# Third Grade Companion Document
# 3-Unit 4: Earth Materials, Change, and Resources

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## Introduction to the K-7 Companion Document
## An Instructional Framework

### Overview

The Michigan K-7 Grade Level Content Expectations for Science establish what every student is expected to know and be able to do by the end of Grade Seven as mandated by the legislation in the State of Michigan. The Science Content Expectations Documents have raised the bar for our students, teachers and educational systems.

In an effort to support these standards and help our elementary and middle school teachers develop rigorous and relevant curricula to assist students in mastery, the Michigan Science Leadership Academy, in collaboration with the Michigan Mathematics and Science Center Network and the Michigan Science Teachers Association, worked in partnership with Michigan Department of Education to develop these companion documents. Our goal is for each student to master the science content expectations as outlined in each grade level of the K-7 Grade Level Content Expectations.

This instructional framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet the instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting findings and expanding thinking beyond the classroom.

These companion documents are an effort to clarify and support the K-7 Science Content Expectations. Each grade level has been organized into four teachable units- organized around the big ideas and conceptual themes in earth, life and physical science. . The document is similar in format to the Science Assessment and Item Specifications for the 2009 National Assessment for Education Progress (NAEP). The companion documents are intended to provide boundaries to the content expectations. These boundaries are presented as “notes to teachers”, not comprehensive descriptions of the full range of science content; they do not stand alone, but rather, work in conjunction with the content expectations. The boundaries use seven categories of parameters:

a. **Clarifications** refer to the restatement of the “key idea” or specific intent or elaboration of the content statements. They are not intended to denote a sense of content priority. The clarifications guide assessment.
b. **Vocabulary** refers to the vocabulary for use and application of the science topics and principles that appear in the content statements

and expectations. The terms in this section along with those presented within the standard, content statement and content expectation comprise the assessable vocabulary.

c. **Instruments, Measurements and Representations** refer to the instruments students are expected to use and the level of precision expected to measure, classify and interpret phenomena or measurement. This section contains assessable information.
d. **Inquiry Instructional Examples** presented to assist the student in becoming engaged in the study of science through their natural curiosity in the subject matter that is of high interest. Students explore and begin to form ideas and try to make sense of the world around them. Students are guided in the process of scientific inquiry through purposeful observations, investigations and demonstrating understanding through a variety of experiences. Students observe, classify, predict, measure and identify and control variables while doing “hands-on” activities.
e. **Assessment Examples** are presented to help clarify how the teacher can conduct formative assessments in the classroom to assess student progress and understanding
f. **Enrichment and Intervention** is instructional examples the stretch the thinking beyond the instructional examples and provides ideas for reinforcement of challenging concepts.
g. **Examples, Observations, Phenomena** are included as exemplars of different modes of instruction appropriate to the unit in which they are listed. These examples include reflection, a link to real world application, and elaboration beyond the classroom. These examples are intended for instructional guidance only and are not assessable.
h. **Curricular Connections and Integrations** are offered to assist the teacher and curriculum administrator in aligning the science curriculum with other areas of the school curriculum. Ideas are presented that will assist the classroom instructor in making appropriate connections of science with other aspects of the total curriculum.

This Instructional Framework is NOT a step-by-step instructional manual but a guide developed to help teachers and curriculum developers design their own lesson plans, select useful portions of text, and create assessments that are aligned with the grade level science curriculum for the State of Michigan. It is not intended to be a curriculum, but ideas and suggestions for generating and implementing high quality K-7 instruction and inquiry activities to assist the classroom teacher in implementing these science content expectations in the classroom.

## 3rd Grade Unit 4:
## Earth Materials, Change, and Resources

### Content Statements and Expectations

## 3 – Unit 4: Earth Materials, Change, and Resources

### Big Ideas (Key Concepts)

- The Earth has natural resources that are renewable or non-renewable.
- Humans are dependent on and affect their environments in helpful and harmful ways.
- The Earth's surface changes through slow processes and fast processes.
- Earth materials have useful properties and can enhance the quality of life.

### Clarification of Content Expectations

**Standard: Earth Systems**

**Content Statement – E.ES.E.4**
**Natural Resources – The supply of many natural resources is limited. Humans have devised methods for extending their use of natural resources through recycling, reuse, and renewal.**

**Content Expectations**

**E.ES.03.41** Identify natural resources (metals, fuels, fresh water, soil, and forests).

**Instructional Clarifications**

1. Identify means to recognize metals, fuels, fresh water, soil, and forests as natural resources.
2. Natural resources are naturally occurring materials and include metals, fuels, fresh water, soil, and forests.
3. Natural resources have different properties and help to sustain plant and animal life.
4. People use natural resources to make or produce the things that they need.
5. Natural resources can originate from living organisms (forests) or from non-living things (fuels, metals, freshwater).

**Assessment Clarifications**

1. Natural resources are naturally occurring materials and include metals, fuels, fresh water, soil, and forests.
2. Natural resources come from living organisms (forests) or from non-living things (fuels, metals, fresh water).

**E.ES.03.42** Classify renewable (fresh water, forests) and non-renewable (fuels, metals) resources.

**Instructional Clarifications**

1. Classify means to arrange or order natural resources as renewable or non-renewable based on the ability of the natural resource to be replaced by nature in a reasonable amount of time.
2. Natural resources are materials or things that people use from the Earth.
3. A renewable resource is one that can be replaced in a reasonable amount of time. It can be used again or made again by people or nature; or never run out. Fresh water and forests are examples. Other examples include plants and animals. Solar, wind, wave, or geothermal energies are renewable because they are based on renewable resources.
4. A non-renewable resource is one that cannot be replaced, renewed or re-grown by nature or people. It exists in a fixed amount in nature. Most non-renewable resources come from the Earth; they are found in the ground. Fuels taken from the Earth (fossil fuels) and metals are considered non-renewable because the Earth cannot replenish them at a rate fast enough for sustainability. They take longer than a person's lifespan to be replaced.
5. A common misconception is that all natural resources are renewable and can be replaced by nature.

**Assessment Clarifications**

1. Classify natural resources as renewable and non-renewable based on the ability of the resource to be replaced by nature in a reasonable amount of time.
2. A renewable resource is one that can be replaced in a reasonable amount of time. It can be used again or made again by people or nature; or never run out. Water and forests are examples. Other examples include plants and animals.
3. A non-renewable resource is one that cannot be made again by nature or people. There is a certain amount of them in nature and can be used up. Most come from the ground. Fuels taken from the Earth and metals are considered non-renewable because it takes millions of years for the Earth to produce more.

**E.ES.03.43** Describe ways humans are protecting, extending and restoring resources (recycle, reuse, reduce, renewal).

**Instructional Clarifications**

1. Describe means to tell or depict in spoken or written words how humans are protecting, extending and restoring resources.
2. Resources should be conserved and protected. This is especially true for non-renewable resources but renewable resources can also be killed (plants and animals) or overused (over-foresting, over-fishing the Great Lakes).
3. Some natural resources can be recycled. Recycled is to collect and return items or material to be manufactured into a new product. Materials that

are easily recycled include: glass, some plastics, paper, and aluminum, cardboard and steel.
4. Reuse is to use an object or item again or find new uses for items instead of throwing them away. Products that can be used again are paper bags, plastic jugs, jars, coffee mugs, plastic containers and flatware, etc.
5. Reduce is to produce less waste by choosing to buy fewer products or buying less wasteful products to conserve natural resources. Some examples are turning out the lights, using less water, reusing grocery bags, riding bikes, carpooling, using mass transportation, and considering the packaging before purchasing a product.
6. Renewal of resources includes activities such as replanting, reforesting, and composting.
7. A common misconception is that students cannot make a difference.

**Assessment Clarifications**

1. Resources should be conserved and protected. This is especially true for non-renewable resources but renewable resources can also be killed (plants and animals) or overused (over-foresting and over-fishing the Great Lakes).
2. Some natural resources can be recycled. Recycled is to collect and return items or material to be manufactured into a new product. Materials that are easily recycled include: glass, some plastics, paper, and aluminum, cardboard and steel.
3. Reuse is to use an object or item again or find new uses for items instead of throwing them away. Products that can be used again are paper bags, plastic jugs, jars, coffee mugs, plastic containers and flatware, etc.
4. Reduce is to produce less waste by choosing to buy fewer products or buying less wasteful products to conserve natural resources. Some examples are turning out the lights, using less water, reusing grocery bags, riding bikes, carpooling, using mass transportation, and considering the packaging before purchasing a product.
5. Renewal of resources includes replanting, reforesting, composting.

**E.ES.03.44** Recognize that paper, metal, glass, and some plastics can be recycled.

**Instructional Clarifications**

1. Recognize is to identify or perceive that some materials can be recycled.
2. Many materials that are used everyday can be recycled. This reduces the waste of natural resources, reduces energy usage, and reduces pollution and greenhouse gas emissions.
3. Almost all materials can be recycled but some of the most common are paper, metal, glass, and some plastics.
4. Recycled paper is made into new paper.
5. Recycled glass is made into new glass products.
6. Recycled metal is used in sheet metal for cars, bridges and even new cans.
7. Recycled plastic can be made into new plastic containers, clothing, furniture, and building products.

8. A common misconception is that all items can be recycled.

**Assessment Clarifications**

1. Many materials that are used everyday can be recycled.
2. Almost all materials can be recycled but some of the most common are paper, metal, glass, and some plastics.

## Content Statement – E.ES.E.5
## Human Impact – Humans depend on their natural and constructed environment. Humans change environments in ways that are helpful or harmful for themselves and other organisms.

## Content Expectations

**E.ES.03.51** Describe ways humans are dependent on the natural environment (forests, water, clean air, Earth materials) and constructed environments (homes, neighborhoods, shopping malls, factories, and industry).

**Instructional Clarifications**

1. Describe is to tell or depict in spoken or written words how humans are dependent on their natural and constructed environments.
2. A natural environment is the surroundings of an animal that include the living and non-living elements or conditions that occur in nature, such as the air, water, plants, animals, climate, soil, rocks, and light.
3. A constructed environment is the surroundings, tools, and structures, that include items that are manufactured or built and/or used by inhabitants of the environment, such as homes, stores, factories, neighborhoods, vehicles, and appliances.
4. Living things needs include air, water, food, space and shelter.
5. Living things depend on their environment to help meet their needs.
6. Living things depend on their natural environment for clean air, clean water, forests, food, and Earth materials such as soil, sand, rocks and minerals.
7. Humans depend on their constructed environments to meet their basic needs and for shelter, work and recreation. Constructed or man-made environments include homes, neighborhoods, shopping malls, factories and industry.

**Assessment Clarifications**

1. Humans depend on their environment to help meet their needs.
2. A natural environment is the surroundings of an animal that include the living and non-living elements or conditions that occur in nature, such as the air, water, plants, animals, climate, soil, rocks, and light.
3. A constructed environment is the surroundings, tools, and structures, that include items that are manufactured or built and/or used by inhabitants of the environment, such as homes, stores, factories, neighborhoods, vehicles, and appliances.

4. Humans depend on their natural environment for clean air, clean water, food, forests, and Earth materials such as soil, sand, rocks and minerals.
5. Humans depend on their constructed environments to meet their basic needs and for shelter, work and recreation. Man-made (constructed) environments include homes, neighborhoods, shopping malls, factories and industry.

**E.ES.03.52** Describe helpful or harmful effects of humans on the environment (garbage, habitat destruction, land management, renewable and non-renewable resources).

**Instructional Clarifications**

1. Describe means to tell or depict in spoken or written words how humans affect the environment.
2. Changes that humans make to their environment can have helpful or harmful effects.
3. Harmful effects include garbage, habitat destruction, resource depletion, and pollution.
4. The average American produces approximately 1500 pounds of garbage per year. Very little is recycled. Waste management and the 4 R's (reduce, reuse, recycle, renewal) are critical to resource conservation.
5. Farming, mining, logging, pollution and urban sprawl are the main causes of habitat destruction. The main effects of habitat destruction are species extinction and loss of a diverse community of plants and animals.
6. Helpful effects include land management and conservation of renewable and non-renewable resources.
7. Land management is the process of managing natural resources in a sustainable way. By improving agricultural practices, reclaiming wasted land, protecting the environment, conserving soil, water, and air quality humans contribute to positive land management practices.
8. The management and conservation of renewable and non-renewable resources are essential for sustainability. Alternative energy sources, land management, reducing, reusing and recycling programs, and waste management are all ways to conserve our natural resources.

**Assessment Clarifications**

1. Changes that humans make to their environment can have helpful or harmful effects.
2. Harmful effects include garbage, habitat destruction, poor use of resources, and pollution.
3. Helpful effects include land management and the management of non-renewable and renewable resources (reduce, reuse, recycle, renew).

## Standard: Solid Earth

## Content Statement – E.SE.E.1
## Earth Materials – Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere. Earth materials have properties that sustain plant and animal life.

## Content Expectations

**E.SE.03.13** Recognize and describe different types of Earth materials (mineral, rock, clay, boulder, gravel, sand, soil).

### Instructional Clarifications

1. Recognize is to identify or perceive minerals, rock, clay, boulders, gravel, sand and soil as different types of Earth materials.
2. Describe means to tell or depict in spoken or written word the properties of different Earth materials.
3. Earth materials are naturally occurring materials taken from the Earth such as minerals, rocks, clay, boulders, gravel, sand and soil.
4. The solid material of the Earth's crust is rock.
5. Natural processes break down the Earth's crust, which form Earth materials.
6. Most rocks are made of two or more minerals. Rocks are classified based on how they were formed: igneous, metamorphic, and sedimentary.
7. Minerals are naturally occurring inorganic substances. Inorganic means that they are made up of things that are not alive. Diamonds (carbon) are considered to be a mineral but originate from organic materials. Some minerals consist of only one element, but most are compounds. They are identified based on their physical properties such as hardness, color, and density. It is difficult for third grade students to distinguish between rocks and minerals. They need to know that rocks are made up of two or more minerals.
8. Rocks can be broken by weathering and breakage. Most of the Earth's surface is covered with broken rock materials that include boulders, sand, gravel, silt and clay. Rocks sizes vary from boulders to gravel to soil to sand to clay.
9. Clay is a naturally occurring material composed mostly of fine-grained minerals. When dried or fired, it becomes hardened.
10. Soil makes up the outermost layer of the Earth's surface. Soil is a combination of organic materials (living and dead organisms), minerals/rocks of differing sizes and nutrients. The different sized materials (sand, silt and clay) give soil texture.
11. Based on their composition, soils have different properties such as color, texture, particle size and ability to hold water.
12. A common misconception is that rocks and minerals are the same thing.
13. A common misconception is that soil has always been in its present form.

14. A common misconception is that dirt and soil are different.
15. A common misconception is that soil is broken down rocks.
16. A common misconception is that sand is only made from broken down rocks.

**Assessment Clarifications**

1. Earth materials are naturally occurring materials taken from the Earth such as minerals, rocks, clay, boulders, gravel, sand and soil.
2. Rocks and minerals are solid material that makes up the Earth.
3. Most rocks are made of two or more minerals.
4. Rocks can be many different sizes such as boulders, gravel and sand.
5. Clay is a naturally occurring material. When dried or fired, it becomes hardened and used to make bricks.
6. Soil makes up the outermost layer of the Earth's surface. Soil is a combination of dead plants and animals; minerals; different sized rock materials (sand, silt, clay) and nutrients.
7. Based on their composition, soils have different properties such as color, texture, and particle size.

**E.SE.03.14** Recognize that rocks are made up of minerals.

**Instructional Clarifications**

1. Recognize is to identify or perceive that rocks are made of minerals.
2. Minerals are made of one or more element, neatly stacked together to form crystals. A mineral is inorganic, a mineral is naturally occurring, a mineral has a chemical composition, and a mineral has a crystalline structure.
3. Rocks are made of two or more minerals. Minerals give color, hardness and sparkle to rocks.
4. A common misconception is that rocks and minerals are the same things.

**Assessment Clarifications**

1. Minerals are natural solid substances found in the Earth's crust.
2. Rocks are made of two or more minerals. Minerals give color, hardness and sparkle to rocks.

## Content Statement – E. SE.E.2

## Surface Changes – The surface of the Earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

## Content Expectation

**E.SE.03.22** Identify and describe natural causes of change in the Earth's surface (erosion, glaciers, volcanoes, landslides, and earthquakes).

**Instructional Clarifications**

1. Identify means to recognize natural causes of change in the Earth's surface.
2. Describe means to tell or depict in spoken or written word the changes in the Earth's surface.
3. There are many changes that occur on the Earth's surface or crust. Some happen rapidly and some take millions of years.
4. Weathering is the breaking of rocks. Erosion is the movement of weathered material.
5. Erosion is the wearing away of the Earth's surface by wind, water, ice, or other geologic processes. Water is the most powerful agent of erosion, which is the movement of weathered rocks and soil. Erosion is sometimes a slow process that is difficult to see because it happens over thousands of years (Grand Canyon). Erosion may also be seen as a rapid process as when rainwater runs down a slope.
6. Glaciers are moving masses of ice and snow that change the land. When glaciers move they carry trees, soil, rock along causing erosion. When glaciers melt, they leave behind soil and rock. Glaciers are an example of a slow process. The state of Michigan is an excellent example of glacial movement.
7. A volcano is an opening in the Earth's surface through which lava and other materials (rock fragments, gases, ash) erupt. Volcanoes are associated with the movement of tectonic plates. As plates move and make contact, magma (melted rock) forms, rises to the surface and erupts through weak areas in the Earth's surface. Magma that has reached the Earth's surface is called lava. Volcanic ash is full of nutrients and enriches the soil. Volcanoes are an example of a rapid process.
8. Landslides are the movement of a mass of rock, soil or debris down a slope. It can start with an earthquake, volcano, rainfall, or a man-made activity. Landslides are an example of a rapid process.
9. Earthquakes are one of the most destructive natural events. Earthquakes occur when two tectonic plates slip and release the tension or energy between them. Scientists believe that there are certain areas on Earth that are more likely to experience earthquakes but they can happen anywhere. Earthquakes cause the Earth's surface to tremble and shake, which causes a little or a lot of destruction. It is a very rapid process.
10. A common misconception is that mountains are created rapidly.
11. A common misconception is that glaciers do not move.
12. A common misconception is that volcanoes do not help the Earth.

**Assessment Clarifications**

13. There are many changes that occur on the Earth's surface or crust. Some happen rapidly and some take millions of years.
14. Erosion is the wearing away of the Earth's surface by wind, water, ice. It is also the movement of weathered rocks and soil. Erosion is a slow process (Grand Canyon).
15. Glaciers are moving masses of ice and snow that change the land. The changes made by glaciers are a slow process.

16. A volcano is an opening in the Earth's surface through which lava and other materials erupt. This process happens quickly.
17. Landslides are the movement of a large amount of rock, soil and other materials down a slope. It can start with an earthquake, volcano, rainfall, or a man-made activity. Landslides are an example of a rapid process.
18. Earthquakes are one of the most destructive natural events. Earthquakes cause the Earth's surface to tremble and shake, which causes a lot of destruction. It is a very rapid process.

**Content Statement – E.SE.E.3**

## Using Earth Materials – Some Earth materials have properties that make them useful either in their present form or designed and modified to solve human problems. They can enhance the quality of life as in the case of materials used for building or fuels used for heating and transportation.

### Content Expectations

**E.SE.03.31** Identify Earth materials used to construct some common objects (bricks, buildings, roads, glass).

**Instructional Clarifications**
1. Identify means to recognize the Earth materials used to construct some common objects.
2. Earth materials are naturally occurring materials taken from the Earth's crust.
3. Some Earth materials have properties that make them useful in building or construction.
4. Bricks are made from a variety of Earth materials including clay and rock (shale).
5. Earth materials (rock and sand) are used in building construction.
6. Sand, rock (limestone) and petroleum are used in road construction (concrete and asphalt.)
7. Sand and limestone are used to make glass and glass products.

**Assessment Clarifications**
1. Bricks are made from a variety of Earth materials including clay and rock.
2. Earth materials such as rock and sand are used in building construction.
3. Sand and rock are used in road constructions (concrete and asphalt.)
4. Sand is used to make glass and glass products.

**E.SE.03.32** Describe how materials taken from the Earth can be used as fuels for heating and transportation.

**Instructional Clarifications**
1. Describe means to tell or depict in spoken or written word how materials taken from the Earth are used as fuels for heating and transportation.

2. A fuel is any material that can burn.
3. Fossil fuels or fuels taken from the Earth include crude oil, natural gas and coal. A fossil fuel contains the remnants of plants and animals, forms over millions of years, and can be burned to release energy.
4. Oil is formed within the Earth's crust from the remains of organisms that lived millions of years ago. It is contained in porous, sedimentary rock along with water and natural gas. Machines must drill down through the rock to reach the oil.
5. Crude oil can be separated and processed into different fuels at refineries for automobiles, airplanes, heating homes, and construction.
6. Coal is a fossil fuel that was formed millions of years ago. As plants in swampy areas died, they formed peat. The peat became buried under the Earth's surface and through heat and pressure it changed into coal. Coal is used to produce electricity and as a heating fuel for homes.
7. Natural gas is a mixture of flammable gases, mostly methane and ethane. Natural gas usually occurs beneath the surface of the Earth in the same area as petroleum (oil). Natural gas is processed to make it more useful as a fuel for heating or generating electricity.
8. The movement toward alternative fuels is increasing because of concern about what to use for energy when there are no longer any fossil fuels or they are too expensive.
9. A common misconception is that humans will never run out of natural fuels.
10. A common misconception is that fuels are manufactured.

**Assessment Clarifications**

1. Fuels taken from the Earth include oil, natural gas and coal.
2. The different fuels are used for transportation (automobiles, trains, airplanes), heating and cooling buildings, and construction.

## Inquiry Process, Inquiry Analysis and Communication, Reflection and Social Implications

| **Inquiry Process** |
|---|
| **S.IP.03.11** Make purposeful observations of Earth materials to describe them in terms of color, particle, size, texture, and ability to hold water. |
| **S.IP.03.11** Make purposeful observations of rocks and minerals to determine that rocks are made up of minerals. |
| **S.IP.03.12** Generate questions based on observations of Earth materials. |
| **S.IP.03.13** Plan and conduct simple and fair investigations to determine the ability of Earth materials to hold water. |
| **S.IP.03.14** Manipulate simple tools that aid observation and data collection (hand lens, balance, scale, graduated cylinder, stop watch/timer). |
| **S.IP.03.15** Make accurate measurements with appropriate units (grams, centimeters, milliliters, minutes, seconds) for the measuring tool. |
| **S.IP.03.16** Construct simple charts and graphs from data and observations generated in Earth material investigation. |
| **Inquiry Analysis and Communication** |
| **S.IA.03.11** Summarize information from charts and graphs to determine the ability of a variety of Earth materials to hold water. |
| **S.IA.03.12** Share ideas about Earth materials through purposeful conversation in collaborative groups. |
| **S.IA.03.13** Communicate and present findings of observations and investigations into Earth materials. |
| **S.IA.03.14** Develop research strategies and skills for information gathering to find out about a variety of Earth materials that are used to construct common items and used as fuels for heating and transportation. |
| **S.IA.03.15** Compare and contrast sets of data from multiple trials of the Earth material investigation to explain reasons for differences. |
| **Reflection and Social Implications** |
| **S.RS.03.11** Use data/samples as evidence to separate fact from opinion regarding the ability of different Earth materials to hold water. |
| **S.RS.03.12** Use evidence when communicating findings from Earth material investigations. |
| **S.RS.03.13** Demonstrate how Earth materials are used to construct some common objects and are taken from the Earth as fuels for heating and transportation though illustrations and models. |
| **S.RS.03.14** Identify technology used to find and remove Earth materials to be used for building and fuel. |
| **S.RS.03.16** Describe the effect humans have on the balance of the natural world through the used of Earth materials. |

**Vocabulary**

| Critically Important – State Assessable | Instructionally Useful |
|---|---|
| boulder | habitat |
| Earth materials | pollution |
| rock | rock cycle |
| clay | fossil fuels |
| sand | sustainability |
| gravel | farmland |
| soil | solid rock |
| soil texture | Earth materials' ability to hold water |
| soil color | crude oil |
| water | natural gas |
| wind | coal |
| ice | nutrients |
| helpful change | particle size |
| changes in the Earth's surface | |
| harmful change | |
| earthquake | |
| erosion | |
| landslide | |
| glacier | |
| metal | |
| mineral | |
| oil | |
| recycle | |
| reduce | |
| reuse | |
| renewal | |
| rock breakage | |
| volcanic eruptions | |
| weathered rock | |
| weathering | |
| natural resources | |
| renewable resources | |
| non-renewable resources | |
| metals | |
| fuels | |
| freshwater | |
| forests | |
| natural environment | |
| constructed environment | |
| garbage | |
| habitat destruction | |
| land management | |
| crude oil | |
| natural gas | |
| coal | |

## Instruments, Measurements, Representations

| Measurement | Instruments | Representation |
|---|---|---|
| weight | scale | ounces, pounds |
| mass* | balance | grams |
| time | stop watch, timer, clock with a second hand | seconds, minutes, hours |
| volume | graduated cylinder | milliliters |
| **Observation Tools:**<br>hand lens | | |
| **Representations in Charts, Tables, and Graphs**<br>With teacher assistance, third grade students label and enter information into a data table that represents multiple trials. Third grade students use the median number for graphing.<br>With teacher direction, and the use of information from a data table, students construct a simple bar graph that includes appropriate labels (clear title, axes labels, unit labels, scales or standard interval counting beginning at zero).<br>Third grade students are expected to read and interpret both horizontal and vertical bar graphs. | | |

*To be instructed in fourth grade.

## Instructional Framework

*The following Instructional Framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting, findings, and expanding thinking beyond the classroom. The Instructional Framework is NOT a step-by-step instructional manual, but a guide intended to help teachers and curriculum developers design their own lesson plans, select useful and appropriate resources and create assessments that are aligned with the grade level science curriculum for the State of Michigan.*

### Instructional Examples

### Earth Systems
**Natural Resources:** E.ES.03.41, E.ES.03.42, E.ES.03.43, E.ES.03.44
**Human Impact:** E.ES.03.51, E.ES.03.52

### Objectives

- Understand that the Earth's natural resources are renewable and non-renewable.
- Describe how humans can protect, extend and restore natural resources through recycling and renewal programs, by reusing materials and reducing the amount resources used.
- Relate how humans are dependent on and affect their natural and constructed environments.

### Engage and Explore

- Invite students to look around and identify different materials they see in the classroom. Create a list on the board that includes items such as wood, metal, paper, glass, cotton, wool, cloth, leather, plastic, rubber, etc. Working in small groups, challenge students to classify the materials into two groups: items found in nature or man-made (manufactured). Create a class list for future use. (S.IA.03.12)
- Within collaborative groups, students review the lists of previously classified objects: *Items Found in Nature* or *Man-made or Manufactured*. Based on their discussions, students modify the list.
- Have students research the man-made products to discover that man-made materials are made from natural materials on Earth (plastics from petroleum, glass from sand, and ceramics from minerals).

- Introduce students to the term *natural resource* to describe materials from the Earth that are useful to people. After students identify the Earth material or natural resource found in each of the classroom items, challenge them to classify the natural resources into items that are *renewable* and *non-renewable*. Which items can be grown again or replaced by nature? Which items cannot be replaced or take many years to replace? Are there natural resources missing from the lists?
- In groups, students research renewable and non-renewable resources and organize findings into a chart or other graphic organizer to share with the class. (E.ES.03.41, E.ES.03.42, S.IA.03.12, S.IA.03.13)

## Explain and Define

- Groups share their charts/graphic organizers of renewable and non-renewable resources with the class. (E.ES.03.42, S.IA.03.11, S.IA.03.12)
- Create a class definition of the terms *natural resource, Earth material, renewable resource, non-renewable resource*. (E.ES.03.41, E.ES.03.42)

## Elaborate and Apply

- Extend student understanding of renewable and non-renewable resources by exploring how humans protect, extend, and restore natural resources within the school, homes, and the community. Students create a survey on practices to protect, extend and restore natural resources to be completed as a class, within the school, at home. (E.ES.03.43, S.IS.03.14)
- Pull out clean, discarded objects (paper, cardboard, milk containers, plastic containers and bags, etc.) from a trash bag to sort into recyclable, reusable, renewable or reducible categories. (E.ES.03.43, E.ES.03.44)
- Elaborate on student understanding by engaging them in activities such as building a mini-landfill, creating a classroom recycling program, creating art from junk, etc. (E.ES.03.43)
- Challenge students to reduce, reuse and recycle in the classroom (using half sheets of paper, using wooden rather than plastic pencils, using reusable lunch bags and drink containers (no plastic bottles), using paper rather than Styrofoam plates in the cafeteria, etc.) and keep a classroom record of ideas, activities, and solutions to share with other classrooms. (E.ES.03.43, E.ES.03.44, S.IA.03.12)
- Divide students into four groups. Provide each group with a topic: forests, clean water, clean air, and Earth materials. Research human dependence on the natural environment and resources. Develop a game, chart, or other performance to share findings. (E.ES.03.51, S.IA.03.13)
- Elaborate further by defining the term, *constructed environment*. Create a list of constructed environments (homes, neighborhoods, shopping malls, factories, and industry). Divide the class into groups to explore human dependence on constructed environments. In groups, create a chart that describes the natural resources (renewable and non-renewable) used in a constructed environment and how human (animal, plant) needs are met within each environment. Students create an imaginary environment

designed to meet all human needs, i.e., build a house, create a town, draw a factory, etc. (E.ES.03.51, S.IA.03.12)

## Evaluate Student Understanding

Formative Assessment Examples

- Classify lists of classroom items into two groups: items found in nature and man-made items. (E.ES.03.41)
- Classify and graphically organize natural resources into renewable and non-renewable. (E.ES.03.42)
- Create and conduct surveys of individual, class, school, and home activities to protect, extend, and restore natural resources. Use the information to make suggestions and recommendations for more responsible practices. (E.ES.03.43)
- Develop a program to reduce, reuse, and recycle natural resources in the classroom. (E.ES.03.44)
- Develop a game or chart that depicts human dependence on the natural environment. (E.ES.03.51)

Summative Assessment Examples

- Define and illustrate the terms natural resource, renewable resource, non-renewable resource, recycle, reuse, reduce, renewal, habitat destruction, land management. (E.ES.03.41, E.ES.03.43, E.ES.03.52)
- In a paper grocery bag, each student collects his/her individual “clean” trash for a specified number of days. Students examine the trash and divide it into categories: reduce, reuse, recycle, renew, other. Students identify and graphically display ways to reduce the amount of trash produced and improve their impact on the environment. (E.ES.03.43)
- Design a doghouse that uses all renewable materials. (E.ES.03.42)
- Using the topics: land management, clean air, clean water, garbage, renewable resources, non-renewable resources create a conservation law that protects, extends or restores resources. (E.ES.03.41, E.ES.03.42, E.ES.03.43, E.ES.03.44, E.ES.03.52, E.ES.03.53)

## Enrichment

- Write letters to the principal, city manager, or mayor explaining the importance of improving the current recycling program.
- Create books to teach younger students about protecting, extending and restoring natural resources.
- Create issue/solution cards. Place a title on 3 x5 cards with helpful or harmful effects of humans on the environment (garbage, waste management, habitat destruction, land management, renewable resources, non-renewable resources, etc.). Give each student a card. On the cards, students describe ways they are individually directly or indirectly involved in the topic. On the reverse, students describe solutions or ways that they can enhance or improve their relationship with the environment. As a class, students create class lists/charts defining the positive and negative effects humans have on the environment with solutions/improvements for each.

## Intervention

- Conduct a home study project regarding ways to reduce energy use and the use of natural resources.
- Identify and draw a diagram of natural resources found and used in the classroom. For each natural resource, identify one way to reduce its use.
- Read books such as *The Three R's: Reduce, Reuse, Recycle* by Nuria Roca and Rosa Curto, 2007, and discuss ways that an individual can make a difference.
- Take a field trip to a recycling center.

## Examples, Observations, and Phenomena (Real world Contexts)

This unit lends itself to real world contexts because of the importance of conserving, appreciating, and protecting our natural resources. Energy conservation is in the media on a daily basis. Newspaper and magazine articles regarding positive and negative conservation practices are real world sources for what is happening to the natural resources and climate on Earth.

Classification and measurement are everyday skills. Classification of Earth materials as natural and man-made; renewable and non-renewable; recyclable and non-recyclable is useful classification for environmental awareness. As students explore Earth materials they are discovering the importance of conserving natural resources at home, at school, in the community and globally. They examine their personal practices of recycling, reusing, and reducing natural resources in the paper they use, water consumption, energy use, recycling, avoiding the use of plastics, and reusing products. Students discover that natural resources are contained in all products: clothing, bicycles, toys, computers, games, sporting equipment, etc.

## Literacy Integration

### Reading

**R.CM.03.01** connect personal knowledge, experiences, and understanding of the world to themes and perspectives in text through oral and written responses.

**R.CM.03.04** apply significant knowledge from grade-level science, social studies, and mathematics texts.

Examples of trade books available for learning about natural resources:

*How the Earth Works* by Michelle O'Brien Palmer, 2002
*Planet Earth/Inside Out* by Gail Gibbons, 1998
*50 Simple Things Kids Can Do To Save the Earth* by The Earthworks Group, 1990
*Don't Know Much About Planet Earth* by Kenneth Davis and Tom Bloom, 2001
*The Three R's: Reduce, Reuse, Recycle* by Nuria Roca and Rosa Curto, 2007

### Writing

**W.GN.03.03** Write and informational piece including a report that demonstrates the understanding of central ideas and supporting details using an effective organizational pattern (i.e., compare/contrast, cause/effect, problem/solution) with a title, heading, subheading, and a table of contents.

- Write an informational piece that demonstrates understanding of natural resources with supporting details comparing and contrasting renewable and non-renewable resources.

**W.GN.03.04** use the writing process to produce and present a research project, initiate research questions from content area text from a teacher-selected topic; and use a variety of resources to gather and organize information.

### Speaking

**S.CN.03.03** speak effectively emphasizing key words and varied pace for effect in narrative and informational presentations.

**S.DS.03.04** plan and deliver presentations using an effective information organizational pattern (e.g., descriptive, problem/solution, cause/effect); supportive facts and details reflecting a variety of resources; and varying the pace for effect.

## Listening

**L.CN.03.01** ask substantive questions of the speaker that will provide additional elaboration and details.

## Instructional Examples

**Solid Earth**
**Earth Materials:** E.SE.03.13, E.SE.03.14
**Surface Changes:** E.SE.03.22
**Using Earth Materials:** E.SE.03.31, E.SE.03.32

### Objectives

- The surface of the Earth changes through slow and rapid processes.
- Earth materials have properties that make them useful.
- Earth materials are used in common objects and for fuels in heating/cooling and transportation.

### Engage and Explore

- Engage students in an outdoor Earth exploration. Give each student a clipboard and a reusable container to collect observations and examples of Earth materials observed and found on the playground. This should be an "unguided" activity in which students share ideas among themselves rather than receiving direction from the teacher. Students draw and describe findings and locations of Earth materials on the playground. Students collect small samples of Earth materials such as soil, pebbles, sand, rocks, etc. (no plants or animals). (E.SE.03.13, S.IA.03.12)
- Working in small, collaborative groups, students sort the Earth materials (rocks, sand, soil, clay, pebbles, etc.) into student-selected groups. As students observe the materials, encourage them to write questions or ideas to explore during the unit. (E.SE.03.13, S.IP.03.11, S.IP.03.12)

### Explore

Note: The teacher should supplement the Earth materials students found on the playground so that each student group has an adequate sample of minerals, rocks, clay, gravel, sand, and soil.

- Using a hand lens, scale or balance, and ruler; students explore and record observations of the different Earth materials found on the playground or provided by the teacher. Within groups, then as a class, determine categories or classifications for each Earth materials. Student observations should be recorded in drawings and written descriptions. Create a chart to record findings. (E.SE.03.13, E.SE.03.14, S.IP.03.11, S.IP.03.14, S.IP.03.15, S.IP.03.16, S.IA.03.12)

| EARTH MATERIALS | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Minerals | Rocks | Pebbles | Sand | Soil | Clay | Drawing |
| Color | | | | | | | |
| Texture | | | | | | | |
| Particle Size | | | | | | | |
| Ability to hold water | | | | | | | |
| | | | | | | | |

- Give each student a rock. Using a hand lens, examine each rock carefully. Compare with other rocks within their group. What are the similarities and differences? Within their group, discuss properties and add to the Earth Materials chart. Put the rocks in water. Observe changes in color. Discuss the color of the rocks (One color? More than one color?) And texture (smooth, rough, grainy). (E.SE.03.13, E.SE.03.14, S.IP.03.14)
- Give each student a sample of a mineral. Using a similar format as their rock discovery, students will describe the color and texture of their minerals. (E.SE.03.14)
- Within groups, students will describe the similarities and differences between the rocks and minerals. Conclude that minerals appear to have one color and texture while rocks appear to be made from different colors and textures. Groups of students will develop a definition of rocks and minerals. (E.SE.03.13, E.SE.03.14, S.IP.03.14)
- Give students samples of pebbles, clay, soil, and sand. Using a hand lens, encourage students to make observations of color, texture and particle size of each sample and record findings on their chart. Place drops of water on each sample and observe. Place a small amount of each sample on the surface of a glass of water and observe the interaction of the Earth material and the water. Record findings on their charts or in a student journal. In groups, describe the similarities and differences of each. (E.SE.03.13, E.SE.03.14, S.IP.03.11, S.IP.03.16)
- Explore the ability of Earth materials to hold water by conducting a simple investigation. While working in collaborative groups, challenge students to find out: Are all Earth materials able to hold the same amount of water? Students design and conduct a simple and fair investigation. Using hand lenses, balances, scales, graduated cylinders, and timers; students make accurate measurements of the weight and volume of water before and after it is filtered through the various Earth materials. They collect and summarize their data and observations on simple bar graphs or charts. (E.SE.03.13, S.IP.03.11, S.IP.03.12, S.IP.03.13, S.IP.03.14, S.IP.03.15, S.IA.03.11, S.IA.03.12, S.RS.03.11)

- In collaborative groups, students share evidence from their charts, graphs and communicate findings regarding the ability of various Earth materials to hold water. (S.IA.03.13, S.IA.03.15, S.RS.03.11, S.RS.03.12)

## Explain and Define

- Students communicate and present their findings to complete the Earth Materials chart. (E.SE.03.13, S.IA.03.11, S.IA.03.15, S.RS.03.12)
- Classroom definitions based on color, texture, particle size, and ability to hold water will be developed for minerals, rocks, boulders, pebbles, sand, and soil. (E.SE.03.13)

## Elaborate and Apply

- Elaborate on Earth materials by challenging students to identify and demonstrate how they are used in common objects and purposes. Through research and interviews, students explore and discover the use of Earth materials in construction, road building, fuels, heating, and transportation. As students gather ideas and information from research, discussions, and interviews, they complete a flip chart, step book or other graphic organizer to display information that includes 1. Purpose 2. Earth Material 3. Source 4. Renewable? Non-Renewable. (E.SE.03.31, S.IA.03.14)
- Challenge the students with the question: Have the Earth and Earth materials stayed the same throughout our history? Using maps and globes, students collaborate to identify processes that cause changes in the Earth's surface. Students explore erosion as a slow change and glaciers, volcanoes, landslides and earthquakes as rapid changes. Students create a graphic organizer to record information and findings from research. (E.SE.03.22)
- Demonstrate the effects of erosion by pouring or sprinkling water on a sandy slope and a grass slope. Using a fan to blow air across the slopes demonstrates wind erosion. Record observations in a graphic organizer. (E.SE.03.22)
- Create a glacier using a scoop of ice cream, waxed paper and chocolate sandwich cookies. Allow the ice cream to move across a piece of waxed paper lined with crushed chocolate sandwich cookies. Discuss the effect of the movement of the *glacier*. What happened to the ice cream, waxed paper, and cookie? How is this similar to and different than a real glacier? (E.SE.03.22)
- Visit the FEMA for Kids website to learn about volcanoes. (Note: The baking soda and vinegar activity is a poor model of a volcano.) (E.SE.03.22)
- Landslides can be modeled using the Earth materials. (E.SE.03.22)
- Students explore earthquakes by pushing hands together. Slowly begin to slide one hand across the other. The burst of energy when the two hands separate is an example of the energy burst in earthquakes. Students can research recent earthquakes. (E.SE.03.22)

- Recall the classroom Earth materials search that was used to engage the students at the beginning of the unit. Review the Earth materials that students identified in the classroom. Conduct an Earth materials search outside the school building. As students walk around the school building, they record materials used in construction. Divide students into groups to investigate the composition of construction materials. Create a class chart of Earth materials used in construction. (E.SE.03.31)
- Provide newspaper articles, magazine ads, or commercial clips to demonstrate the current trends in fuel costs and availability. Students share ideas related to fuels. Where do fuels come from? What is a fossil fuel? How do they get into our homes? The gas station? Do we all use the same kinds of fuels? What is alternative energy? How can we use alternative energy at home? At school? (E.SE.03.32)
- Students select a fuel to investigate and create a display, illustration or model to share information on the source, method to extract fuel from the Earth, impact on environment, alternative solutions, and the importance of conserving Earth materials. (E.SE.03.32, E.SE.03.13, E.SE.03.14)

## Evaluate Student Understanding

Formative Assessment Examples

- Create a chart of Earth materials' observations. (E.SE.03.13)
- Summarize findings from an Earth materials investigation on charts and graphs. (E.SE.03.13, E.SE.03.14)
- Create a flipbook to record research findings on Earth materials used in common objects and purposes. (E.SE.03.31, E.SE.03.32)
- Write thank you letters to companies for their green practices and products. (E.SE.03.31)
- Share information from research on fuels and alternative energy sources. (E.SE.03.32)

Summative Assessment Examples

- Create a poster, demonstration, book or other product that explores a boulder as it breaks down and turns into soil. (E.SE.03.13, E.SE.03.14)
- Create a display that illustrates the slow and rapid changes in the Earth's surface. (E.SE.03.22)
- Design a green building using renewable Earth materials in the construction and alternative fuels for heating and cooling. (E.SE.03.31, E.SE.03.32)

## Enrichment

- Investigate the growth of seeds in soil, clay, and sand. Create a potting soil based on findings.
- Assign groups of students to research construction materials (glass, lumber, bricks, asphalt, concrete, etc) and associated manufacturers/companies. Investigate current "green" practices that companies use to protect, extend and restore resources. Write thank you letters to the companies, thanking them for their efforts to protect the environment.
- Divide students into groups to investigate fuels used for transportation (gasoline, diesel fuel, jet fuel, other) and fuels used for heating/cooling (natural gas, propane, oil, coal, other). Students investigate the source, the projected supply, and the environmental impact. What will make the demand for fossil fuels greater in the future? What could change the projections?
- Investigate alternate energy sources. Design a mode of transportation that uses an alternative energy source and renewable resources in its construction.
- Investigate geothermal energy as an alternate for fuels for heating and cooling. How does geothermal energy relate to volcanoes and other Earth processes?

## Intervention

- Collect various Earth materials from the schoolyard and backyard. Identify the material. Investigate how the materials can be used in common objects.
- Create a rock, mineral, or Earth material collection. Encourage students to collect samples while on vacation or while visiting other locations. Discover the similarities and differences of the collected samples.
- Investigate different kinds of sand from various beaches. Use a magnifying lens to observe the similarities and differences. Explore the samples with a magnet (students may find magnetite or micro-meteorites). Discuss findings.
- Investigate different soils from areas in the schoolyard or ask students to bring samples from home. Discuss reasons for the similarities and differences. Using a magnifying lens, divide soil into its various components.
- As a class, design and conduct an investigation that explores a student-developed question on Earth materials.
- Read selected informational texts on topics such as natural resources, Earth's surface changes, protecting Earth resources.
- Invite a construction engineer or builder to speak to the students about building homes and the materials used in construction. Emphasize natural resources, green building practices, and alternative energy sources.

## Examples, Observations and Phenomena (Real World Contexts)

This unit lends itself to real world contexts because of the importance of conserving, appreciating, and protecting our natural resources. The real world application is evident in the media with reference to shortages of resources, pollution, forest fires, habitat destruction, climate change, and extinction of organisms.

Classification and measurement are everyday skills. Students classify and examine materials to identify properties. As students explore Earth materials they are discovering the importance of Earth materials in common objects. As they discover that natural resources are used in all products, their appreciation of conserving natural resources at home, at school, in the community and globally is reinforced.

Rock and mineral collections are high interest for young learners. The study of the make up of rocks and minerals and how they are formed and found sparks an interest in the make-up of the surface of the Earth. Students are familiar with the clearing of land for building of homes, shops, malls, etc., yet may not be aware of the Earth materials that are removed and discarded to make way for the development of properties. Changes in the surface of the Earth are not all due to natural occurrences. Many are due to activities of humans.

The news media and magazines are excellent sources of information regarding recent occurrences of Earth changes. Volcanoes, earthquakes, landslides are evidence that the Earth is dynamic. Erosion and other Earth changes are apparent as students travel across the country and within their own towns. Large examples include the Rocky Mountains, Grand Canyon, Appalachian Mountains, Niagara Falls, Sedona, AZ, the Bad Lands, etc. Local examples of Earth changes include river valleys, moraines, hills, valleys, etc.

Students discover the importance of alternate fuels (wind, solar, biofuel energy) as they investigate the non-renewable energy sources currently used for transportation (oil, natural gas, coal). The current energy crisis is evidence of the need for alternate energy.

## Literacy Integration

### Reading

**R.CM.03.01** connect personal knowledge, experiences, and understanding of the world to themes and perspectives in text through oral and written responses.

**R.CM.03.04** apply significant knowledge from grade-level science, social studies, and mathematics texts.

Examples of trade books available for learning about natural resources:

*How the Earth Works* by Michelle O'Brien Palmer, 2002
*Planet Earth/Inside Out* by Gail Gibbons, 1998
*Don't Know Much About Planet Earth* by Kenneth Davis and Tom Bloom, 2001

### Writing

**W.GN.03.03** write and informational piece including a report that demonstrates the understanding of central ideas and supporting details using an effective organizational pattern (i.e., compare/contrast, cause/effect, problem/solution) with a title, heading, subheading, and a table of contents.

- Write an informational piece that demonstrates understanding of natural resources with supporting details comparing and contrasting renewable and non-renewable resources.

**W.GN.03.04** use the writing process to produce and present a research project, initiate research questions from content area text from a teacher-selected topic; and use a variety of resources to gather and organize information.

- Use the writing process to prepare and present information on the ability of Earth materials to hold water, beginning with a research question and using a variety of resources including evidence from investigations to organize information.

### Speaking

**S.CN.03.03** speak effectively emphasizing key words and varied pace for effect in narrative and informational presentations.

**S.DS.03.04** plan and deliver presentations using an effective information organizational pattern (e.g., descriptive, problem/solution, cause/effect); supportive facts and details reflecting a variety of resources; and varying the pace for effect.

### Listening

**L.CN.03.01** ask substantive questions of the speaker that will provide additional elaboration and details.

**Mathematics Integration**

### Measurement

**M.UN.03.01** Know and use common units of measurements in length, weight and time.

**M.UN.03.02** Measure in mixed units within the same measurement system for length, weight, and time: feet and inches, meters and centimeters, kilograms and grams, pounds and ounces, liters and milliliters, hours and minutes, minutes and seconds, years and months.

- Know and use common units of measurement in weight and volume when conducting simple investigations.
- Measure in mixed units with the same measurement system in weight (kilograms, grams) or volume (liters, milliliters).

### Data and Probability

**D.RE.03.01** Read and interpret bar graphs in both horizontal and vertical forms.

**D.RE.03.02** Read scales on the axes and identify the maximum, minimum and range of values in a bar graph.

**D.RE.03.03** Solve problems using information in bar graphs, including comparison of bar graphs.

- Create, read and interpret bar graphs in both vertical and horizontal forms when recording data from an investigation.
- Create and read scales and axes and identify the maximum, minimum, and range of values on a bar graph.
- Solve problems and interpret evidence, using information in bar graphs, including comparison of bar graphs.