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Rocky Beach Worksheet Answer Key

Weathering is the process by which the surface of the Earth changes through mechanical and chemical processes. In this activity, we are going to experience the effects of mechanical abrasion weathering by conducting research using a weathering model.

Engineering Design Scenario

An island exists in a tropical region of the Pacific Ocean. The island has nutrient-rich soil, tropical plant life, abundant wildlife, and pristine views in all directions. From the perspective of beachgoers, the island is perfect in every way, but one: no beaches! The island has three shorelines composed of rocks and boulders. Each shoreline is composed of a different rock type.

The owner of the island hired a developing company to build a beautiful resort property on one shoreline—but which one? The developer's main goal for the resort is to provide sandy beaches. As civil engineers, your task is to create the beautiful beaches from the existing rock material. In order to be environmentally responsible, engineers take into consideration the potential for displacing a variety of tidal zone species and so make any effort possible to rehome organisms prior to construction. Again, to consider the potential ecosystem impact of this project, the engineers must consider that the island is a great distance from the mainland and resources are limited and expensive. Before your team creates the beach, you need to determine which shoreline is the easiest, simplest, and least expensive to transform into a beautiful, sandy beach.

If your "civil engineering firm" (your group) is able to complete the project on time and under budget, it receives a bonus of $1,000,000 and unlimited use of the resort.

Your engineering challenge: Apply your knowledge of rocks and mechanical weathering to determine which shoreline is best for developing the beach resort.

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Procedure

1. Obtain weathering vessel and "rocks" from the instructor.
2. Record **pre-weathering** observations of your "rocks" Record your observations in the table below.
3. Place your "rocks" in the weathering vessel.
4. Begin **gently** weathering your "rocks" by turning the weathering vessel upside down then right side up—for 2 minutes. Have one group member keep track of the time for each weathering session.
5. After 2 minutes of gentle weathering, record a second set of observations of your "rocks."
6. Commence **rigorous** weathering of your "rocks" by shaking the sealed weathering vessel vigorously for 2 minutes. Note: These are the same "rocks" from the gentle weathering.
7. Record your third set of observations for these "rocks."
8. As part of the improve/redesign step of the engineering design process, talk with your partner and then make notes below the table about of improvement ideas about a future weathering model.
9. Place your weathered rocks in the trash.
10. Repeat steps 2-8 for the remaining rock types you are testing.
11. When you are finished with each of the trials, return your materials to the instructor and answer the analysis questions on the next page.

Data Collection—Observations

Rock	Observations BEFORE Weathering	Observations After GENTLE Weathering	Observations After RIGOROUS Weathering
#1 Sugar cube	White; square; rigid; brittle; rough; breaks apart easily	White; rigid; brittle; edges are rounding off; square is breaking off into smaller pieces	Broken into small white pieces roughly the size of sand grains
#2 Jolly Rancher	Hard; smooth texture; semi-rectangular shape; semi-transparent green, red or blue color; smells fruity	Semi-rectangular shape; some small pieces have broken off; broken pieces have jagged edges; no color change	Sharp edges are rounded off; broken pieces are broken into even smaller pieces; colors have blended into a dark greenish color
#3 M&M's	Hard, smooth texture; circular/round shape; green, yellow, red, orange, blue or brown color	Some small pieces have broken off exposing a dark brown interior; broken pieces have jagged edges	Exterior shell of all the "rocks" are broken off; broken shells are in a powder form; some brown chunks remain; the powder has a soft, smooth texture

Notes—Ideas for future improvement of weathering modeling method:

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Analysis Questions

Answer the following questions using complete sentences.

1. Describe the types of mechanical weathering.

   Abrasion: Friction causes rocks to break apart into smaller rocks.
   Ice wedging: When larger rocks to split because of the expansion of water, exerting outward forces on the rock interior that occurs during phase change from liquid to solid.
   Thermal expansion and contraction: As rocks heat up, they expand, and as rocks cool down, they contract. When this happens many times, cracks form and pieces of rock break off.

2. Explain how the rocks changed from the beginning of EACH simulation to the end of each simulation.

   The rocks started off with distinctive shapes, textures and hardness. Weathering caused each to break into small pieces. Sharp edges and corners became softer. The shapes, textures and hardness of each was greatly altered through each simulation.

3. Based on your research results, of the three types of "rocks" you weathered, which shoreline do you recommend would be the easiest, simplest, and least expensive to transform into a beautiful, sandy beach? **WHY?** Provide a detailed explanation.

   (Answers will vary since each group may recommend a different rock type, but expect all explanations to provide logical evidence for the recommendation.)

4. Using your innovation and creativity skills, come up with another method that might work to artificially weather your rocks. There's no right or wrong answer. Just use what you have learned to come up with another way to weather the rocks. Describe how it would work.

   (Answers will vary. Some might include incorporating other weathering methods, such as chemical and biological, as well as ice wedging, and thermal expansion and contraction, or different ways to use abrasion and friction. If time permits, this question is a good jumping off point for an activity extension: challenge students to brainstorm alternative artificial weathering techniques and then decide on a plan that they test and compare to other methods. Also see the Activity Scaling section.)