Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 1. All students will describe the Earth's surface; describe and explain how the Earth's features change over time; and analyze effects of technology on the Earth's surface and resources. (Geosphere)

Benchmark
Describe and identify surface features using maps (SCI.V.1.MS.1).

Benchmark Clarification
Maps are just one of the tools that scientists use to identify surface features of the Earth. Depending on the type of map, information given in the map's key can be used to describe the Earth's surface features.
Students will:

- Interpret different kinds of maps to identify local and regional landforms
- Interpret maps of the continents and maps of the ocean floor to identify global landforms, such as plateaus, mountains, plains, etc.

Key Concepts (voc.)
Landforms:

- plains
- deserts
- plateaus
- basins
- Great Lakes
- rivers
- Continental Divide
- mountains
- mountain ranges
- valleys

Tools:

- raised relief maps:
- topographic maps

Real-World Context
Maps showing local and regional surface features:

- Great Lakes
- local topography

Maps showing global surface features:

- continents
- ocean floors

Instructional Example SCI.V.1.MS.1

Benchmark Question: What is the Earth's surface like?
Focus Question: How do different types of maps help us to identify surface features of the Earth?

Students will write their personal definitions of "surface features." Students will work together to develop one common definition. The teacher should be sure that the final definition includes both features below sea level/ocean floor features and above sea level/continental features

Once a common definition of surface features is complete, the class could brainstorm specific surface features and their locations in the world.

Working in small groups, students will use a variety of maps (i.e., satellite imaging, topographical, physical and relief to compare and contrast designated areas across the U.S. and the world. Each small group will create a model of a specific area/region showing features from various maps that may include plains, deserts, plateaus, basins, the Great Lakes, the Continental Divide, a mountain range, and a mountain chain. Each group of students will present their information to the class. In their presentations, students will describe in detail the characteristics of the surface features and compare their model to the maps they used. After their presentations, students will identify different surface features from stations of topographical maps.

Constructing: (*link to SCI.I.1MS.1*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.5*).

Reflecting: (*link to SCI.II.1MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography
http://mtn.merit.edu/mcf/SCI.V.1.MS.1.html

http://nationalgeographic.com/maps/map_links.html#mag
http://topozone.com/find.asp
http://www.fourmilab.ch/earthview/vplanet.html
http://www.nationalgeographic.com/maps/physical.html

USGS Topographic Maps Illustrating Physiographic Features: "Use this index to select the names and locations of topographic maps that illustrate the particular physical feature of interest, such asthose resulting from glaciation, karst, tectonics, orvolcanism. The index is also organized by state."
http://rockyweb.cr.usgs.gov/public/outreach/featureindex.html

Map Finder: find 7.5 minute topographic maps by entering zip code, city, or clicking a state image map.
http://edcwww.cr.usgs.gov/Webglis/glisbin/finder_main.pl?dataset_name=MAPS_LARGE

Landforms on Topographic Maps: find examples of landforms depicted on topographic maps inclucing Geologic Structures, Igneous Activity, Mass Movement, Streams, Underground Water, Glaciers, Wind, Waves and Currents.
http://www.csus.edu/indiv/s/slaymaker/Geol10L/landforms.htm

Landform Identification: Cerritos College offers a series of tutorials using topographic maps, photos, and aerial imagery to identify glacial, coastal, volcanic, wind, fluvial, karst, tectonic, and mass wasting landforms. In some cases, exercises are present for students to test their skills in identifying landforms.
http://www2.cerritos.edu/earth-science/tutor/landform_identification.htm

Topographic Map Examples: entire quads depicting landforms and cultural features. File sizes are large.
http://www.csus.edu/indiv/s/slaymaker/Geol10L/wholemaps.htm

Color Landform Atlas of the U.S. offers shaded relief maps (large file size), county maps, black and white maps, satellite image, 1895 maps (Big: 1.92 Mb), and postscript file maps for printing of all 50 states.
http://fermi.jhuapl.edu/states/states.html

Seafloor and Land Elevation Map: spectacular 2 x 2 minute map of earth bathymetry/topography.
http://www.ngdc.noaa.gov/mgg/image/2minsurface/

Tapestry of Time and Terrain: USGS map merging topographic and geologic maps, click on maps for further information on a particular location's physiographic province and geologic age.
http://tapestry.usgs.gov/

Braus, Judy. *Geology: The Active Earth*. RANGER RICK'S NATURESCOPE SERIES. National Wildlife Federation, 1995.

Deserts/Volcanoes. Bill Nye Video. Disney Educational. (800/295-5010).

Finding Yours Bearings. AIMS.
http://www.aimsedu.org/aimscatalog/

Through The Eyes of Explorers. AIMS.
http://www.aimsedu.org/aimscatalog/

Wetlands, Rivers & Streams. Bill Nye Video. Disney Educational. (800/295-5010).

Classroom Assessment Example SCI.V.1.MS.1

Pairs of students will use topographical and ocean floor maps to create a model of a specific geographical area focusing on existing surface features and the surrounding area. They will present their models to the class. They will explain the models and their correlation to the map (See Instructional Example).

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.1.MS.1

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of model	Transfers few map features to a model correctly.	Transfers some map features to a model correctly.	Transfers many map features to a model correctly.	Transfers all map features to a model correctly.
Correctness of labels	Model illustrates at least two correctly labeled surface features.	Model illustrates at least four correctly labeled surface features.	Model illustrates at least five correctly labeled surface features.	Model illustrates six or more correctly labeled surface features.
Presentation of model	Presents information that explains the correlation between at least two surface features .	Presents information that explains the correlation between at least four surface features .	Presents information that explains the correlation between at least five surface features .	Presents information that explains the correlation between six or more surface features .

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 1. All students will describe the Earth's surface; describe and explain how the Earth's features change over time; and analyze effects of technology on the Earth's surface and resources. (Geosphere)

Benchmark
Explain how rocks are formed (SCI.V.1.MS.2).

Benchmark Clarification
Forces in the Earth form rocks in different ways.

Students will:

- Describe occurrences that take place on and below Earth's surface, as rocks continually change (recycle)
- Use the rock cycle as a guide to explain the interconnected relationships among sedimentary, metamorphic, and igneous rocks

Key Concepts (voc.)
Rock cycle processes:

- Melting, cooling, solidification (igneous rocks)
- Intense heat and pressure creates a new class of rocks(metamorphic rocks)
- Weathering, erosion, deposition, and cementation of sediments from igneous, metamorphic, or sedimentary rocks create a new class of rocks (sedimentary rocks)

Heat source is the breakdown of radioactive elements in the interior of the Earth

Materials:

- silt
- clay
- gravel
- sand
- rock
- lava
- magma
- remains of living things (bones, shells, plants)

Real-World Context
Physical environments where rocks are being formed:

- volcanoes
- ocean trenches
- ocean thermal vents
- mid-oceanic ridges
- metamorphic environments within the Earth's crust
- caves

Depositional environments:

- ocean floor
- deltas
- beaches
- swamps
- lake bottoms

Instructional Example SCI.V.1.MS.2

Benchmark Question: How are rocks formed?
Focus Question: How is the formation of rocks related to the rock cycle?

Note: This benchmark is best taught after a volcano unit.

Students will observe a variety of rocks. They will collect data on the shape and size of crystals or mineral grains, rock color, and the presence of rock layers. The teacher will ask what is similar and different about these rocks. From these data, students will develop charts and make generalizations to determine which of the three basic groups the rocks fit into. Care must be taken to differentiate sedimentary and metamorphic rocks. Foliated (layered) metamorphic rocks like schist and gneiss often look just like sedimentary rocks

Discussions about where rocks come from will help students infer the cyclical nature of the raw recycled materials necessary to form rocks. Students will demonstrate their understanding of the classification of rocks and how they are formed by drawing a preliminary diagram of the rock cycle and communicating their rationale to the class. Students also will question the conclusions of their peers. If students don't generate questions about incorrect rock cycles, the teacher will ask leading questions specific to the presented rock cycle. It is important that the teacher allow students to construct meaning on their own.
An accurate rock cycle should include the following ideas:
<u>Igneous rock:</u>

- Can be broken down to form sediments
- Can be exposed to pressure and heat to form metamorphic rock
- Can re-melt to form magma or lava
- Will form from cooled magma or lava

<u>Sedimentary rock:</u>

- Can be broken down to form sediments
- Can be exposed to pressure and heat to form metamorphic rock

- Can melt to form magma or lava

Metamorphic rock:
- Can melt to form magma or lava
- Can be broken down to form sediments
- Can be exposed to pressure and heat to form metamorphic rock

As a class, with teacher guidance, students will use their models and reasoning to complete a traditional rock cycle drawing.

Constructing: (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.1.MS.2.html

http://volcano.und.nodak.edu/

http://www.ucmp.berkeley.edu/exhibit/geology.html

Geology 202: Introduction to Geology: "This site contains notes and self-directed exercises which complement the lectures and laboratories of Geology 202, Introduction to Petrology - a course offered in the Geological Sciences Department of the University of
British Columbia (UBC)."
http://www.science.ubc.ca/~geol202/

Organization of Igneous Rocks: a comprehensive guide to igneous rocks. At this easily navigated site, resources are available for igneous rock classification, keys for identification, landforms, phase diagrams, distribution, and a self test.
http://geollab.jmu.edu/Fichter/IgnRx/IgHome.html

Image Gallery: a search engine for rock imagery from UBC. A limited number of landforms images are also available.
http://www.science.ubc.ca/~eoswr/cgi-bin/db_gallery/searchframe.html

Earth's Crust/Rocks & Soil. Bill Nye Video. Disney Educational. (800/295-5010).

Classroom Assessment Example SCI.V.1.MS.2

Create a model of the rock cycle that includes the three basic types of rocks; igneous, metamorphic, and sedimentary. Present this model to the class, sharing understanding of how the rock cycle is used to explain how rocks are formed.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.1.MS.2

Criteria	Apprentice	Basic	Meets	Exceeds
Construction of rock cycle model	Illustrates rock cycle that includes the three rock types and three processes that are accurate.	Illustrates rock cycle that includes the three rock types and four to six processes that are accurate.	Illustrates rock cycle that includes the three rock types and all processes are accurate.	Illustrates rock cycle that includes the three rock types with an accompanying explanation that is accurate. Examples of rocks are included.
Presentation of rock cycle model	Presents information that explains three processes from the model.	Presents information that explains four to six processes from the model.	Presents information that explains the complete rock cycle processes.	Presents information that explains the complete rock cycle processes and includes examples of rocks.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 1. All students will describe the Earth's surface; describe and explain how the Earth's features change over time; and analyze effects of technology on the Earth's surface and resources. (Geosphere)

Benchmark
Explain how rocks are broken down, how soil is formed, and how surface features change (SCI.V.1.MS.3).

Benchmark Clarification
Soil formation is related to mechanical (physical) and chemical weathering (*link to Glossary*) that breaks down rocks and changes the surface of the Earth.

Students will:

- Explain how weathering, erosion (*link to Glossary*) contribute to soil formation. Note: decomposition is really chemical weathering which would be included under "weathering"
- Explain how mechanical weathering (i.e., frost action, water, and wind) and chemical weathering (i.e., acid rain and acid secretions by decomposers like fungi and lichens) change surface features

Weathering: the process by which rock and other materials at the Earth's surface are broken down and decomposed by the action of rain, running water, oxidation, wind, and other natural, mechanical, and chemical means

Erosion: the transport of weathered materials from the Earth's surface by running water, rain, wind, waves, downslope movment, or other natural forces

Key Concepts (voc.)
Chemical and mechanical weathering

Erosion by:

- glaciers
- water
- wind
- down-slope movement

Decomposition (Chemical Weathering) by:

- fungi
- lichens

Real-World Context
Regions in Michigan where erosion by wind, water, or glaciers have occurred:

- river valleys
- gullies
- shoreline of Great Lakes
- along the shoulders of roads
- under downspouts
- chemical weathering from acid rain
- formation of caves
- sinkholes

Physical weathering from frost action:

- potholes
- cracks in sidewalks

Physical and chemical weathering by:

- bacteria
- fungi
- worms
- rodents
- other animals

Instructional Example SCI.V.1.MS.3

Benchmark Question: How does soil determine surface changes over time?
Focus Question: What are the basic soil sample types and what characteristics do they have?

The class will examine three different types of sediments: sand, silt, and clay and compare grain size, shape, and color.

The class will collect and identify three very different types of soil samples by analyzing their components and describing their qualities.

While collecting their samples, students will need to list features of the environment – number of trees, percent of ground cover, standing water, etc.

Students will place their samples in jars with water, shake their jars, and observe them.

Students will record observations of the layers of sediment and measure the depth of each layer.

Students will estimate the percent of sand, silt, and/or clay in their soil samples. They will classify their soil samples based on these estimates.

Students will apply their gathered environmental data to hypothesize what surface changes can occur at the soil sample site due to wind, water, and erosion.

Students will present their findings and discuss their conclusions in written lab reports.

Note: This is a good activity related to soil and surface change. Students may not be able to collect three different types of sediments. Sandy, silty, and clayey soil (soil texture) may not be found on one campus (or town). The teacher may need to get these soils well ahead of time. Surface samples will have plenty of organic matter that will cloud the water so much that it will be difficult to see the sediment. Teachers should get soil samples that are relatively free of organic matter.

Also, the number of trees, percent of ground cover, standing water, etc. are not likely to be distinguished by soil type on a campus as a function of texture because other factors (perched water table, amount of humus, presence of surface impermeable surface) can mask the effect of soil textures.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.1***)**, (*link to SCI.II.1.MS.2*), **(***link to SCI.II.1.MS.3*), **(***link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.1.MS.3.html

County Soil Survey books.
USDA. *Dig In! Hands-On Soil Investigations*. NSTA, 2001.
http://www.geology.iastate.edu

DETERMINATION OF SOIL TEXTURE IN THE FIELD: A University of Florida brochure for using the hand texture test properly.
http://hammock.ifas.ufl.edu/txt/fairs/57390

Soil Quality Information Sheets: concise, readable summaries of soil quality resource concerns like erosion, compaction, salinization, and pesticides. There is also a section on how soil quality can be judged through organic matter, pH, and infiltration.
http://www.statlab.iastate.edu/survey/SQI/sqiinfo.shtml

National Resources Conservation Service Educational Resources: an introduction for K-6 level students answering basic questions about the physical, chemical, and biological properties of soil with a special emphasis on soil conservation.
http://www.nhq.nrcs.usda.gov/CCS/squirm/skQ13.html

NASA's Soil Science Education Page: "This page contains a lot of new, exciting, funand informative material on the soil."
http://ltpwww.gsfc.nasa.gov/globe/index.htm

Classroom Assessment Example SCI.V.1.MS.3

Each student will write an essay that answers the following questions:

- How does the soil type affect the amount of water that is filtered or remains on the surface?
- How does that water contribute to surface erosion?
- How does that water contribute to the creation of landforms such as caves, gullies, etc.?

Each student will create a visual aid (i.e., a picture, map, 3D model) that lists the three basic soil types and describes their characteristics.
Each student will orally present his or her essay and visual aid to the class.

(Give students rubric before activity.)

Scoring of Classroom Assessment Guide SCI.V.1.MS.3

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of essay	Writes an essay that is irrelevant to topic.	Writes an essay that states basic terms.	Writes an essay that is accurate and elaborates on relevant concepts.	Writes an essay that contains no contradictions and elaborates on all relevant concepts and terms in detail.
Correctness of visual aid	Identifies three soil types.	Identifies three soil types and shows the relationship between soil and one factor.	Identifies three soil types and shows the relationship between two soil types and studied factors.	Identifies three soil types and shows the accurate relationship between all soil types and studied factors.
Effectiveness of presentation	Presents limited information relevant to the topic.	Presents information that is relevant to the topic and demonstrates an effort to organize that information.	Presents an accurate, interesting, and organized report.	Presents an interesting and accurate program that is clearly focused.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 1. All students will describe the Earth's surface; describe and explain how the Earth's features change over time; and analyze effects of technology on the Earth's surface and resources. (Geosphere)

Benchmark
Explain how rocks and fossils are used to understand the age and geological history of the Earth (SCI.V.1.MS.4).

Benchmark Clarification
Fossil records are used to describe the ever-changing nature of the Earth's surface.

Students will:

- Explain how these rocks and fossils can be used to determine and date the age of a specific rock layer

Key Concepts (voc.)

- fossils
- extinct plants and animals
- ages of fossils
- rock layers
- timelines
- relative dating

See Ancient life (*link to SCI.III.4.E.1*).

Real-World Context
Fossils found in:

- gravel
- mines and quarries
- rocks on beaches (Petoskey stones)
- museum displays
- Michigan examples of layered rocks
- specific examples of extinct plants and animals such as dinosaurs

Instructional Example SCI.V.1.MS.4

Benchmark Question: How do the Earth's features change over time?
Focus Question: How is rock layering used to explain the age or geologic history of the Earth?

Students will discuss timelines:

- What are they?
- Who uses them?
- How could they be useful in the study of the Earth? The teacher will display and explain a geologic timeline.

Students will:

- use a variety of maps, rocks, fossils, and visual aids/media to collect data on rock layers.
- use this information to classify various fossil types found within specific rock layers.
- interpret data and place their fossils in the appropriate geological time period.

Once this process is complete, students will apply the information to a new fossil and correctly place the new fossil in the correct geological time period.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.5*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*), (*link to SCI.II.1.MS.6*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.1.MS.4.html

Fossils, Rocks, and Time—This 24-page free booklet explains the basics of how fossils are used in establishing time sequence in geology. 94-0054

Geologic Time—"This 20-page booklet explains relative and radiometric time scales and how geologists measure the age of the Earth. It illustrates the scientific processes that are used to interpret the Earth's geologic history. 94-0121"
http://pubs.usgs.gov/gip/fossils/

Michigan Stratigraphy (rock layers): The Michigan Department of Environmental Quality (DEQ) archives a number of maps dealing with Michigans stratigraphy.
http://www.deq.state.mi.us/gsd/freepaga.html#TOP

Dinosaurs Fact and Fiction: "contains answers to some frequently asked questions about dinosaurs, with current ideas and evidence to correct some long-lived popular misconceptions."
http://pubs.usgs.gov/gip/dinosaurs/

Geological Time Machine: The University of California at Berkeley Museum of Paleontology offers the easily navigable Geological Time Machine with sections on stratigraphy with information about deposition, nomenclature, and strata identification; ancient life with an overview of major biological events, including origin and extinction of important groups;localitieswith resources about particular fossil localities, and tectonics which discusses continental migrations, changes in global circulation, and climate change. This site also offers links to K-12 educational resources and museum exhibits.
http://www.ucmp.berkeley.edu/help/timeform.html

American Museum of Natural History.
http://www.amnh.org/

VanBurgh, Dana. *How To Teach With Topographic Maps*. NSTA, 1994.
http://www.amnh.org/exhibition/fossil_halls/personalities/index.html

http://www.nationalgeographic.com/

http://www.usgs.gov/

Classroom Assessment Example SCI.V.1.MS.4

Pairs of students will compose a newspaper article on a animal fossil and include the following information: the climate in which it lived, how the organism moved, what it ate, and what it looked like. Based on their understanding of that information, small groups of students will create a travel brochure showing what life was like during that time period and why people would want to visit that time period. The brochure should include information about their fossils, illustrations of their fossils, and details about the geological time period.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.1.MS.4

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of fossil article	Writes an article that incorporates one of the required components.	Writes an article that incorporates any two required components.	Writes an article that incorporates any three of the required components.	Writes an article that incorporates all of the required components.
Completeness of geological period brochure	Designs a brochure that is complete on all sides.	Designs a brochure that is complete on all sides and partially labeled.	Designs a brochure that is complete on all sides, is labeled, and is neatly done.	Designs a brochure that is complete on all sides, is accurately labeled, shows creativity, and is neatly done.
Accuracy of illustrations	Attempts to illustrate a fossil but it is unidentifiable.	Illustrates a fossil that resembles the specimen and is labeled.	Neatly illustrates and labels a fossil and other objects of the environment.	Illustrates a fossil and many aspects of the environment neatly and with labels and details.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 1. All students will describe the Earth's surface; describe and explain how the Earth's features change over time; and analyze effects of technology on the Earth's surface and resources. (Geosphere)

Benchmark
Explain how technology changes the surface of the Earth (SCI.V.1.MS.5).

Benchmark Clarification
Human activities such as mining, logging, farming, and building houses, malls, and highways have changed the surface of the Earth.

Students will:

- Investigate how humans have caused positive and negative changes to the surface of the Earth

Key Concepts (voc.)
Types of human activities:

- surface mining
- construction and urban development
- farming
- dams
- landfills
- restoring natural areas

Real-World Context

- local example of surface changes due to human activities listed in the Key Concepts
- local examples of negative consequences of these changes:
  - groundwater pollution
  - destruction of habitat and scenic land
  - reduction of arable land
  - soil erosion
  - flooding due to the increase in impermeable surfaces

- Local examples of positive consequences:
  - soil conservation
  - reforestation
    - restoring habitats: forests, wetlands, prairies

Instructional Strategy SCI.V.1.MS.5

Benchmark Question: How has technology changed the surface of the Earth?
Focus Question: What is the effect of interactions between humans and technology in your local area?

Through student discussion groups, field trips, and inquiry-based activities, students will observe the positive and negative effects associated with a technological society. Students will collect data through the use of observations and measurements on a variety of environmental effects linked to humans' use of automobiles, industry, agriculture, construction, sewage disposal, and manufacturing. Students will then use concept maps to visually connect these relationships.

Students will develop real-world connections by producing a plan for their local community that will address one of the above issues and communicating that plan to an appropriate agency or government body. Students could also use this information to write a letter to the editor of a local newspaper.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*).

Resources/References:
Webliography.
http://mtn.merit.edu/mcf/SCI.V.1.MS.5.html

Land and People: Finding a Balance—for reference and the brighter student: "This teaching packet for high school challenges students to examine current environmental issues in three different regions and helps them prepare to find a balance between humans and the environment in the future. It contains a teaching guide, a colorful poster, and separate activities. The student materials include a reading about each region, a focus question that leads to role-playing activities, and scientific data about the region. 97-0350"
http://www.usgs.gov/education/learnweb/LandPeople/

Guide to Environmental Issues: "The Guide offers basic information on numerous environmental topics. Frequently asked questions are answered in plain English, and an extensive glossary gives nonbureaucratic definitions for more than 200 environmental terms. The Guide includes synopses of federal environmental laws and six pages of telephone numbers and Hotlines."
http://www.epa.gov/students/guide_to_environmental_issues.htm

Terms of Environment "defines hundreds of terms in non-technical language the more commonly used environmental terms appearing in EPA publications, news releases, and other Agency documents available to the general public, students, the media, and Agency employees.
http://www.epa.gov/students/terms_of_environment.htm

U.S. EPA Student Center: designed for the K-12 audience, a complete guide to environmental issues relating to air, water, and land.
http://www.epa.gov/students/text.htm

River Cutters. GEMS.
http://www.lhs.berkeley.edu/GEMS/
Wright, Russell. *Gold Rush! Rocks & Minerals* Module. NSTA, 1996.
Wright, Russell. *Oil Spill! Oceanography Module.* NSTA, 1995**.**

Classroom Assessment Example SCI.V.1.MS.5

Each student will create a concept map that connects the relationships of positive and negative effects associated with a technological society and will develop a written plan that identifies and explains one of the identified issues. Each student will show cause and effect relationships with arrows on the concept map to support his or her claims. Each student will write a letter to the editor and propose solutions that offset the negative effects of this technology.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.1.MS.5

Criteria	Apprentice	Basic	Meets	Exceeds
Correctness of concept map	Selects one technological issue and connects two positive cause and effect relationships and one negative cause and effect relationship.	Selects one technological issue and connects three positive cause and effect relationships and two negative cause and effect relationships.	Selects one technological issue and connects four positive cause and effect relationships and three negative cause and effect relationships.	Selects one technological issue and connects five or more positive cause and effect relationships and four or more negative cause and effect relationships.
Completeness of explanation	Attempts to identify human consequences and shows cause and effect relationships.	Identifies and explains human consequences of identified issues, shows two cause and effect relationships, and attempts to support claims.	Identifies and explains human consequences of identified issues, shows three cause and effect relationships, supports claims, and attempts to propose solutions for change.	Identifies and explains human consequences of identified issues, shows cause and effect relationships (using concept map), supports claims, and proposes solutions or changes.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 2. All students will demonstrate where water is found on Earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

Benchmark
Use maps of the Earth to locate water in its various forms and describe conditions under which they exist .(SCI.V.2.MS.1).

Benchmark Clarification
Water exists in various forms on Earth. Different conditions cause water to exist as a liquid, solid, or gas.

Students will:
- Use a variety of maps such as relief, weather, topographic, road maps, and satellite images to locate water on Earth
- Use a variety of maps to interpret the state of water at a specific location on Earth

Key Concepts (voc.)
Liquid water forms:
- lakes
- rivers
- oceans
- springs
- seas

Frozen water forms:
- continental glacier
- valley glacier
- snow on mountains
- polar cap
- icebergs

Gaseous water in atmosphere

Real-World Context

- local lakes
- rivers
- streams
- ponds
- springs

Examples of frozen water:

- snow
- glaciers
- icebergs
- polar regions
- frozen Great Lakes shorelines

Instructional Example SCI.V.2.MS.1

Benchmark Question: Where is water found on Earth and what are its characteristics?
Focus Question: What is the relationship between latitude and elevation on the forms that water takes on the Earth's surface?

Students will use a variety of maps to locate where various forms of water occur on the Earth's surface (i.e., in solid and liquid states, water vapor is always present in the atmosphere). Students will make a data table listing the examples and the state of matter associated with each example. Students will discuss where each form of water exists. Students will graphically show relationships between the form that water takes and its location based on latitude and elevation. Students should conclude that water in its solid state is found at higher elevations and higher latitudes. Water in its liquid state is found at lower elevations and lower latitudes nearer the equator.

Note: Half of Michigan's residents get their water through groundwater. Ground water should be included in instruction of this benchmark.

Constructing: (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*).

Reflecting: (*link to SCI.II.1MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.2.MS.1.html

EPA Office of Water
http://www.epa.gov/students/clean_water_basics.htm

Water Science for Schools: offers information on many aspects of water, along with pictures, data, maps, and an interactive center where you can give opinions and test your water knowledge. http://www.epa.gov/students/clean_water_basics.htm

River Cutters. GEMS.
http://www.lhs.berkeley.edu/GEMS/

VanBurgh, Dana. *How To Teach With Topographic Maps*. NSTA, 1994.
http://www.gsfc.nasa.gov/

http://www.noaa.com/

http://www.weather.com/

http://water.usgs.gov/education.html

http://www-atlas.usgs.gov/

http://mapping usgs.gov/esic/index.html

http://mapping usgs.gov/esic/map_dealers/mi.html

Classroom Assessment Example SCI.V.2.MS.1

Students will form small groups. Each group will choose a continent and obtain maps and references for one of the continents' regions. (Consider surface maps, relief maps, an almanac, and internet sites that are listed in the resources). It may be hard to find these maps for regions outside the U.S. Each group will research to find the elevation of the snow line for each mountain chain, the direction of flow for major rivers, and the location of major bodies of water (if applicable). Each group will develop a chart listing the two forms of water and ten different surface features according to the form of water found on that feature. Each student will write an essay that explains the role that latitude and elevation play in the form that water takes across this region of the continent.

Note: The teacher will need to provide substantial background information for students, it will be difficult to list a surface features on which ice will occur beyond mountain tops and valleys.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.2.MS.1

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of chart	Lists five or fewer surface features.	Lists six to eight surface features and places up to six correctly on the data chart.	Lists nine surface features with at least eight placed correctly on the data chart.	Lists ten or more surface features with ten placed correctly on the data chart.
Accuracy of essay	Writes an incomplete essay to address the issue of latitude and/or elevation about the form that water takes on this continent.	Writes an essay that correctly addresses a few of the connections between elevation, latitude, and the forms of water that are found in this region of the continent.	Writes an essay that correctly addresses many of the connections between elevation, latitude, and the forms of water that are found in this region of the continent.	Writes an essay that correctly addresses all of the connections between elevation, latitude, and the forms of water that are found in this region of the continent.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 2. All students will demonstrate where water is found on Earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

Benchmark
Describe how water in Michigan reaches the oceans and returns (SCI.V.2.MS.2).

Benchmark Clarification

Water cycles through the environment from the atmosphere to the biosphere, hydrosphere, and lithosphere and back again to the atmosphere. Water flows from Michigan to the AtlanticOcean and then returns to Michigan through the atmosphere.

Students will:

- Describe how water in Michigan reaches the ocean through surface run-off, creeks, streams, and rivers
- Describe how water returns to Michigan in the form of precipitation through the water cycle

Key Concepts (voc.)
Water path:

- Surface run-off
- creeks
- streams
- wetlands
- rivers
- Great Lakes
-

See Water cycle (*link to SCI.V.3.MS.3*).

See About groundwater (*link to* SCI.*V.2.MS.*

Sources:

- snowmelt
- rainfall

Real-World Context

- maps showing:
  - streams
  - lakes
  - rivers
  - oceans
- examples of direction of travel by water in rivers and lakes
- investigations of river and lake temperatures

Examples of groundwater:

- springs
- wells
- water soaking into the ground

Instructional Example SCI.V.2.MS.2

Benchmark Question: How does water move?
Focus Question: What path does water in Michigan take when it flows toward the ocean?

Students will examine maps of North America, the U.S., the Great Lakes Basin, the State of Michigan, and their local area. On the U.S map, students will highlight major rivers and tributaries from Michigan to the Atlantic Ocean; on the state map they will highlight major rivers. Students will also study a topographic map of their local area in Michigan and determine the direction of flow for major streams in their area. Students will work together to determine the paths that water takes from Michigan to reach the Great Lakes and the Atlantic Ocean. They will use arrows to show this path on a United States map.

Constructing: (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.5*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.2.MS.2.html

The Michigan Watershed Homepage: links to Michigan watershed information, educational resources, and more.
http://www.deq.state.mi.us/swq/watershd/

Sharing Michigan's Watersheds it's Everyone's Business: Information for upper elementary level students about water and Michigan's watersheds.
http://www.deq.state.mi.us/enved/Student%20Info%20Kit.htm

http://www.globe.gov

Crowder, Jane**.** *Water Matters- Volume 3- Oceans, Watersheds & Hazardous Waste***.** NSTA, 1999.

River Cutters. GEMS.
http://www.lhs.berkeley.edu/GEMS/

*Water Cycle/ Oceanography***.** Bill Nye Video. Disney Educational. (800/295-5010).

Water Precious Water. AIMS.
http://www.aimsedu.org/aimscatalog/

Classroom Assessment Example SCI.V.2.MS.2
The teacher will give each group of students a set of laminated maps to study locations of large bodies of water as well as rivers, streams, etc. To determine direction of flow of streams and rivers, students will check elevation by using a topographic map of the area. Each student will describe the path that water takes in written form (story, essay, or poem) and present his or her description to the class.

(Give students checklist before activity.)

Scoring of Classroom Assessment Example SCI.V.2.MS.2

This is a pass/fail activity. Three out of four equals a pass.
Checklist:

1. Student identifies origin and final location of water.
2. Student traces a plausible path from origin to ocean.
3. Student writes and explains his or her reasoning for the path.
4. Student presents findings and communicates his or her rationale to the class.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 2. All students will demonstrate where water is found on Earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere (Hydrosphere).

Benchmark
Explain how water exists below the Earth's surface and how it is replenished (SCI.V.2.MS.3).

Benchmark Clarification

Precipitation can filter through the layers of the Earth and create groundwater, one type of useable water resource.

Students will:
- Illustrate how groundwater accumulates and forms the water table
- Explain how groundwater is replenished

Key Concepts (voc.)
Groundwater:
- water table
- spring
- porous
- saturate
- filtration

Sources:
- snowmelt
- rainfall

Real-World Context
Examples of groundwater, including springs, artesian wells, seeps, and water soaking into the ground

Instructional Example SCI.V.2.MS.3

Benchmark Question: Where is water found on Earth and what are its characteristics?
Focus Question: How does groundwater move below the Earth's surface?

Note: Prior to this activity, the teacher may want to construct a model of groundwater using an aquarium. Workshops are available through the Michigan State University Cooperative Extension Service Groundwater Education Program.

Students will observe and interpret diagrams showing the direction of movement of groundwater and some of its sources. Students will develop their own diagrams that replicate this movement. Student diagrams might include the following:

- Sources of groundwater (lakes, rivers, etc.)
- Aquifers – Earth materials that contain groundwater and permit its flow (sandstone, sandy soil)
- Aquatards – Earth materials that prevent the easy flow of liquids (granite, clay)

Students will place samples of these materials (sandstone, types of soil, pebbles) or materials that represent natural Earth materials in a clear container and slowly pour water over the materials. Students will describe the movement of water through each material and record their observations. Students will compare the movement of water through each material and relate these observations to real-world phenomena. They will consider filtration, permeability.

Once diagrams are complete, students will write an essay that describes their diagrams and explains how and why movement takes place. Students will receive feedback from peers as they compare and share their essays.

Constructing: (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*).

Reflecting: (*link to SCI.II.1.MS.5*)

Resources/References:

Webliography
http://mtn.merit.edu/mcf/SCI.V.2.MS.3.html

Groundwater Basics - Information on the benefits from groundwater and ways to conserve and protect it.
http://www.groundwater.org/GWBasics/gwbasics.htm

Ground water Primer-If you have any questions about ground water and what you can do to help protect it, chances are you'll find an answer here.
http://www.epa.gov/students/ground_water_primer.htm

Healthy Lawns for Healthy People -An environmental education curriculum for upper elementary and middle school consisting of activities and educational handouts targeting groundwater preservation and related topics. For a free copy of the curriculum guide write: Healthy People, Healthy Oakland Organization, 1200 North Telegraph, Pontiac 48336, or phone: 248-452-9174

Acid Rain. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Crowder, Jane. *Water Matters- Volume 2- Navigation, Groundwater and Water Quality*. NSTA, 1997.
Groundwater Education Manual & Model. MSU Extension Service.

Wright, Russell. *Toxic Leak!* GROUNDWATER MODULE. NSTA, 1996.

Classroom Assessment Example SCI.V.2.MS.3

Working in small groups, students will design and create three-dimensional models that show movement of groundwater. Students will provide written explanations of their designs and models as they relate to the real world. These models should be based on the diagrams developed by the students and may include household materials such as foam rubber, cereal, etc. or natural Earth materials.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example V.2.MS.3

Criteria	Apprentice	Basic	Meets	Exceeds
Construction of groundwater model	Attempts to build a working model.	Produces a working model that shows water movement without labeling.	Produces a working model that correctly labels and demonstrates the movement of water.	Produces a working model that replicates two or more pathways that water takes. The model demonstrates and correctly labels those pathways.
Completeness of explanation	Provides an incomplete explanation of the model and does not demonstrate how it works or show how the model connects to the Real-World Context.	Provides a complete explanation of the model and does not demonstrate how it works or show how the model connects to the Real-World Context.	Provides a complete explanation of the model and demonstrates how it works, connecting the model to the Real-World Context.	Provides a complete explanation of the model and demonstrates how it works, connecting the model to the Real-World Context.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 2. All students will demonstrate where water is found on Earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere (Hydrosphere).

Benchmark
Describe the origins of pollution in the hydrosphere (SCI.V.2.MS.4).

Benchmark Clarification
Humans, as well as nature, pollute the hydrosphere. Some of the human activities that can cause water pollution are:

- Construction
- Industrial waste
- Agricultural runoff
- Sewage
- Household dumping
- Burning of high sulphur coal, incinerators, car exhaust

Students will:

- Investigate a human activity that causes water pollution

Key Concepts (voc.)
Sources of pollution:

- sewage
- household dumping
- industrial wastes
- agricultural run-off

See Agricultural pollution (*link to SCI.III.5.MS.6).*

Real-World Context

- examples of polluted water
- examples of occasions when the water supply is restricted, such as during droughts or floods

Instructional Example SCI.V.2.MS.4

Benchmark Question: How do human activities interact with the hydrosphere?
Focus Question: What effect does pollution have on the source of water?

Students will participate in a field trip to collect water samples or the teacher will provide water samples from a lake, stream, river, pond, and household source. Students will make observations or receive descriptions of the natural and industrial surroundings of the five water sources. Students will hypothesize which water sample is most polluted, undrinkable, and why. Students will collect data by performing chemical tests (pH, dissolved oxygen, phosphate, nitrate, colliform, and turbidity and by making microscopic observations of the water samples. Students will compile and use data in charts and graphs to evaluate their original hypothesis. Students will compare and contrast the results of the four water samples to household drinking water and determine if they would consume water from the other four sources.

Note: Teachers should emphasize the increasingly important role that aerial transport of contaminants into water bodies. Most of the Pb and Hg reaching Lake Superior, for example, comes from aerial transport. This leads to a discussion on our interconnectedness because with aerial transport, state and international boundaries are easily crossed. How one state pollutes impacts another.

Constructing: (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.2.MS.4.html

A List of 100 Curricula for Educating Youth About Water
http://www.uwex.edu/erc/ywc/sumlist.htm

Acid Rain Sourcebook: “Activities, information and things you can do about acid rain.”
http://www.epa.gov/students/acid_rain_sourcebook_us.htm

Acorn Naturalists: “Resources for Exploring Aquatic Habitats (Water quality monitoring equipment, aquatic nets, etc.”
http://www.acorn-group.com

Common Aquatic Plants of Michigan: - A description of some of the most commonly occurring aquatic plants in Michigan.”
http://www.deq.state.mi.us/enved/Common%20plants.htm

Ecosystem Experiments for Young Investigators - Water Experiments.
http://www.nalms.org/educate/funexp.htm

Acid Rain. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Crowder, Jane. *Water Matters- Volume 2- Navigation, Groundwater and Water Quality*. NSTA, 1997.

Global Rivers Environmental Education Network.
http://www.g.r.e.e.n.com/

http://www.globe.gov/

Stapp, William. *Field Guide for Water Quality Testing*.

Water Precious Water. AIMS.
http://www.aimsedu.org/aimscatalog/

Classroom Assessment Example SCI.V.2.MS.4

Students will write lab reports about the investigations they performed in the Instructional Example that include analysis of the data and the rationale behind their decisions to consider water consumable or not. The data should be represented in data tables and graphs that include the results of chemical tests, sketches of microscopic observations, and collection of geographical data.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.2.MS.4

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of chemical test data	Presents a chart that shows results of one test.	Presents a chart that shows results of two test types.	Presents a chart that shows results of three test types.	Presents a chart that shows all testing results.
Accuracy of microscopic sketches	Attempts a sketch of micro-organism(s).	Completes a sketch of micro-organism(s).	Completes a sketch of micro-organism(s) showing detail.	Completes sketches of micro-organisms that are detailed and concise.
Completeness of geographical data	Attempts to present geographical data.	Displays one or two areas of geographical data.	Displays all geographical data.	Displays geographical data that is accurate and complete.
Accuracy of conclusion	Attempts a conclusion.	Provides an acceptable conclusion.	Provides a detailed conclusion.	Provides a detailed and accurate conclusion.
Completeness of lab report	Presents limited information that is relevant to water consumption.	Presents information that demonstrates an effort to organize the information.	Presents an accurate, interesting, and well-organized report.	Presents an interesting and accurate report that is clearly focused with explanation of results.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 3. All students will investigate and describe what makes up weather and how it changes from day to day, from season to season, and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Benchmark
Explain patterns of changing weather and how they are measured (SCI.V.3.MS.1).

Benchmark Clarification
Weather scientists/meteorologists try to predict the weather. They use a variety of instruments to measure weather in order to develop patterns. They base their predictions on these measurements and patterns.

Students will:
- Use weather maps and satellite images to detect weather patterns
- Use weather maps and satellite images information to write weather predictions
- Manipulate a variety of weather measuring instruments to measure temperature, wind speed and direction, cloud cover, humidity, dew point, amount of rainfall, and other weather phenomena

Key Concepts (voc.)
Weather patterns:
- cold front
- warm front
- stationary front
- air mass
- humidity

Tools:
- thermometer
- rain gauge
- wind direction indicator
- anemometer
- weather maps
- satellite weather images
- cloud charts
- barometer

Real-World Context

- sudden temperature, pressure, and cloud formation changes
- records, charts, and graphs of weather changes over period of days
- lake effect snow

Instructional Example SCI.V.3.MS.1

Benchmark Question: What causes different kinds of weather?
Focus Question: How do you interpret and forecast weather?

A local meteorologist could be invited to speak to the class as an introduction or to evaluate projects at the end of the unit. The teacher will introduce students to standard weather symbols. Students will track the movement of weather across a global map using weather symbols. Students will use this data to interpret and predict forecasts of upcoming weather.

Students will observe, identify, and record weather data using weather maps, satellite images, weather measuring instruments, and local weather forecasts. They will record their data in a data table.

Students will design and make one weather instrument.

Using their constructed instrument, students will design an investigation to show how that instrument is used to predict the weather. Students will share their tools and data with the class.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*).

Reflecting: (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.3.MS.1.html

Michigan Weather Conditions: most current weather reports and forecasts from Michigan's weather stations.
http://www.wunderground.com/forecasts/MI.html

Surface Weather Map from Intellicast-see the location of pressure zones, fronts, precipitation, and isobars.
http://www.intellicast.com/LocalWeather/World/UnitedStates/SurfaceAnalysis/

Midwest Temperature Map: color contour of temperature patterns.
http://www.wunderground.com/US/Region/Midwest/2xTemperature.html

Surface Wind Map: Color contour map of surface wind intensity; wind vector arrows are displayed to show the wind direction.
http://www.wunderground.com/US/Region/US/2xWindSpeed.html

National Jetsteam Chart: undulations in the path of the jet stream are a main determinant in the type of weather we receive.
http://www.intellicast.com/LocalWeather/World/UnitedStates/JetStream/

Weather Radar from Lansing: the closest location for receiving radar imagery of weather systems affecting the state
http://www.intellicast.com/LocalWeather/World/UnitedStates/Midwest/Michigan/Lansing/Radar/

Atmosphere/ Flight. Bill Nye Video. Disney Educational. (800/295-5010).

Down To Earth. AIMS.
http://www.aimsedu.org/aimscatalog/

Global Warming and the Greenhouse Effect. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Wild About Weather. RANGER RICK'S NATURESCOPE SERIES. National Wildlife Federation, 1993.

http://www.globe.gov/

Classroom Assessment Example SCI.V.3.MS.1

From the data collected in the Instructional Example, students will work in small groups to formulate weather patterns and explain relationships. Each group will chart the patterns using weather symbols and use all gathered information to create a forecast to present to the class. This forecast should include weather tools, maps, and data tables.

(Give students rubric before activity.)

Note: Changes in the jet stream can produce big changes over a short period of time. Lake effect snow makes snowfall variable. Summer precipitation is notoriously variable over a small area. Teachers should be looking for logic and consistency in write-up rather than a total reliance on whether a forecast is right or wrong..

Scoring of Classroom Assessment Example SCI.V.3.MS.1

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of data table	Produces a data table.	Produces a detailed data table.	Produces an organized data table that is detailed.	Produces an organized data table that is accurate and detailed and includes a graph of the weather data.
Accuracy of weather forecast	Makes an inaccurate weather prediction without reference to data table or tools.	Uses tools and data table to make an inaccurate weather prediction.	Uses tools and data table to make an accurate weather prediction.	Uses tools and data table to make detailed and accurate weather predictions.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 3. All students will investigate and describe what makes up weather and how it changes from day to day, from season to season, and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Benchmark
Describe the composition and characteristics of the atmosphere (SCI.V.3.MS.2).

Benchmark Clarification
Human and natural activities affect the atmosphere. Scientists have collected data about the atmosphere from weather balloons, weather airplanes, satellites, and computer modeling.

Students will:
- Explain the chemical composition of the atmosphere using molecular components like nitrogen, oxygen, water vapor and other gases
- Describe the atmosphere using characteristics such as air pressure, temperature changes, and humidity

Key Concepts (voc.)
Composition:
- air
- molecules
- gas
- water vapor
- dust particles

Characteristics:
- air pressure changes with altitude
- temperature changes with altitude
- humidity

Real-World Context
Examples of characteristics of the atmosphere:
- water boils at different temperatures at different elevations
- pressurized cabins in airplanes
- demonstrations of air pressure

Examples of air-borne particulates:

- smoke
- dust
- pollen
- bacteria

Effects of humidity:

- condensation
- dew on surfaces
- comfort level of humans

Instructional Example SCI.V.3.MS.2
Benchmark Question: What makes up weather?
Focus Question: What is air pressure and how does it affect weather?

Students will demonstrate that air exerts pressure by experimenting with tubs of water and different sized beakers/jars. Students will experience the force of air pressure between the trapped gas in the beakers/jars and the water. Students will write predictions about how the size of the jar affects the amount of air pressure. Working in small groups, they will design and conduct experiments to test their hypothesis. They will collect, record, and interpret data. Students will relate their data to weather changes caused by the differences in air pressure.

A variety of activities can be completed to show water vapor in the air. One activity is to use two tablespoons of cobalt chloride to one pint of water solution. Coffee filters can be dipped into the solution and hung to dry. When dry, students can form a flower using a pipe cleaner and a student lunch milk carton for the base. Students can place the flower in their bathrooms at home and observe the color of the flower before they shower and again after they shower and record their observations.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.3*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.5*), (*link to SCI.I.1.MS.6*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.3.MS.2.html

CLIMATE EFFECTS ON HUMAN HEALTH: long term effects of how temperature, humidity, wind, and pressure affect human health.

http://www.ciesin.org/docs/001%2D338/001%2D338.html

Weather Topics: indexed weather topics in the easy to read format characteristic of USA Today. http://www.usatoday.com/weather/index/windex.htm

Weather Animations: USA Today archives a number of effective and quick loading animated gifs depicting weather phenomena relating to air masses, air pressure, El Nino, floods, hurricanes, lightning, optical effects, seasons, storms, winds, and more. http://www.usatoday.com/weather/wgraph0.htm

http://ww2010.atmos.uiuc.edu/

http://www.weather.com/

Williams, Jack. *The Weather Book- An Easy-to Understand Guide to the USA's Weather*. NSTA, 1997.

Classroom Assessment Example SCI.V.3.MS.2

Students will build models to show variations in air pressure or humidity. They will work with the model to explore and collect data on the properties of air. They will write their observations and conclusions from the investigation. They will relate their work to another application such as hot air balloons, temperature variation at the top and bottom of a mountain, and pressurized cabins on an airplane.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.3.MS.2

Criteria	Apprentice	Basic	Meets	Exceeds
Accuracy of observations	Writes no observations.	Writes a few accurate observations.	Writes two accurate observations.	Writes three or more accurate observations.
Completeness of conclusions	Writes no conclusions.	Writes one complete conclusion.	Writes two complete conclusions.	Writes three or more complete conclusions.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 3. All students will investigate and describe what makes up weather and how it changes from day to day, from season to season, and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Benchmark
Explain the behavior of water in the atmosphere. (SCI.V.3.MS.3)

Benchmark Clarification
Water moves through the atmosphere in a pattern called the water cycle. As it moves through the atmosphere, water changes states from a solid to a liquid, from a liquid to a gas, and from a liquid to a solid.

Students will:
- Investigate various forms of water in the atmosphere
- Explain how water changes states as it moves through the water cycle by using the terms evaporation, condensation, and precipitation

Key Concepts (voc.)
Water cycle:
- evaporation
- water vapor
- warm air rises
- cooling
- condensation
- clouds

See Changes of State (*link to SCI.IV.2.MS.1).*
See Water on the Earth's Surface (*link to SCI.V.2.MS.2*)

Precipitation:
- rain
- snow
- hail
- sleet
- freezing rain

Real-World Context
Aspects of the water cycle in weather:

- clouds
- precipitation
- evaporating puddles

Instructional Example SCI.V.3.MS.3

Benchmark Question: What form does water take as it moves through the water cycle?
Focus Question: What different forms will water take when it is heated or cooled?

Students will observe a demonstration that introduces the concept of water changing forms through condensation, evaporation, and precipitation, which are processes of the water cycle.

In the demonstration, water is heated by a hot plate. This represents the Sun heating water from the lakes, rivers, streams, and the ocean. Students will observe the process of evaporation, draw diagrams of the movement of water molecules, explain what happens to the water molecules in captions under the diagrams, and give examples of the process of evaporation.

The steam from the heated water represents the process of condensation as water vapor in the air cools. Students will observe that water droplets or ice crystals are formed from the water vapor that is cooled by the air. They will observe the process of condensation, draw diagrams of the movement of water molecules, explain what happens to the water molecules in captions under the diagrams, and give real-world examples of the process of condensation.

Finally, students will observe droplets that fall to the floor and compare them to the rain or other forms of precipitation that fall back to the oceans and ground. They will observe the process of precipitation, draw diagrams of the movement of water molecules, explain what happens to the water molecules in captions under the diagrams, and give real-world examples of the process of precipitation.

Last, students will draw pictures that illustrate real-world examples of evaporation, condensation, and precipitation.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*).

Reflecting: (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.3.MS.3.html

Follow a Drip Through the Water Cycle
http://www.epa.gov/students/clean_water_basics.htm

The Water Cycle
http://www.epa.gov/students/clean_water_basics.htm

Smith, P. Sean. *Project Earth Science: Meteorology*. NSTA,1999.

Water Cycle.
http://www.epa.gov/grtlakes/seahome/groundwater/src.cycle.htm#cycle

Classroom Assessment Example SCI.V.3.MS.3

Students will create diagrams that accurately illustrate all processes (evaporation, condensation, and precipitation) and varying forms that water takes as it moves throughout the water cycle. Diagrams must include short written descriptions of real-life examples. Processes and states of matter must be labeled correctly.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.3.MS.3

Criteria	Apprentice	Basic	Meets	Exceeds
Diagram of water cycle	Diagrams the water cycle with arrows; attempts to correctly connect and label processes and/or states of matter.	Diagrams the water cycle using illustrations; attempts to correctly connect and label the processes and three states of matter.	Diagrams the water cycle using illustrations, correctly showing and labeling all relationships between processes and states of matter.	Diagrams the water cycle with detailed illustrations, correctly and clearly showing relationships between all processes and states of matter.
Correctness of real-world examples	Correctly gives a real-world example of a state of matter and a process related to the water cycle.	Correctly describes two to three real-world examples of a state of matter and processes related to the water cycle.	Correctly describes four to five real-world examples of at least two states of matter and processes related to the water cycle	Correctly describes six or more real-world examples of processes and states of matter related to the water cycle.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 3. All students will investigate and describe what makes up weather and how it changes from day to day, from season to season, and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Benchmark
Describe health effects of polluted air (SCI.V.3.MS.4).

Benchmark Clarification
Polluted air affects people's health in many ways. Pollution can be man-made or naturally occurring.

Students will:

- Research causes of natural pollution: pollen, carbon dioxide, ozone, sulfur dioxide, etc., and the effects these pollutants have on human health
- Research man-made pollution: car exhaust, power plant emissions, industrial emissions, etc., and the effects these pollutants have on human health
- Recommend solutions that will minimize the harmful effects of air pollutants on humans

Note: Indoor air pollution needs to be considered, given the fact that we spend 90% of our time indoors and that many of the pollutants that we fear are higher inside the house than outside. See web link listed in resources.

Key Concepts (voc.)
Effects:

- breathing difficulties
- irritated eyes

Sources (man-made):

- car exhaust
- industrial emissions
- acid rain

Real-World Context

- locations and times when air quality is poor
- local sources of potential air pollution
- ozone warnings

Instructional Example SCI.V.3.MS.4

Benchmark Question: What are the relationships between human activities and the atmosphere?
Focus Question: What human health risks are associated with air pollution?

Students in small groups will select an urban, agricultural, or industrial area. Using a variety of resources, including technology and media, students will collect and share data relating to health issues caused by air-borne pollutants from the chosen area.

Each small group will create a visual presentation displaying that pollutants are normally found in the chosen area, where the pollutants originate, and the health effects associated with them.

Each small group will generate a plan to eliminate or decrease these pollutants. The plan can be shared with parents and other members of the community to increase a general awareness of the human health risks from air pollution.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.5*).

Reflecting: (*link to SCI.II.1MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.3.MS.4.html

Ozone Action! - clean air coalition of Southeast Michigan Teacher's
Resource Kits for grades K-12. Resources and activities link MEAP science proficiency standards and math/science objectives with the Ozone Action! Program.
http://www.semcog.org/ozoneaction/teachers.html

Ozone Action - Teacher Packets: Available in K-5, 6-8, and 9-12 grand formats. Packets include lesson plans and activities for teachers to use as part of their science curriculum to educate students on the effects of ground-level ozone.
http://www.cesmi.org/public/ozone.html

The Inside Story This page provides basic facts about pollutants found inside our buildings and homes.
http://www.epa.gov/students/inside_story.htm

Midwest Air Quality Information: air quality trends, maps, and reports for EPA Region 5 (Michigan, Wisconsin, Indiana, Illinois, Ohio, and Minnesota).
http://www.epa.gov/ARD-R5/naaqs/naaqs.htm

EPA'S National Air Quality Trends: "This is the twenty-fourth annual report on air pollution trends in the United States issued by the U.S. Environmental Protection Agency." http://www.epa.gov/oar/aqtrnd96/general.html

Acid Rain. GEMS. http://www.lhs.berkeley.edu/GEMS/

Classroom Assessment Example SCI.V.3.MS.4

Students will create letters to the editor that alert the community to the airborne pollutants in the surrounding area and the health effects related to these pollutants. Each letter to the editor should include:

- An understanding of the issues based on research
- Visual connections that relate pollutants to health issues in the form of graphs or data tables
- Alternatives/solutions to the stated problems

Students should send copies of their letters to a local newspaper.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.3.MS.4

Criteria	Apprentice	Basic	Meets	Exceeds
Understanding of health effects	Provides a personal interpretation of at least one health issue as it relates to pollutants.	Provides a research-based interpretation of at least one health issue as it relates to pollutants.	Provides a research-based interpretation of at least two health issues as they relate to pollutants.	Provides a thorough and accurate research-based interpretation of several health issues as they relate to pollutants.
Connections between a pollutant and a health issue	Presents a visual connection between a pollutant and a health issue.	Presents a visual connection between more than one pollutant and the resulting health issues.	Presents clear, visual connections between some pollutants and health issues.	Presents clear, logical connections between many pollutants and health issues including data tables or graphs.
Solution to problems	Explains one possible solution that is not feasible.	Explains one solution that is feasible.	Explains thoughtful alternatives and/or some solutions to the problem.	Explores and generates questions and proposes alternatives or many solutions to the problem.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 4. All students will compare and contrast our planet and Sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy, and Universe)

Benchmark

Compare the Earth to other planets in terms of supporting life (SCI.V.4.MS.1).

Benchmark Clarification

The Earth is the only planet in the solar system that is known to support life as we know it. Scientists have drawn this conclusion based on comparing data from other planets to data from Earth. Some of these factors are:

- temperature and pressure conditions
- surface features
-
- gravitational pull
- the position in the solar system
- ability of the atmosphere to screen ultraviolet radiation
- proper concentration of carbon dioxide. Mars has too little; Venus has too much

Students will:

- Compare Earth to other planets in the solar system

Key Concepts (voc.)

Surface conditions:

- gravity
- atmosphere
- temperatures
- ozone
-

Relative distances; relative sizes

Sun produces light and heat for each planet

Molecules necessary to support life:

- water
- oxygen
- nitrogen
- carbon

See Cell processes (*link to SCI.III.1.MS.2).*
See Photosynthesis (*link to SCI.III.2.MS.3).*
See Light needed for Energy (*link to SCI.III.5.MS.2).*

Real-World Context

- examples of local and extreme outdoor conditions on Earth vs. conditions on other planets
- exploration of planets and their satellites

Instructional Example SCI.V.4.MS.1
Benchmark Question: How does our planet and Sun compare to other planets and star systems?
Focus Question: What conditions do living things need to exist on other planets?

Students will brainstorm conditions necessary for life on Earth (water, oxygen, suitable temperatures, presence of ozone, proper amount of greenhouse gases like carbon dioxide and water vapor etc.) Students will list characteristics and traits that allow organisms to sustain life on Earth.

Using a variety of sources, students in small groups will select a planet (other than Earth), conduct research, and gather factual information about that planet, including its atmosphere, surface features, gravitational pull, and temperature conditions. These sources may include data collected from Galileo, Voyager, and other NASA space probes.

Using gathered information on the planets, each small group will create an illustration of an alien creature that has adapted to the conditions found on their selected planet, such as an alien drawn with space suit to adapt to the gases and extremely hot temperatures of Venus. Students will write and present a report describing their alien and its adaptations in relation to the planet's conditions.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.2*), (*link to SCI.I.1.MS.5*).

Reflecting: (*link to SCI.II.1.MS.1*), (*link to SCI.II.1.MS.2*), (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*), (*link to SCI.II.1.MS.6*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.4.MS.1.html

The Nine Planets: Take Bill Arnett's multimedia tour of the Solar System. " 'The Nine Planets' is a collection of information about our Solar System intended for a general audience with little technical background. "

http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html

http://www.nasaspacelink.com/

http://www.thursdaysclassroom.com/

Fraknoi, Andrew. *The Universe at Your Fingertips*. NSTA, 1995.

Messages From Space. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Out of This World. AIMS.
http://www.aimsedu.org/aimscatalog/

Sun/Planets. Bill Nye Video. Disney Educational. (800/295-5010).

Classroom Assessment Example SCI.V.4.MS.1

Small groups will build a form or a model of an alien from another planet found in our solar system. They will use their research information to determine which characteristics the alien must have to adapt to their planet's atmosphere, surface features, gravitational pull, and temperature conditions.
Each group will present its design to the class and support their design with research information.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.4.MS.1

Criteria	Apprentice	Basic	Meets	Exceeds
Model of alien adaptations	Uses model to explain relationships of a single planet condition to the characteristics of the alien.	Uses model to explain relationships of two or three planet conditions to the characteristics of the alien.	Uses model to explain relationships of all four planet conditions to the characteristics of the alien.	Uses model to explain relationships of all four planet conditions to the characteristics of the alien. The illustration is colored with background effects.
Quality of model	Builds a poor model.	Builds an average model.	Builds an above average model.	Builds an excellent model.

Strand: V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard: 4. All students will compare and contrast our planet and Sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe (Solar System, Galaxy, and Universe).

Benchmark
Describe, compare, and explain the motions of solar system objects (SCI.V.4.MS.2).

Benchmark Clarification
The solar system is in constant and predictable motion and involves many different types of natural and man-made objects. Diagrams, models, and simulations can help students understand these celestial motions.

Students will:

- Demonstrate an understanding of the motion of major objects in our solar system, including the rotation (*link to Glossary*), orbit (*link to Glossary*), and revolution (*link to Glossary*) of planets, moons, and asteroids

Rotation: the motion of one object spinning on an axis
Orbit: the path of any celestial body around another celestial body
Revolution: the motion of one object in space around another

Key Concepts (voc.)

- orbit
- rotation (spin)
- axis
- gravity
- planets
- moons
- rings
- comets
- asteroids
- seasons

Tilt of the Earth on its axis
Direct/Indirect rays
See Force and Change in Motion (*link to SCI.IV.3.MS.2).*
See Gravity (*link to SCI.IV.3.MS.3).*

Real-World Context

- observations of comet motion over days and weeks
- length of day and year on planets
- changes in length of daylight and height of Sun in sky
- changes in daily temperature patterns
- summer and winter solstices
- spring and fall equinoxes

Instructional Example SCI.V.4.MS.2
Benchmark Question: How do objects in the solar system move?
Focus Question: How does the gravitational pull of objects in the solar system affect revolution?

Students will brainstorm a list of objects in the solar system. Using this list, students will connect prior knowledge to how the objects move. Students may remember information about Halley's Comet and how it returns to the Earth's view every seventy-six years. This could spark a discussion on where the comet is when we can't see it.

Students will have prior knowledge about some celestial objects; the teacher will direct discussion accordingly. By the end of the discussion, students should gain an understanding of how objects revolve around the Sun. Students will demonstrate that understanding by role-playing a solar system. Students will write a role-play in groups that demonstrate how planets, comets, and other objects revolve around the Sun.

Some natural questions will arise once students begin to write. Students will question why "moons" or natural satellites revolve around planets and not the Sun. The teacher will facilitate a discussion about gravity and get students to arrive at answers to their own questions. Students will create a relative-size model of the Sun and planets. See the chart below for the scale model.

From this model, students will be able to visualize how large the Sun is compared to the rest of the planets. Students will relate size to gravitational pull.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.4*), (*link to SCI.I.1.MS.5*).

Reflecting: (*link to SCI.II.1MS.1*), (*link to SCI.II.1.MS.4*), (*link to SCI.II.1.MS.5*), (*link to SCI.II.1.MS.6*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.4.MS.2.html

Captain Comet:Stardust is the first NASA mission dedicated to exploring a comet. Geared toward a K-12 audience, this site offers images, a FAQ section, puzzles, and general information about comets.
http://stardust.jpl.nasa.gov/captaincomet/index.html

The Nine Planets: Take Bill Arnett's multimedia tour of the Solar System. " 'The Nine Planets' is a collection of information about our Solar System intended for a general audience with little technical background. "
http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html

http://www.spacelink.nasa.gov/

http://www.windows.uca.edu/

Fraknoi, Andrew. *The Universe at Your Fingertips*. NSTA, 1995.

Lunar prospector.
http://lunar.arc.nasa.gov/

Messages From Space. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Moon.
http://www.seds.org/nineplanets/luna.html

Out of This World. AIMS.
http://www.aims.edu.org/aimscatalog/

Sun/Planets. Bill Nye Video. Disney Educational. (800/295-5010).

Chart for planet scale model: 1cm = 6692km

Name	Actual diameter in kilometers	Scale diameter in meters
Sun	**1,395,161 km**	**2.08 meters**
Mercury	**4,880 km**	**7.3 mm**
Venus	**12,104 km**	**1.8 cm**
Earth	**12,756 km**	**1.9 cm**
Mars	**6,787 km**	**1.0 cm**
Jupiter	**142,800 km**	**21.3 cm**
Saturn	**120,600 km**	**18.0 cm**
Uranus	**50,800 km**	**7.6 cm**
Neptune	**48,600 km**	**7.3 cm**
Pluto	**3,000 km**	**4.5 mm**

Classroom Assessment Example SCI.V.4.MS.2

Students will work in pairs, taking on the identity of a particular planet, to write and perform a role-play about how (in terms of revolution duration) and why (in terms of gravitational attraction) objects move around the Sun. One student should move around the Sun as his or her partner does the following:

- Explains where his or her "planet" (partner) is in relationship to other planets
- Explains why his or her partner is moving in a particular path
- Gives examples of other planets or heavenly bodies that affect his or her planet's location in space. Gives the number of satellites (moons) and gives possible reasons for this number
- Explains why planets or other heavenly bodies affect his or her partners' location in space

Each pair of students will write explanations to the above considerations (These should be written prior to the role-play). Role-plays should include many different approaches so all students might fully comprehend the effect that heavenly bodies have on one another.

(Give students rubric before activity.)
Scoring of Classroom Assessment Example SCI.V.4.MS.2

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of explanation	Explains the revolution of a planet by thoroughly addressing one point.	Explains the revolution of a planet by thoroughly addressing two points.	Explains the revolution of a planet by thoroughly addressing three points.	Explains the revolution of a planet by thoroughly addressing all five points.

Strand: V. Use Scientific Knowledge form the Earth and Space Sciences in Real-World Contexts

Content Standard: 4. All students will compare and contrast our planet and Sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe (Solar System, Galaxy, and Universe).

Benchmark
Describe and explain common observations of the night skies (SCI.V.4.MS.3).

Benchmark Clarification
People have always observed the night sky and made observations of changes they have seen. Many cultures have recorded these observations and tried to determine patterns. Different objects move in different patterns.

Students will:
- Diagram the phases of the Moon over time
- Identify well-known constellations and stars

Key Concepts (voc.)
- perceived/actual movement of Moon across sky
- Moon phases
- eclipses
- stars and constellations
- planets
- Milky Way
- comets
- comet tail
- meteors
- asteroids

The Sun is the light source for all solar system objects except meteors, whose light is due to friction with the atmosphere

Emitted light vs. reflected

See (*link to SCI.IV.4.MS.3).*
See *(link to SCI.IV.4.MS.4).*

Real-World Context

- outdoor observing of the skies using:
  - telescopes
  - binoculars
  - "naked-eye" viewing
- telescopic and spacecraft-based photos of:
  - planets
  - moons
  - comets
  - news reports of planetary and lunar exploration

Instructional Example SCI.V.4.MS.3

Benchmark Question: How do objects in the solar system move?
Focus Question: Why do objects in the night sky appear to change?

On a nightly basis (early fall or late spring), students will practice using star charts to locate constellations in the night sky. Students will study the phases of the Moon and provide insightful, thoughtful explanations for the changing phases. Through role-play they are to use their knowledge in a new situation. For example, a student (Earth) holding a ball (Moon) could revolve around a light source (Sun) to diagram various phases. For a month, students will diagram the appearance (the amount of reflected light) of the Moon and its location relative to the horizon in the night sky. They will research the make-up, appearance, and occurrence of meteor showers and comets, offering a meaningful account of their presence and composition.

Constructing: (*link to SCI.I.1.MS.1*), (*link to SCI.I.1.MS.3*).

Reflecting: (*link to SCI.II.1.MS.3*), (*link to SCI.II.1.MS.5*).

Resources/References:

Webliography.
http://mtn.merit.edu/mcf/SCI.V.4.MS.3.html

Lunar Phases Web Tool: First, there are three tutorial pages that explain the elements of the lunar phases diagram one-by-one. Second, there is the lunar phases tool and quiz. The tool is an interactive version of the diagram and can be used to solve the problems posed by the quiz.
http://www.calvin.edu/~lmolnar/moon/

Your Sky: -A useful resource for obtaining sky maps for "any time and date, viewpoint, and observing location. Each map is accompanied by an ephemeris for the Sun, Moon, planets, and any tracked asteroid or comet. A control panel permits customization of magnitudes, color, image size, and other parameters."
http://www.fourmilab.to/yoursky/

http://www.thursdaysclassroom.com/

Earth, Moon and Stars. GEMS.
http://www.lhs.berkeley.edu/GEMS/

Moon/ Outer Space. Bill Nye Video. Disney Educational. (800/295-5010).

Outer Space/Way Out There. Bill Nye Video. Disney Educational. (800/295-5010).

Pieces and Patterns. AIMS.
http://www.aimsedu.org/aimscatalog/

Classroom Assessment Example SCI.V.4.MS.3

Pairs of students will create a three-dimensional or poster model that shows the Earth-Moon-Sun system. The model should be detailed, colorful, and easy to understand. It should include the phases of the Moon with consideration given to the misconceptions that the new moon phase is not the 1st Quarter phase and that a lunar eclipse does not occur with each full moon. Each pair of students will explain their model to the class. Each student should be prepared to answer teacher- and student-posed questions about the following:

1. Reasons for the various phases we see
2. Conditions for an eclipse to occur
3. Length of revolution
4. Effect on the Earth's rotation
5. The amount of reflected light that one sees from Earth

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.4.MS.3

Criteria	Apprentice	Basic	Meets	Exceeds
Construction of model	Fails to construct a model that attempts to show relationships in the system.	Constructs a model that shows correct and somewhat detailed relationships within the system.	Constructs a model that accurately shows relationships, is correct, and is easy to understand.	Constructs a model that is very detailed, interesting, and could easily be used as a teaching tool in showing Earth-Moon-Sun system relationships.
Explanation of model	Attempts to explain or illustrate required concepts.	Correctly illustrates at least seventy-five percent of the concepts and details required.	Correctly illustrates most phases of the Moon and uses model to demonstrate changing phases, an eclipse, and rotation and revolution.	Correctly illustrates and manipulates the model to show all phases of the Moon; demonstrates changing phases, an eclipse, and rotation and revolution.
Correctness of answers	Correctly answers at least fifty percent of the posed questions.	Correctly answers seventy-five percent of the posed questions with an attempt to use the model as a reference.	Correctly answers all questions, often using the model as a teaching tool.	Correctly answers all questions, effectively using the model as a teaching tool.