ROCKS ROCK! (MODIFIED FOR ADEED)

Science Concept:

In the rock cycle the processes of erosion, transport, and reformation form sedimentary rocks. (NOTE: Students should be familiar with the process of sedimentary rock formation before completing this lesson.)

Objectives:

The student will:

- describe the processes of the rock cycle that form sedimentary rocks;
- develop a model showing the formation of sedimentary rock; and
- create a descriptive and informative PowerPoint presentation.

GLEs Addressed:

Science

[10] SD1.1 The student demonstrates an understanding of geochemical cycles by using a model to explain the processes (i.e., formation, sedimentation, erosion, and reformation) of the rock cycle.

[10] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring, and communicating.

Writing

[10] W4.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms (e.g., letter, report, biography, autobiography, and/or essay) to inform, describe, or persuade.

Vocabulary:

cementation – cementation is one of the processes that work together to turn sediment into sedimentary rock (lithification). Mineral-laden water percolates through sediment with open pore spaces. The spaces are gradually filled by minerals precipitating from the water, binding, or cementing, the grains together

clasts – fragments of a pre-existing rock or fossil embedded within another rock

compaction – occurs when the weight of overlying material compresses more deeply buried sediment. Along with cementation, this process converts sediments to solid rock

conglomerate – a sedimentary rock made of rounded rock fragments, such as pebbles, cobbles, and boulders, in a finer-grained matrix. To call the rock a conglomerate, some of the constituent pebbles must be at least 2 milimeters (about 1/13th of an inch) across

crystallization – growth of minerals (crystalline solids) from a liquid or gas

dissolve – a condition where solid particles mix, molecule by molecule, with a liquid and appear to become part of the liquid

erosion – removal of material by water, wind, or ice. As soon as a rock particle (loosened by weathering) moves, by some flowing agent such as air, water or ice, it is erosion

evaporate – to change from a liquid or solid state into vapor

extrusive – noting or pertaining to a class of igneous rocks that have been forced out (extruded) in a molten or plastic condition upon the surface of Earth

grains – the individual mineral crystals or particles within a rock or sediment deposit

halites – a halite is a soft white or colorless mineral, sodium chloride, NaCl, occurring in cubic crystals with perfect cleavage; rock salt

intrusive – igneous rock that cools and solidifies beneath Earth's surface

matrix – fine-grained material surrounding larger grains in a sedimentary rock

reformation – The act of forming again; to change to a better state, form, etc.; to improve by alteration, substitution, abolition, etc.

runoff – that portion of precipitation that moves from the land to surface water bodies; that portion of precipitation which is not intercepted by vegetation, absorbed by the land surface or evaporated, and thus flows overland into a depression, stream lake or ocean

sandstone – sedimentary rock made mostly of sand-sized grains

sediment – the word geologists use for loose, uncemented pieces of minerals and rock that come in all sizes and go by common names like sand, boulders, clay, silt, pebbles, and cobbles

solution – the process by which a gas, liquid, or solid is dispersed homogeneously in a gas, liquid, or solid without chemical change; a homogeneous, molecular mixture of two or more substances

texture – the characteristic physical structure given to a material, an object, etc., by the size, shape, arrangement, and proportions of its parts

transport – to carry, move, or convey from one place to another

Materials:

- Safety goggles (one pair per student)
- Safety gloves (one pair per student)
- Safety apron (one per student)
- Nails (one per group)
- Sugar cubes (one box per group)
- Table salt (one pound per group)
- Fine sand (one pound per group)
- 1-liter Erlenmeyer flask (one per group)
- Flat baking pan (8 to 12 inches) (one per group)
- Books (several per group)
- Hot plate (one per group)
- Access to a sink
- Shoe boxes or hot water bath containers with bottom spouts (three per group)
- Computer with PowerPoint
- Rock samples or pictures/slides of different types of sedimentary rocks like halite (with big crystals), geodes, chert or flint, limestone, sandstones, conglomerates, and shale
- Science journal
- STUDENT WORKSHEET: "Sedimentary Rock Formation"
- STUDENT WORKSHEET: "Apply"

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process Skills: observing, inferring, and communicating

1. Divide students into groups and distribute a set of rock samples to each group. If a slide show or pictures are available, show the picture(s) of each rock.
2. Ask students to observe each rock and write a description of each rock in their journals. Ask them to explain how the rock was formed in their journal, based on their observations.

3. Ask the following questions and discuss as a class. List student ideas on the board.
   a. Where do you find rocks like these?
   b. What are they made from?

Explore

Process Skills: investigating, designing, and developing models

4. Guide students through the creation of a group concept map to describe the process of sedimentary rock formation.
5. Distribute the STUDENT WORKSHEET: "Sedimentary Rock Formation." Remind students of the class lab safety rules, such as wear gloves when working with hot equipment (hot plate) and always wear aprons and goggles in the lab.
6. Distribute materials to each group as indicated on the worksheet. Instruct students to design an exploration to make a sedimentary rock based on their group concept map. Check group plans for safety and workability.
7. After their plan has been approved, instruct students to begin their exploration. Make sure they record their observations. While groups are working, circulate around the room. Encourage groups to make inferences and generalizations. Possible guidance questions include:
   a. What variables do you see in your concept map?
   b. How could these variables affect your exploration?
   c. How could you change the transport rate?
   d. Will pouring the water faster make a difference?
   e. What about water temperature?
   f. What other changes could be made to change the outcome?
   g. What features or changes do you see during each step of the exploration?
   h. Were the outcomes what you expected and why?
8. Instruct students to discuss within their groups to compare observations and discuss the processes.
9. Ask students to redesign the concept map based on their exploration.
10. Allow each group time to share their exploration, findings, and revised concept map with the class. Allow groups to redesign their concept map a third time based on shared information, if necessary.

Generalize

Process Skills: describing, inferring, comparing, and making generalizations

11. Ask the following questions and discuss as a class:
    a. How does the water move/transport the salt?
    b. What features did you see when the water evaporated?
    c. How large were the crystals? Could they be made larger?
    d. What happened to the sand during heating?
    e. How are these processes related to sedimentary rocks; the rock cycle?
    f. How are sedimentary rocks formed?
    g. Identify any materials that did not react as expected. What happened and why?
    h. What variables affect the results?
    i. How could these variables be controlled?
12. Ask students to compare and contrast their findings and concept maps with other group members and record this information in their journal.

Apply

Process Skills: inferring, describing, predicting, and communicating

13. Distribute the STUDENT WORKSHEET: "Apply" and ask students to record the answers on a separate sheet of paper or in their science journal.

ROCKS ROCK!

RUBRIC

Assessment Task:

Create a PowerPoint of at least nine (9) slides that explains the processes of erosion, transport, and reformation of sedimentary rocks in the rock cycle. The PowerPoint should include your "model" (a developed concept map based on your exploration that explains the three processes). There should be pictures or drawings for each part of the process and you must have detailed descriptions relaying a clear understanding (proper use of vocabulary) of how each part of the process works in making a sedimentary rock. All three parts of the process should be included and all three models for each material should be present. You can use pictures from the Web to help illustrate the concepts, but proper MLA citing must be followed.

Rubric:

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student describes the processes of the rock cycle that form sedimentary rocks.	[10] SD1.1	The student describes the three processes (erosion, transport and reformation) in relation to one substance.	The student describes the three processes (erosion, transport and reformation) in relation to two of the substances.	The student describes the three processes (erosion, transport and reformation) in relation to all three substances.
The student develops a model showing the formation of sedimentary rock.	[10] SA1.1	The student develops a model that explains one of the processes (erosion, transport and reformation).	The student develops a model that explains two of the processes (erosion, transport and reformation).	The student's model explains all three of the processes (erosion, transport and reformation).
The student creates a descriptive and informative PowerPoint presentation.	[10] W4.2.2	The student does not create a PowerPoint or creates one that has less than nine (9) slides.	The student creates a PowerPoint with nine (9) slides.	The student creates a PowerPoint with more than nine (9) slides.

NAME: _____

STUDENT WORKSHEET

SEDIMENTARY ROCK FORMATION

Materials:

- Safety goggles (one pair per student)
- Safety gloves (one pair per student)
- Safety apron (one per student)
- Nail
- Sugar cubes (one box)
- Table salt (one pound)
- Fine sand (one pound)
- 1-liter Erlenmeyer flask
- Flat baking pan, 8 to 12 inches
- Books (several)
- Hot plate
- Access to a sink
- Shoe boxes or hot water bath containers with bottom spouts (three)
- Science journal

Concept Map:

1. Draw your group concept map.

NAME: _____

SEDIMENTARY ROCK FORMATION

Exploration:

2. Design an exploration to create a sedimentary rock, using the materials provided, based on your concept map. Describe your exploration set up and procedure below. Be sure to list each step.

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3. Ask teacher for approval of your exploration design.

___ approved Teacher's signature: _____

Data:

4. Record all observations and make note of each step of your procedure. Note any changes to your planned procedure. Use another sheet of paper if necessary.

NAME: _____

SEDIMENTARY ROCK FORMATION

Findings:

5. Explain the processes that occurred.

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Conclusion:

6. Redesign your concept map based on your findings.

NAME: _____ STUDENT WORKSHEET

APPLY

Directions: Answer the following questions on a separate sheet of paper or in your science journal.

1. Where have you seen the processes involved in sedimentary rock formation in every day occurrences?

2. Did your concept maps match with other groups? Why or why not?

3. What changes would you make to your exploration and why?

4. How could you make different crystal sizes? Explain the relationship between crystal formation and magma cooling.

5. Describe another process for making sedimentary rocks.

6. Based on the knowledge gained during this lesson, explain the white crust on faucets and how limestone caves are formed.