth's surface.

CONTENT STATEMENT

Earth's surface has specific characteristics and landforms that can be identified.

About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes and ground water.

Earth's surface can change due to erosion and deposition of soil, rock or sediment. Catastrophic events such as flooding, volcanoes and earthquakes can create landforms.

CONTENT ELABORATION

Prior Concepts Related to Surface of Earth

PreK-2: Wind and precipitation can be measured, water can change state, heating and freezing can change the properties of materials, and living things can cause changes on Earth.

Grade 3: The composition and characteristics of rocks and soil are studied.

Grade 4 Concepts

Earth is known as the Blue Planet because about 70 percent of Earth's surface is covered in water. Freshwater is a small percentage of the overall water found on Earth; the majority is oceanic.

There are many different processes that continually build up or tear down the surface of Earth. These processes include erosion, deposition, volcanic activity, earthquakes, glacial movement and weathering.

Beginning to recognize common landforms or features through field investigations, field trips, topographic maps, remote sensing data, aerial photographs, physical geography maps and/or photographs (through books or virtually) are important ways to understand the formation of landforms and features. Common landforms and features include streams, deltas, floodplains, hills, mountains/mountain ranges, valleys, sinkholes, caves, canyons, glacial features, dunes, springs, volcanoes and islands.

Connecting the processes that must occur to the resulting landform, feature or characteristic should be emphasized. This can be demonstrated through experiments, investigations (including virtual experiences) or field observations. Technology can help illustrate specific features that are not found locally or demonstrate change that occurred (e.g., using satellite photos of an erosion event such as flooding).

Future Application of Concepts

Grade 5: Earth is a planet in the solar system that has a unique composition. Global seasonal changes are introduced, including monsoons and rainy seasons, which can change erosion and deposition patterns.

Grades 6-8: Changes in the surface of Earth are examined using data from the rock record and through the understanding of plate tectonics and the interior of Earth. Historical studies of erosion and deposition patterns are introduced, in addition to soil conservation, the interaction of Earth's spheres and ocean features specific to erosion and deposition.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Research a specific weathering feature (such as a sinkhole or cave). Evaluate the risk of collapse and methods of prevention of collapse (using actual data) and recommend one solution based on the scientific data. Create a model (virtual, graphic or 3-D) of the actual cave or sinkhole and demonstrate the risk of collapse and how the suggested preventative measure or solution impacts that risk.	Plan, build and use a model (such as a small-scale stream table) that can demonstrate the formation of a landform or feature that formed through contact with water (alluvial fan, sinkhole, mid-channel bar, canyon, valley, depositional islands). Ask: ***What factors accelerate the processes? What factors must exist for the landform to form?*** Share findings with the class.	Using topographic or aerial maps, locate areas that have been formed through deposition and erosion. Include areas of Ohio that have been impacted by glacial ice or movement. Discuss findings with the class.	Recognize that 70 percent of Earth's surface is water, which is why Earth is known as the Blue Planet. Identify common landforms from maps or graphics.
		Using LANDSAT data, research and locate a specific major landform or geographical feature on Earth that formed through erosion or deposition. Represent findings graphically or orally to the class.	Identify the processes that can change the surface of Earth (e.g., erosion, deposition, volcanic activity, earthquakes, glacial movement and/or weathering).

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- Fieldtrips to local caves, caverns, sinkholes, glacial areas, stream systems, lakes, etc., should be encouraged to experience Ohio geologic landforms and features first hand. There also are numerous virtual fieldtrips to visit caves, canyons, glaciers, mountains and valleys.
- The Ohio Department of Natural Resources provides helpful resources and **geologic maps** that can be used to study landforms and surface geology of Ohio. The relationship between the types of rocks and the resulting features or landforms is a very important connection, especially if local/regional maps are used in conjunction with field trips or outside investigations around the community or school property.
- Viewing landforms and surface geology from **satellite photographs** and through remote sensing can be a helpful tool in illustrating landforms in different parts of the world and conditions that exist for formation. Click on the geographical features icon to see satellite photos of Earth's surface.
- The **NASA Visible Earth Program** houses hundreds of satellite photos that can be used to illustrate specific landforms. Comparing the photo to a map can be a good way to learn about recognizable features such as delta systems, mountain ranges, volcanoes and canyons.
- The **National Atlas** mapmaker site can plot areas within the United States where specific geologic features are found. For example, by clicking on ***Geology***, then the ***Karst, Engineering Aspects*** option, areas that have caves, caverns and sinkholes are shown. This can be a good starting resource to locate other maps, photos and graphics related to landforms and features that form through erosion and/or deposition.
- The **USGS** website provides data, information, books and maps that relate to Earth's surface, weathering and erosion. Many of these resources are free and some are available at cost.
- The **National Speleological Society** provides information and resources for caves and caving for young students. Taking a field trip to an Ohio cave connects what is learned in the classroom about weathering and erosion to the real world. It is essential to learn about the processes of cave formation and karts topography, including lab investigations, to prepare students for a cave or cavern field experience.

COMMON MISCONCEPTIONS

- NSTA offers a list of landform resources at **http://learningcenter.nsta.org/search.aspx?action=quicksearch&text=landforms**. Included are guides for formative assessment techniques that can be used to determine student misconceptions about landform formation, weathering and erosion. One reference in particular (an assessment probe) can be found at **http://learningcenter.nsta.org/product_detail.aspx?id=10.2505/9780873552554.22**. It deals with beach sand and applies to all Earth Science content at grade 4.
- Funded by the National Science Foundation, ***Beyond Penguins and Polar Bears*** is an online magazine for K-5 teachers. For a list of common misconceptions about glacial movement, weathering and erosion, as well as ways to address them, visit **http://beyondpenguins.nsdl.org/issue/column.php?date=August2009&departmentid=professional&columnid=professional!misconceptions**.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

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CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case study ***Linda–Grades 2-4*** is an example of how to work with teacher teams to help students of all ability levels to develop scientifically accurate ideas and investigations.

The Annenberg Foundation offers training modules that support Earth and Space Sciences for K-4 teachers. There are numerous resources and video clips of actual classroom practices that can be useful training tools at **http://www.learner.org/resources/series195.html**.

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MODEL CURRICULUM GRADE 4

EARTH AND SPACE SCIENCE (ESS)

Topic: Earth's Surface

This topic focuses on the variety of processes that shape and reshape Earth's surface.

CONTENT STATEMENT

The surface of Earth changes due to weathering.

Rocks change shape, size and/or form due to water or ice movement, freeze and thaw, wind, plant growth, gases in the air, pollution and catastrophic events such as earthquakes, mass wasting, flooding and volcanic activity.

Note: The ice movement (above) refers to large bodies of ice, such as glaciers that can break large rocks into small ones.

CONTENT ELABORATION

Prior Concepts Related to Weathering

PreK-2: Wind is moving air, water and wind have measurable properties, water changes state, properties of materials change when exposed to various conditions (e.g., heating, freezing) and living organisms interact with their environment.

Grade 3: Rocks and soil have unique characteristics. Soil contains pieces of rock.

Grade 4 Concepts

Different types of rock weather at different rates due to specific characteristics of the rock and the exposure to weathering factors (e.g., freezing/thawing, wind, water). Weathering is defined as a group of processes that change rock at or near Earth's surface. Some weathering processes take a long time to occur, while some weathering processes occur quickly.

The weathering process must be observed in nature, through classroom experimentation or virtually. Seeing tree roots fracturing bedrock or the effect of years of precipitation on a marble statue can illustrate ways that rocks change shape over time. Investigations can include classroom simulations, laboratory testing and field observations.

Future Application of Concepts

Grade 5: Earth is a planet in the solar system that has a unique composition, global seasonal changes and patterns are introduced, including temperature fluctuations/ranges, monsoons and/or rainy seasons which can impact the weathering of Earth's surface.

Grades 6-8: The relationship between the characteristics of rocks and the environment in which they form is explored as well as how rocks break down (weather) and are transported (erosion), water flows through rock and soil at different rates, and the causes of changes on Earth's surface.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Research a specific weathering feature (e.g., sinkhole, cave). Evaluate the risk of collapse and methods of prevention of collapse (using actual data) and recommend one solution based on the scientific data. Create a model (virtual, graphic or 3-D) of the actual cave or sinkhole and demonstrate the risk of collapse and how the suggested preventative measure or solution impacts that risk.	Plan and implement an experiment to model and compare different types of weathering and/or rates of weathering that can occur.	Differentiate between weathering and erosion.	Identify weathering as processes that change rock at or near Earth's surface. Recognize that weathering can occur at different rates.
		Using geologic, topographic or aerial maps, research areas in the U.S. that are impacted by natural sinkholes, caverns or caves. Collect data regarding the characteristics of these regions. Compare and contrast the data to determine common characteristics that are present in each area. Represent findings graphically.	Recognize that water, wind, pollution/ gases in the air, ice movement, earthquakes, volcanoes, freezing/ thawing and plant action can all weather rock and soil.

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- It is important for students to understand **the difference between weathering and erosion**, as well as how the two processes work together to form geologic features.
- **Online geologic museum sites** can offer examples and data for studying rates of weathering and different types of weathering. Testing the weathering rate of a variety of substances can help in the understanding that some things may take a long time to weather and others a short time.
- The **USGS** provides weathering-rate data for a variety of rocks and types of soil. This data can help teachers determine types of materials that weather at a rate that could be observed in a classroom setting).

COMMON MISCONCEPTIONS

- Funded by the National Science Foundation, *Beyond Penguins and Polar Bears* is an online magazine for K-5 teachers. For a list of common misconceptions about glacial movement, weathering and erosion, as well as ways to address them, visit **http://beyondpenguins.nsdl.org/issue/column.php?date=August2009&departmentid=professional&columnid=professional!misconceptions**.

DIVERSE LEARNERS

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MODEL CURRICULUM GRADE 4

EARTH AND SPACE SCIENCE (ESS)

Topic: Earth's Surface

This topic focuses on the variety of processes that shape and reshape Earth's surface.

CONTENT STATEMENT

The surface of Earth changes due to erosion and deposition.

Water, wind and ice physically remove and carry (erosion) rock, soil and sediment and deposit the material in a new location.

Gravitational force affects movements of water, rock and soil.

CONTENT ELABORATION

Prior Concepts Related to Erosion and Deposition

PreK-2: Wind is moving air, water and wind have measurable properties, water changes state, forces change the motion of an object and some forces act without touching (e.g., gravitational forces).

Grade 3: Soil and rock have unique characteristics. Soil and rock are nonliving resources that can be conserved.

Grade 4 Concepts

Erosion is a process that transports rock, soil or sediment to a different location. Weathering is the breakdown of large rock into smaller pieces of rock. Erosion is what carries the weathered material to a new location. Gravity plays an important role in understanding erosion, especially catastrophic events like mass wasting (e.g., mudslides, avalanches, landslides) or flooding.

Erosion is a "destructive" process and deposition is a "constructive" process. Erosion and deposition directly contribute to landforms and features formation that are included in grade 4. Topographic maps and aerial photographs can be used to locate erosional and depositional areas in Ohio. Surficial geology maps also can illustrate the patterns of glacial erosion and deposition that have occurred. Field trips and field investigations (may be virtual) are recommended as erosional and depositional features that can be seen locally or within the state can help to connect the concept of erosion and deposition to the real world.

Future Application of Concepts

Grade 5: Earth is a planet in the solar system that has a unique composition, global seasonal changes are introduced, including monsoons and rainy seasons, which can change erosion and deposition patterns.

Grades 6-8: Historical studies of erosional and depositional patterns are introduced, in addition to soil conservation, the interaction of Earth's spheres, ocean features specific to erosion and deposition, and plate tectonics.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Sediment fences are often placed around construction sites to help control sediment from moving offsite (erosion) into the surrounding environment (deposition). Design and construct a model of one specific sediment-control measure (using scientific research). Evaluate and test it using different types of materials. Different groups in the class should model different methods of control. Each group should present findings and demonstrate the models.	Use actual geologic data from a specific location, such as the **Grand Canyon**. Research the formation of the canyon. Ask: ***Why does some rock weather and erode faster than others? What caused the weathering and erosion in the canyon? How can the age of the canyon be estimated?*** Use the research data to make a geologic cross section (3-D or virtual model or a graphic) to model the canyon.	Differentiate between weathering and erosion.	Identify erosion as a process that transports rock, soil or sediment to a new location.
	Using a surficial geology map of Ohio, trace the patterns of glacial movement that can be recognized by a variety of glacial deposits or erosion. Build a model to investigate the movement of glacial ice that creates a similar pattern. Ask: ***What factors must exist to support the movement of glaciers? Why is glacial movement erosional and depositional?***	Compare and contrast erosion and deposition.	Identify deposition as the settling or coming to rest of transported rock, soil or sediment.

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- The **USGS and the National Park Service** provide explanations about how erosion and weathering are different processes, but often work together. This is a good site to assist teachers in preparing to teach about weathering and erosion.
- The **Ohio Department of Natural Resources** provides resources and information about Ohio's surface geology, including surficial geology maps of Ohio that show **glacial patterns** in Ohio very clearly.
- Understanding **Ohio's glacial history** and the different glacial periods will help middle school students prepare for understanding the geologic history of Ohio. This website includes a discussion of specific resultant landforms that can be seen today. Showing photographs of the landforms and connecting them to maps, drawings or historical stories connects to the real world. Taking a field trip to view a landform in person can be a culminating experience.
- The Ohio **EPA** provides basic background information about sediment contamination and control issues within Ohio. There are video clips of actual sediment-control measures and problems. This is a good starting point for the design section (classroom example) listed above.

COMMON MISCONCEPTIONS

- Funded by the National Science Foundation, *Beyond Penguins and Polar Bears* is an online magazine for K-5 teachers. For a list of common misconceptions about glacial movement, weathering and erosion, as well as ways to address them, visit **http://beyondpenguins.nsdl.org/issue/column.php?date=August2009&departmentid=professional&columnid=professional!misconceptions**.

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MODEL CURRICULUM GRADE 4

LIFE SCIENCE (LS)

Topic: Earth's Living History

This topic focuses on using fossil evidence and living organisms to observe that suitable habitats depend upon a combination of biotic and abiotic factors.

CONTENT STATEMENT

Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.

Ecosystems can change gradually or dramatically. When the environment changes, some plants and animals survive and reproduce and others die or move to new locations. An animal's patterns of behavior are related to the environment. This includes the kinds and numbers of other organisms present, the availability of food and resources, and the physical attributes of the environment.

CONTENT ELABORATION

Prior Concepts Related to Behavior, Growth and Changes

PreK-2: Plants and animals have variations in their physical traits that enable them to survive in a particular environment. Living things that once lived on Earth no longer exist, as their needs were not met. Living things have basic needs, which are met by obtaining materials from the physical environment.

Grade 3: Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

Grade 4 Concepts

Ecosystems are based on interrelationships among and between biotic and abiotic factors. Ohio has experienced various weather patterns. Some parts of Ohio hosted glaciers and other parts of Ohio were submerged with water. Ecosystems can change rapidly (e.g., volcanoes, earthquakes, or fire) or very slowly (e.g., climate change). Major changes over a short period of time can have a significant impact on the ecosystem and the populations of plants and animals living there. The changes that occur in the plant and animal populations can impact access to resources for the remaining organisms, which may result in migration or death. The fossil record provides evidence for changes in populations of species.

Researching and investigating specific areas in Ohio (e.g., Cedar Bog, Lake Erie, Hocking Hills, Ceasar Creek, Kellys Island) via field studies, virtual field trips or other references must be used to explore the relationships between previous environments, changes that have occurred in the environments and the species that lived there.

Note: Grade 4 ES focuses on changes to Earth's surface due to erosion, deposition of soil, rock sediment, flooding, volcanoes and earthquakes that can be taught along with this content.

Future Application of Concepts

Grades 6-8: Organisms that survive pass on their traits to future generations. Climate, rock record and geologic periods are explored in Earth and Space Science.

High School: The concepts of evolution are explored.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Critique plans (written or oral) from different organizations to reintroduce a species into an Ohio environment. Write a newspaper article in support or against the reintroduction of the species based upon scientific facts. 	Conduct an investigation to determine if removing or adding plants to an area increases or decreases erosion. Ask: *How does this impact other organisms in that environment?* 	Read a firsthand description, view drawings of Ohio ecosystems as first observed by explorers and compare the historical environmental descriptions to the current environment. Explain the changes that occurred in the biotic and abiotic components of the ecosystem. 	Describe the immediate consequences of rapid ecosystem change for organisms within an ecosystem and describe the consequences this change will have on an ecosystem a decade or more later (e.g., flooding, wind storms, snowfall, volcanic eruptions). 
		Research a major geologic event (e.g., Mt. St. Helens volcanic eruption, tsunami). Develop a timeline depicting the environment before the event, immediately after the event and in designated time intervals until a stable community is established (e.g., 30 or more years). Find information at **http://www.fs.fed.us/gpnf/mshnvm/education/teachers-corner/library/life-returns01.shtml#01**. 	Describe major changes in Ohio's environments over time and the organisms supported in each (e.g., oceanic, glacial, wetlands, forests). 

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- Investigate various species that have been endangered due to environmental changes and examine efforts to reestablish and support their populations. One example is the trumpeter swan. The **Ohio History Central** provides details of this bird's story.
- The **Virtual Nature Trail at Penn State New Kensington** is an opportunity to observe photos of various species of plants interacting with one another and the environment and examine what changes result due to those interactions.
- **Citizen Science** is program promoted by the National Wildlife Federation to have the public volunteer time to assist scientists in their wildlife research by collecting data, sharing experiences and spreading valuable information. Wildlife can be monitored and the changes that occur in the ecosystem can be monitored and analyzed.
- The ODNR-Division of Wildlife's **Research and Survey** website has information on current research projects on Ohio wildlife, including migration tracking, distribution and reintroduction and monitoring programs.
- The ODNR-Division of Wildlife has a poster with an activity called *Ohio's Wildlife History*. The poster can be ordered by mail through the Education Materials Brochure found online at **www.wildohio.com**.
- *Project Wild* was developed through a joint effort of the Western Association of Fish and Wildlife Agencies and the Council for Environmental Education. This program helps students learn basic concepts about wild animals, their needs and importance and their relationships to people and the environment. The activity guides are available to educators free of charge when they attend a workshop. Information about upcoming workshops are available on the **ODNR Website**. In the activity *Oh Deer*, students portray deer and habitat components in a physical activity that illustrates the factors that cause fluctuations in wildlife populations over time. In *Here Today, Gone Tomorrow*, students identify and describe causes of extinction within animal species and identify locally endangered and threatened species.

Career Connection

Students will choose a recent disaster to explore (e.g., hurricane, earthquake, oil spill, tsunami) and identify the immediate and long-term consequences including the interactions and relationships among the Earth's surface, ecosystem, and plant and animal populations. Through exploring the impact, students will address the types of careers involved in addressing the issues. This may include performing tasks, such as relocating organisms, rebuilding habitats, rescuing or rehabilitating organisms.

COMMON MISCONCEPTIONS

- Students may think that people provide the materials (water, nutrients, light) needed for plants to survive. **Beyond Penguins and Polar Bears** is an online magazine for K-5 teachers that provides information for misconceptions about plants.
- A list of common **ecological misconceptions** about adaptation is provided with strategies for implementing the 5E model of instruction to overcome misconception.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

- Many *Project Wild* activities feature Universal Design for Learning principals by providing multiple means of concept representation; means of physically interacting with materials; and multiple means of engagement, including collaboration and communication. In the activity *Oh Deer*, students portray deer and habitat components in a physical activity that illustrates the factors that cause fluctuations in wildlife populations over time. In *Here Today, Gone Tomorrow*, students identify and describe causes of extinction within animal species and identify locally endangered and threatened species.

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CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

Session 5 of the Annenberg Media series ***Essential Science for Teachers: Life Science*** provides information about how children can learn about the variations of living things and offers with classroom footage to illustrate implementation at **http://www.learner.org/resources/series179.html**.

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MODEL CURRICULUM GRADE 4

LIFE SCIENCE (LS)

Topic: Earth's Living History

This topic focuses on using fossil evidence and living organisms to observe that suitable habitats depend upon a combination of biotic and abiotic factors.

CONTENT STATEMENT

Fossils can be compared to one another and to present-day organisms according to their similarities and differences.

The concept of biodiversity is expanded to include different classification schemes based upon shared internal and external characteristics of organisms.

Most types of organisms that have lived on Earth no longer exist.

Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.

CONTENT ELABORATION

Prior Concepts Related to Behavior, Growth and Changes

PreK-2: Plants and animals have variations in their physical traits that enable them to survive in a particular environment. Living things that once lived on Earth no longer exist, as their needs were not met. Living things have basic needs, which are met by obtaining materials from the physical environment.

Grade 3: Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

Grade 4 Concepts

Fossils provide evidence that many plant and animal species are extinct and that many species have changed over time. The types of fossils that are present provide evidence about the nature of the environment at that time. As the environment changed so did the types of organisms that could survive in that environment.

The opportunity to learn about an increasing variety of living organisms, both the familiar and the exotic, should be provided. The observations and descriptions of organisms should become more precise in identifying similarities and differences based upon observed structures. Emphasis can still be on external features; however, finer detail than before should be included. Hand lenses and microscopes should be routinely used. Microscopes are used not to study cell structure but to begin exploring the world of organisms that cannot be seen by the unaided eye. Non-Linnaean classification systems should be developed that focus on gross anatomy, behavior patterns, habitats and other features.

Future Application of Concepts

Grades 6-8: Diversity of species will be explored in greater detail. The study of Modern Cell Theory and rock formation is required (Earth and Space Science).

High School: The concepts of evolution and cell biology are explored.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Propose and test multiple ways that living things with soft body parts can leave fossil evidence. 	Experiment with making fossils to determine some of the necessary (living and nonliving) conditions for making fossils and to determine if similar conditions exist today. Materials used should include clay, dough, sand, mud, etc. Conditions should include moist, wet and dry. Representations of living organisms used should include those with hard body parts (exoskeletons, bones) and those with soft body parts (plants). 	From observation of fossils in rock layers, infer the environmental conditions that existed when the fossils were formed (e.g., fish fossils would indicate a body of water existed at the time the fossils formed). For more information visit **http://www.ohiohistorycentral.org/subcategory_topic.php?c=NH&s=GEOL&t=FOSS**. 	Identify evidence that can be used to determine the existence of an organism. For more information, visit **http://www.ucmp.berkeley.edu/education/explorations/tours/intro/Introkto4b/tour1nav.php** 
		Observe fossils and compare them to similar plants and animals that live today, using simple classification schemes. For more information, visit **http://www.ucmp.berkeley.edu/education/explorations/tours/stories/middle/C3.html**. 	

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- The University of Berkeley website **Understanding Evolution** can provide teachers with content knowledge on the topic of evolution. This site provides detailed information from various research projects about how fossils provide evidence of climate changes.
- The University of Berkeley's **Stories from the Fossil Record, Past Lives** provides information on how fossils provide information on the behavior of organisms (family and social) as well as how certain features of organisms came to be. Observe fossils and compare them to similar plants and animals that live today, using simple classification schemes. The **Ohio History Central** provides a list of fossils found in Ohio.
- *National Geographic*'s movie **Sea Monsters** provides an opportunity to go on a virtual fossil dig and explore organisms that lived a long time ago but are similar to organisms that are alive today.
- **Life Has a History**, produced by the University of California Museum of Paleontology, illustrates the similarities and differences between living things that exist today and organisms that lived in the past. It is a simple introduction to the fossil record.
- Session 6 of the Annenberg Media series *Essential Science for Teachers: Life Science* provides information about how children can learn about the variations of living things that lead to evolution and offers classroom footage to illustrate implementation at **http://www.learner.org/resources/series179.html**.

COMMON MISCONCEPTIONS

- The Annenberg Media series *Essential Science for Teachers:* **Life Science: Session 5**: *Children's Ideas* provides greater insight to misconceptions children hold about differing traits within a species and their causes. Strategies to address those misconceptions are addressed.
- Students may have the **naïve conception** that if organisms look alike, then they must have a common evolutionary history.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

Session 5 of the Annenberg Media series *Essential Science for Teachers: Life Science* provides information about how children can learn about the variations of living things and offers classroom footage to illustrate implementation at **http://www.learner.org/resources/series179.html**.

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MODEL CURRICULUM GRADE 4

PHYSICAL SCIENCE (PS)

Topic: Electricity, Heat and Matter

This topic focuses on the conservation of matter and the processes of energy transfer and transformation, especially as they apply to heat and electrical energy.

CONTENT STATEMENT

The total amount of matter is conserved when it undergoes a change.

When an object is broken into smaller pieces, when a solid is dissolved in a liquid or when matter changes state (solid, liquid, gas), the total amount of matter remains constant.

Note 1: At this grade, the discussion of conservation of matter should be limited to a macroscopic, observable level.

Note 2: States of matter are found in PS grade 3. Heating and cooling is one way to change the state of matter.

CONTENT ELABORATION

Prior Concepts Related to Changes of Matter

PreK-2: Simple measuring instruments are used to observe and compare properties of objects. Changes in objects are investigated.

Grade 3: Objects are composed of matter, which has weight mass* and takes up space. Matter includes solids, liquids and gases (air). Phase changes are explored.

Grade 4 Concepts:

Some properties of objects may stay the same even when other properties change. For example, water can change from a liquid to a solid, but the mass* of the water remains the same. Parts of an object or material may be assembled in different configurations, but the mass* remains the same. The sum of all of the parts in an object equals the mass* of the object.

When a solid is dissolved in a liquid, the mass* of the mixture is equal to the sum of the masses* of the liquid and solid.

At this grade level, the discussion of conservation of matter should be limited to a macroscopic, observable level. Conservation of matter must be developed from experimental evidence collected in the classroom. After the concept has been well established with experimental data and evidence, investigations can include interactions that are more complex where the mass* may not appear to stay constant (e.g., fizzing tablets in water).

Note: Mass* is an additive property of objects and volume is usually an additive property for the same material at the same conditions. However, volume is not always an additive property, especially if different substances are involved. For example, mixing alcohol with water results in a volume that is significantly less than the sum of the volumes.

Future Application of Concepts

Grades 6-8: Conservation of matter in phase changes and chemical reactions is explained by the number and type of atoms remaining constant. The idea of conservation of energy is introduced.

*While mass is the scientifically correct term to use in this context, the **NAEP 2009 Science Framework** (page 27) recommends using the more familiar term "weight" in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Evaluate research data providing information about the decomposition time for paper, glass, plastic and aluminum. Propose a sustainable plan that might be adopted by a larger population of citizens for minimizing waste products and reserving more space in our landfills. Develop a presentation that could be for an outside audience with the authority to implement the plan within a community.	Investigate what happens to the total amount of mass* during many types of changes (e.g., ice melting, salt dissolving, paper tearing, candle burning, Alka-Seltzer® in water). Propose reasons for any difference in the final weight (mass). Design a revised experiment to test proposals. *While mass is the scientifically correct term to use in this context, the **NAEP 2009 Science Framework** (page 27) recommends using the more familiar term "weight" in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.	Explain why the volume of water decreases when placed in an open container and left to sit for an extended period of time.	Recognize that the amount of matter stays constant during any change.

INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- **Keeping Warm**, an interactive simulation from BBC Schools, allows students to measure temperature changes over time for different insulating materials.
- **Melting and Freezing** from Science NetLinks gives an example of using inquiry to explore the mass of water, margarine and chocolate chips before and after melting. To extend this, students can put the substances in the refrigerator or freezer to reform the solid and find the mass again.
- **Essential Science for Teachers: Physical Science Video 3 Conservation of Matter Part I**, a video on demand produced by Annenberg, is designed for teachers to improve their understanding of physical science and make them aware of common student misconceptions. It also highlights ways to help students overcome misconceptions. While teachers should be aware of the ideas of physical changes and the particle nature of matter, these topics are not appropriate for this grade level.
- **Essential Science for Teachers: Physical Science Video 3 Conservation of Matter Part II**, a video on demand produced by Annenberg, is designed for teachers to improve their understanding of physical science, to make them aware of common student misconceptions. It also highlights ways to help students overcome these misconceptions. While teachers should be aware of the ideas of chemical changes and the particle nature of matter, these topics are not appropriate for this grade level.

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COMMON MISCONCEPTIONS

- **Gases are** not matter because most are invisible.
- Gases do not have mass*.
- **When things dissolve**, they disappear.
- Melting and dissolving are confused.
- Mass* and volume, which both describe an amount of matter, are the same property.
- Breaking something or dissolving makes it weigh less.
- Changing the shape changes the mass* and volume.
- Students believe matter is lost during burning.
- Students believe that a warmed gas weighs less than the same gas that is cooler (Driver, Squires, Rushworth & Wood-Robinson, 1994).

*While mass is the scientifically correct term to use in this context, the **NAEP 2009 Science Framework** (page 27) recommends using the more familiar term "weight" in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

From times of 3:45 to about 13:55 and from 15:00 to 22:20 on this segment of **Essential Science for Teachers: Physical Science** produced by Annenberg, see how to lead students through questions and experiences that allow them to build their ideas of conservation of matter. Please note that exploring the differences between weight and mass and using the particle model of matter to explain conservation of matter are not appropriate for this grade.

Case Studies in Education is a series of videos on demand produced by Annenberg. The segment titled **Linda–Grades 2-4** features a resource teacher who models inquiry-based science lessons for teachers in her large urban district. The segment titled **Terez–Grade 4** features a teacher who is working to incorporate portfolios in her science teaching. Although not all of the content is directly aligned to this content statement, the strategies could be applied to any content.

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MODEL CURRICULUM GRADE 4

PHYSICAL SCIENCE (PS)

Topic: Electricity, Heat and Matter

This topic focuses on the conservation of matter and the processes of energy transfer and transformation, especially as they apply to heat and electrical energy.

CONTENT STATEMENT

Energy can be transformed from one form to another or can be transferred from one location to another.

Energy transfers from hot objects to cold objects as heat, resulting in a temperature change.

Electric circuits require a complete loop of conducting materials through which an electrical energy can be transferred.

Electrical energy in circuits can be transformed to other forms of energy, including light, heat, sound and motion.

Electricity and magnetism are closely related.

CONTENT ELABORATION

Prior Concepts Related to Heat and Electricity

PreK-2: Temperature is a property of objects. Sunlight affects the warming or cooling of air, water and land (ESS). Charged objects can attract uncharged objects and may either attract or repel other charged objects. Magnetic objects can attract things made of iron and may either attract or repel other magnetic objects.

Grade 3: Objects that have energy can cause change. Heat, electrical energy, light, sound and magnetic energy are all forms of energy.

Grade 4 Concepts:

The addition of heat may increase the temperature of an object. The removal of heat may decrease the temperature of an object. There are materials in which the entire object becomes hot when one part of the object is heated (e.g., in a metal pan, heat flows through the pan on the stove transferring the heat from the burner outside the pan to the food in the pan). There are other objects in which parts of the object remain cool even when another part of the object is heated (e.g., in a Styrofoam® cup, very little of the warmth from hot liquid inside the cup is transferred to the hand holding the cup).

Electrical conductors are materials through which electricity can flow easily. Electricity introduced to one part of the object spreads to other parts of the object (e.g., copper wire is an electrical conductor because electricity flows through the wires in a lamp from the outlet to the light bulb and back to the outlet).

Electrical insulators are materials through which electricity cannot flow easily. Electricity introduced to one part of the object does not spread to other parts of the object (e.g., rubber surrounding a copper wire is an electrical insulator because electricity does not flow through the rubber to the hand holding it).

Electrical conductivity must be explored through testing common materials to determine their conductive properties.

In order for electricity to flow through a circuit, there must be a complete loop through which the electricity can pass. When an electrical device (e.g., lamp, buzzer, motor) is not part of a complete loop, the device will not work. Electric circuits must be introduced in the laboratory by testing different combinations of electrical components. When an electrical device is a part of a complete loop, the electrical energy can be changed into light, sound, heat or magnetic energy. Electrical devices in a working circuit often get warmer.

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When a magnet moves in relation to a coil of wire, electricity can flow through the coil. When a wire conducts electricity, the wire has magnetic properties and can push and/or pull magnets. The connections between electricity and magnetism must be explored in the laboratory through experimentation.

Note 1: Exploring heat transfer in terms of moving submicroscopic particles is not appropriate at this grade level.

Note 2: The word "heat" is used loosely in everyday language, yet it has a very specific scientific meaning. Usually what is called heat is actually "thermal or radiant energy." An object has thermal energy due to the random movement of the particles that make up the object. Radiant energy is that which is given off by objects through space (e.g., warmth from a fire, solar energy from the sun). "Heating" is used to describe the transfer of thermal or radiant energy to another object or place. Differentiating between these concepts is inappropriate at this grade level. This document uses the same conventions as noted in the NAEP 2009 Science Framework (see page 29) where "heat" is used in lower grades. However, the word "heat" has been used with care so it refers to a transfer of thermal or radiant energy. The concept of thermal energy, as it relates to particle motion, is introduced in grade 6.

Note 3: Knowing the specifics of electromagnetism is not appropriate at this grade level. At this point, the connections between electricity and magnetism are kept strictly experiential and observational.

Note 4: Energy transfer (between objects or places) should not be confused with energy transformation from one form of energy to another (e.g., electrical energy to light energy).

Future Application of Concepts

Grade 5: Light and sound are explored further as forms of energy.

Grades 6-8: Thermal energy is related to the atomic theory. Kinetic and potential energy are two ways objects can store energy. Conservation of energy and energy transfer through radiation, convection and conduction, and the transfer of electrical energy in circuits are introduced.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Design a device involving energy transfers.			
Design and construct a device that causes a small cart to roll and involves energy transfers between four objects (e.g., push a ball off a table so it falls on an object that releases a rubberband cart).		Design and construct a device that causes a small cart to roll and involves energy transfers between four objects (e.g., push a ball off a table so it falls on an object that releases a rubberband cart).	Recognize that energy can cause motion or create change.
Investigate a simple circuit.			
Design and construct a switch that can turn a light on and off in a circuit.	Build a circuit that contains two light bulbs. Analyze the differences between working and nonworking circuits and determine patterns and trends in the experimental evidence. Formulate a conceptual model of a working circuit based upon the trends in the experimental evidence.	Pictorially represent ways to assemble the circuit and note which are able to light the bulbs and which are not. Compare and contrast circuits that light the bulbs with circuits that do not light the bulbs. Outline the functions of the components of a simple electric circuit (conductor, insulator, energy source, light bulb, switch). Pictorially represent the flow of energy in a circuit in which a battery is used to light a bulb.	Recognize that a working circuit requires a continuous loop of electrical conductors.

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DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Investigate the transfer of heat energy.			
	Plan and implement an experiment to investigate the energy transfer between hot (but not hot enough to burn) and cold water. Formulate a conceptual model that can account for the trends observed in the results.	Organize and represent the data for easy interpretation. Analyze the data to determine patterns and trends. Explain the trends in the results using the conceptual model.	Measure the temperature of water. Recognize that an increase in temperature indicates an increase in heat energy and a decrease in temperature indicates a decrease in heat energy.
		Contrast electrical conductors and electrical insulators.	Identify ways the temperature of an object can be changed (e.g., rubbing, heating, bending of metal).
		Contrast thermal conductors and thermal insulators.	Identify different types of energy conversions within an electrical circuit.

INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- **Electrical Conductors**, an interactive simulation from BBC Schools, allows students to explore different materials and classify them as electrical conductors or insulators. It also emphasizes that a complete loop of conductors is needed for a circuit to be complete. The optional sections that deal with adding bulbs and batteries are not aligned with this content statement.
- **Electricity in a Brown Bag** from eGFI gives examples of how to use inquiry to teach the basic concepts of electricity safely using readily available materials. Using bulb sockets **such as these** available from many vendors, allow students to trace the flow of electricity from the wires through the bulb. Students also can try to light the bulb without the socket.
- **Career Corner** from EIA Energy Kids has several articles that give information about different careers in energy.
- **Coffee Can Speakers: Amazing Energy Transformers** is an article from the March 2007 issue of ***Science and Children*** that gives instructions on how to make a simple speaker to demonstrate the transformation of energy and the relationship between electricity and magnetism. Once the speaker is made and understood, students can be challenged to make changes to the system to improve the sound from the speakers.

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COMMON MISCONCEPTIONS

- Some items cannot be heated.
- Metals get hot easily because they "draw in heat."
- **Energy is a thing**, an object or something that is tangible.
- Cold can be transferred.
- **Larger magnets are** stronger than smaller magnets.
- Current flows from a battery (or other source of electricity) to a light bulb (or other item that consumes electricity), but not from the light bulb to the battery.
- Electricity is produced in the wall socket.
- Pure water is a good conductor of electricity.
- Electricity from a dry cell will shock or hurt if it is touched.
- All wires are insulated.
- Birds can perch on bare wires without being hurt because birds have insulated feet.
- A charge object can only affect other charged objects.
- **Ice cannot change temperature.**
- Heat is a substance.
- Heat is not energy.
- Temperature is a property of a particular material or object (metal is naturally colder than plastic).
- The temperature of an object depends on its size.
- Heat and cold are different, rather than being opposite ends of a continuum.
- Objects of different temperatures that are in constant contact with each other or in contact with air at a different temperature do not necessarily move toward the same temperature.
- Heat only travels upward.
- Heat rises.
- Objects that readily become warm (conductors of heat) do not readily become cold.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

Tom, a new fifth-grade teacher who works with many special needs students, is featured in this video on demand produced by Annenberg. Starting from a time of about 10:15, the video shows Tom working with his class to teach about electricity. Students construct Venn diagrams to compare motors and generators, then explore how different variables in an electromagnet (such as the number of coils) affect the effectiveness of the magnet. Tom has students generate concept maps for magnets. The beginning of the video, while not directly related to this content statement, shows Tom working to incorporate more formative assessment in his teaching and using strategies such as storyboards and concept mapping to reach his diverse learners. The strategies shown can be adapted to all science content.

Linda, a resource teacher who models inquiry-based science lessons for grades 2-4 teachers in her large urban district, is featured in this video on demand produced by Annenberg. Although not all of the content is directly aligned to this content statement, the strategies could be applied to any content.

Terez, a fourth-grade teacher who is working to incorporate portfolios in her science teaching, is featured in this video on demand produced by Annenberg. Although not all of the content is directly aligned to this content statement, the strategies could be applied to any content.