Introduction to Geology and Its Branches

ES.1.01 - Deduce the interrelationships between the different branches of earth science and the...expand more link

Week 01 - Week 01

Comment(s): This is an opportunity to introduce the idea of Earth Science as a course since it is not normally taught as a separate course in Egyptian traditional schools. It underlies all of the Grand Challenges which serve as the basis for the STEM schools, so it is very important to us. In this first class the teacher can pre-assess what students have learned about the branches of Earth Science and can have a discussion which will provide an overview to the course in Grades 1, 2 and 3.This class period would just be a pre-assessment and an overview for the new students because a deep understanding of this LO can only arise out of student work in grades 1, 2, and 3. Learning Outcome: Deduce the interrelationships between the different branches of earth science and the integration of geology within other sciences

Key Concepts: The contribution of geology to the different domains in our lives

Skills: Writing Essential Questions: What in our lives is not geology?

Textbook and Resource Materials:
Week 1: No published activity.

- Welcome students
- Set up expectations – ask students to suggest behavioral expectations
- Student activity: “How can studying the Earth help solve Egypt’s Grand Challenges?” Discuss and share. Teacher should record all answers.
- Teacher synthesis: All of these ideas are part of geology – geology is a science with many aspects or branches – it involves physics, biology, chemistry, technology, and math and it involves studying the solid earth, the water on earth, the life on earth, and the atmosphere.
- Student activity: Draw a concept map using these words and ideas, showing how you think they are organized
- Teacher synthesis: Show a few student examples and ask how they are related?

Evidence of Learning: Concept map showing different geology branches and how they are related

Capstone Connection: Geology impacts dwelling designs; understand the impact of geology and the varied dwellings
SEC Topic & Code: HSST-ES1.01

ES.1.02 - Examine common minerals and identify them and differentiate them from other common...expand more link

Week 01 - Week 04

Comment(s): The LO was modified to refer to student abilities rather than to instructional practices. Although crystal systems are present in every geology textbook, they are not appropriately treated at the high school level and they are not relevant to Grand Challenges.

Learning Outcome: Examine common minerals and identify them and differentiate them from other common minerals.

Key Concepts: 1. Minerals are homogeneous solid earth materials. 2. Minerals have distinct physical properties that enable them to be distinguished from one another. 3. For most common minerals, the most useful properties for hand sample identification include hardness, cleavage or fracture patterns, translucency, and color. 4. Metallic minerals are uncommon, but economically important. 5. For metallic minerals, the additional properties of streak and magnetism are useful for hand sample identification. 6. Completely unambiguous identification of minerals often requires sophisticated laboratory analysis. 7. Some construction materials are highly refined from the original Earth material, while others are used in the original state.

Skills: Writing Essential Questions: What are the rocks I see around me made of?

Textbook and Resource Materials:

Week 2:•Student Activity: Chapter 3, Section 1, Part A and Part B, p. 274-275. Teacher Demonstration: show the skills to find properties – how to find hardness, streak, luster Week 3-4:•Student Activity: Chapter 3, Section 1, Part C or Grade 1 Laboratory Manual: Minerals-Properties. Note: it may be very useful to introduce minerals in related pairs (e.g. quartz and a white feldspar, or quartz and calcite) and ask students to compare and contrast, not just to record properties.

Evidence of Learning: Students can reliably identify quartz, calcite, feldspar, mica, amphibole, pyroxene, olivine and clay in rock samples as well as in laboratory mineral samples. Students can reliably identify magnetite, pyrite, hematite, chalcopyrite, and native copper and sulfur in laboratory mineral specimens. Students produce and use a reliable and accurate dichotomous key for identifying these minerals.
Capstone Connection: Knowledge of properties of building materials will be helpful in the design of a building

Relations: CH.1.02; CH.1.09; CH.1.12; CH.1.13; PH.1.01; PH.1.09; ME.1.03 MA.1.03; BI.1.02
SEC Topic & Code: HSST-ES.1.02

ES.1.03 - Analyze and identify the earth materials that are used as a resource for modern building...expand more link

Week 05 - Week 05

Learning Outcome: Analyze and identify the earth materials that are used as a resource for modern building and integrate design criteria and material properties in choosing materials for engineering design.
Key Concepts: Different Earth materials and different manufactured materials have different engineering properties, such as their behavior under stress, making them suitable for different uses in construction.
Skills: Vocabulary Structure Essential Questions: How can we use earth materials effectively and efficiently in building construction?
Textbook and Resource Materials:

•Student Investigation: Open inquiry about the building properties of Earth materials with full lab report. •Teacher Synthesis: Have students report out on what they learned about building with Earth materials. Synthesize the similarities and differences among materials and also among investigative techniques.

Evidence of Learning: -Clearly identify the benefits and drawbacks of a variety of different construction materials for use in Egypt. -Make and defend a proposal for building materials to be used in safe, energy-efficient, cost-efficient housing development in Egypt. -Identify differences in building materials that might be necessary in coastal versus interior locations in Egypt.

Capstone Connection: Connects to question of building energy efficient structure
SEC Topic & Code: HSST-ES.1.02

Earth Materials (part 2)

- ES.1.04 - Examine and interpret the textural and compositional characteristics of igneous rocks and...expand more link

Week 06 - Week 08

Learning Outcome: Examine and interpret the textural and compositional characteristics of igneous rocks and interpret igneous rock textures and mineral composition.
Key Concepts: 1. Rocks are heterogeneous mixtures of minerals and (rarely) other earth materials. 2. Igneous rocks cooled from melts are found in association with volcanoes and also as rocks that cooled underground. 3. Different cooling histories produce different igneous textures. 4. Differences in magma composition and eruption location create differences in eruption explosivity that affect volcanic rock textures.
Skills: Vocabulary Structure Essential Questions: What role does Geology play in meeting Egypt's Grand Challenges?
Textbook and Resource Materials:

Week 7: •Student Activity: Chapter 3, Section 2, Part A, p. 286-288 or Grade 1 Laboratory Manual: Igneous Rocks. •Teacher synthesis: Focus on relationship of grain size and cooling rate to separate intrusive and extrusive igneous rocks. Week 8: •Student Activity: Chapter 3, Section 2, Part A (continued) and Part B, p. 286-288. Teacher synthesis: Make sure students understand the distribution of igneous rocks in Egypt, especially the presence of old intrusive rocks in areas of exposed basement, the presence of Cretaceous volcanic interbedded with sedimentary sequences and the presence of young volcanic associated with the opening of the Red Sea.

Evidence of Learning: Successfully differentiate between intrusive and volcanic rocks in hand samples or in outcrops. Successfully interpret cooling history from a hand specimen or outcrop observations. Successfully identify and differentiate granite, diorite, gabbro, and peridotite in hand specimens. Successfully identify rhyolite, andesite, and basalt based on silica composition. Successfully interpret eruption explosivity from igneous rock hand sample or silica composition Successfully locate igneous rocks on a geologic map of Egypt.

Capstone Connection: Knowledge of the properties of rock types will help making decisions about building materials
Relations: CH.1.02; CH.1.05; CH.1.09; PH.1.01; PH.1.09; MA.1.03
SEC Topic & Code: HSST-ES.1.02

ES.1.05 - Examine and interpret the textural and compositional characteristics of sedimentary rocks...expand more link

Week 09 - Week 10

Learning Outcome: Examine and interpret the textural and compositional characteristics of sedimentary rocks and interpret sedimentary rock textures, mineral composition and depositional environments.

Key Concepts: 1. Sedimentary rocks that accumulate from particles can be formed in a wide range of environments on Earth's surface. 2. Some sedimentary rocks form from particles of older rocks that are removed from their original location and deposited in a new one. 3. The environment of deposition and the source material both contribute to differences in texture and composition among these sedimentary rocks. 4. Some sedimentary rocks are made of particles from once living organisms. 5. The types of organisms determine much about the texture and mineral composition of such rocks. Such rocks are often only deposited under special conditions. 6. Sedimentary rocks often contain pore spaces that make them important reservoirs of fluids in the upper part of Earth's crust. 7. Sedimentary rocks sometimes contain organic material that may become part of Earth's energy resources. 8. Limestone and cement materials derived from limestone are essential Egyptian building resources due both to their abundance and to the lack of alternative building materials.

Skills: 1. Identifying and differentiating sedimentary rocks. 2. Using hand specimen and microscopic scale features to classify different types of sedimentary rocks. 3. Using sedimentary textures to interpret depositional environment. 4. Interpreting geological maps that describe the geology of Egypt. Essential Questions: What is the history told by sedimentary rocks in Egypt?

Textbook and Resource Materials:
Week 9: •Student Activity: Chapter 3, Section 3, Parts A and B, p. 295-296 or Grade 1 Laboratory Manual: Sedimentary Rocks. Teacher synthesis: Focus on texture and process, especially the relationship of grain size and energy of deposition Week 10: •Student Activity: Chapter 3, Section 3, Part B (continued) and Part C, p. 296-297. Teacher synthesis: Make sure students understand the distribution of sedimentary rocks in Egypt, especially the Cretaceous-Tertiary sequence.

Evidence of Learning: A) Successfully identifying and differentiating among conglomerate, sandstone, siltstone, shale, limestone, and chert in hand specimens and outcrops. B) Successfully interpreting the depositional environment of sedimentary rocks from evidence in hand specimens or outcrops C) Successfully locating sedimentary rocks on a geologic map of Egypt

Capstone Connection: building materials
Relations: CH.1.02; CH.1.05; CH.1.09; PH.1.01; PH.1.09; ME.1.03
SEC Topic & Code: HSST-ES.1.02

ES.1.06 - Examine and interpret the textural and compositional characteristics of metamorphic rocks...expand more link

Week 11 - Week 12

Learning Outcome: Examine and interpret the textural and compositional characteristics of metamorphic rocks and interpret textures and factors that affect metamorphic processes.

Key Concepts: 1. Changes in temperature, pressure, or composition in Earth's subsurface can change the texture and mineral composition of pre-existing rocks, creating metamorphic rocks. 2. Deformation during metamorphism produces foliated textures and may destroy original textures. 3. Deformation (change in shape) and stresses (distribution of forces) are related, but maximum deformation and maximum stress are not always parallel. 4. The metamorphic texture and mineralogy observed in metamorphic rocks are most commonly related to the conditions when the rock experienced its maximum temperature.

Skills: 1. Identifying and differentiating slate, phyllite, schist, gneiss, hornfels, marble, and quartzite in hand specimens and outcrops according to texture and mineral composition. 2. Using microscopic scale features to interpret and classify different types of metamorphic rocks. 3. Using metamorphic rock texture to infer the presence or absence of deformation at the time of metamorphism 4. Interpreting geological maps that describe the geology of Egypt.Essential Questions: What do metamorphic rocks reveal about the geologic history of Egypt?

Textbook and Resource Materials:
Week 11:• Student Activity: Chapter 3, Section 4, Investigate, Part A, p. 306 or Grade 1 Laboratory Manual: Metamorphic Rocks. Teacher Synthesis: Make sure students understand the nature of foliation and the progression of foliations from slate to schist to gneiss Week 12:• Student Activity: Chapter 3, Section 4, Investigate, Part B and C, p. 307.

Teacher Synthesis: Make sure students understand the shape changes produced by shearing and that it is these changes that produce metamorphic foliation. Make sure that students understand the distribution of metamorphic rocks in Egypt and that they are restricted to exposures of basement rocks

Evidence of Learning: A) Successfully identify and differentiate among slate, phyllite, schist, gneiss, hornfels, marble, or quartzite in hand specimen and outcrop. B) Successfully identify the presence of foliation in hand sample and interpret foliation as a product of deformation. C) Successfully locate metamorphic rocks on a geologic map of Egypt.

Capstone Connection: Building materials
Relations: CH.1.02; CH.1.05; CH.1.09; PH.1.01; PH.1.09
SEC Topic & Code: HSST-ES.1.02

ES.1.07 - Interpret the relationships among sedimentary, igneous, and metamorphic rocks in terms of...expand more link

Week 13 - Week 14

Learning Outcome: Interpret the relationships among sedimentary, igneous, and metamorphic rocks in terms of Earth processes and the rock cycle and use their understanding of the rock cycle to explain the Egyptian cross section.

Key Concepts: 1. The rock cycle is a group of processes that act on the different types of rocks and change rocks from one form to another over geologic time. 2. Rock composition and texture provides evidence that can be interpreted to yield a geologic history. 3. Most of the current surface rocks of Egypt record sedimentary deposition, but there is also evidence of igneous and metamorphic processes in the past.
Skills: 1. Interpreting rock types and textures in terms of the rock cycle. 2. Integrating interpretations of process into a geologic history. 3. Interpreting cross sections to study the age relationships of different rock units. 4. Interpreting different geological maps that show outcrops of different rocks of Egypt.

Essential Questions: What is the geologic history of Egypt and surrounding areas?

Textbook and Resource Materials:
Week 13: • Student Activity: Look at samples and see examples – granite – crushed granite – arkose. Brainstorm all the processes that might link igneous, sedimentary, and metamorphic rocks to each other. Then assemble them in an informative way Week 14: • Chapter 3, Section 5, Investigate, p. 316-317 (use Geologic Map of Egypt and cross-sections instead of the map in the book)

Evidence of Learning: Successfully identify rock cycle processes from hand specimens, outcrops, or geologic map or cross section evidence. Successfully interpret cross sections or maps to infer a geologic history. Successfully identify important rock cycle processes in the geologic history of Egypt. Successfully identify modern examples of rock cycle processes in Egypt.

Capstone Connection: Apply understanding of the rock cycle to enable identifying a location for the dwelling and building materials
Relations: BI.1.13
SEC Topic & Code: HSST-ES.1.02