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 **Findley Oaks STEM Connect**

 **3rd Grade Design Brief**

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| **Month****January** | **Challenge** Erosion | **Unit**Rocks and Soil |

**Standard:**

Students should follow the **Engineering Design Process.**

**Background/Problem:**

**Erosion** is the movement of weathered materials from one location to another. For example, if wind blows beach sand from a dune and scatters the sand over a beach parking lot, the sand is said to have been eroded. The formation of the Grand Canyon is an example of water eroding the land over millions of years. Agents of erosion include moving water, wind, gravity, and animal traffic.

**Weathering** is the chemical or physical breakdown of rock into smaller pieces. A number of different agents’ weather rock including water, wind, gravity, animal traffic, and the freezing and thawing process.

A number of factors can affect the rate at which erosion occurs. Some of these factors are particle size, speed of the agent of erosion, and the type of erosion agent.

People have devised numerous methods for reducing erosion. Some of these methods include terracing (cutting stair steps into the side of a hill), planting ground cover (like turf and bushes), building retaining walls, creating less severe slopes, and using soil lifts, which are similar to sand bags. Some methods of erosion prevention are more effective than other methods.

**Design Challenge:** You have been tasked with building a level basketball court at Findley Oaks Elementary. Unfortunately, the only piece of land large enough to locate your court is on a steep hillside. You'll have to come up with an erosion control plan that keeps the land from washing

over your court during heavy rainfalls. Are you up for the challenge? The ball's in your court.

Answer the following questions by circling the best choice, being as accurate as possible.

1. Typically, erosion in rivers takes place because:

a. Water moves the soil around the flowing river.

b. People move the soil.

c. The soil is strong and resists the water flowing on it.

2. How is it possible for erosion to cause building damage or failure?

a. Buildings move over time because the materials that they are made of get weaker.

b. The soil under the building moves and the weight and magnitude of the building is too much for the soil below it.

c. Water gets into people’s houses and damages the walls, which can cause failure.

3. Which of the following earth materials is least susceptible to be eroded?

a. Clay

b. Silt

c. Sand

d. Gravel or rock

4. What type of water flow moves soil the most?

a. Laminar flow

b. Normal flow

c. Turbulent flow

5. Draw your building before the flood.

**Criteria: Your creation must:**

* **be useable and useful.**
* **be strong, sturdy, and stable.**

Constraints:

You must work with a partner (or in a group of 3) teacher discretion.

Make sure you have a design plan before you start.

Materials: (per team or group) 2,3 (teacher discretion)

The class needs:

* simulation of river flow, via an erosion table with hydraulic bench OR a stream table OR a homemade erosion table; see below for details on these options
* small-size model buildings, one per student, made via 3D printer (plus computer and free drawing software) OR LEGO pieces; see below for details on these options
* 10 pounds fine sand ($5)
* water, sink and buckets

Tools:

Scissors

Crazy scissors

Staplers

Hole punch

Rulers

Paper/pencil for design planning

Options: Brainstorm ideas…. make sure the students have time to plan.

Use design brief below.

**Assessment**

Top of Form

1. Which term is defined as the breakdown of rock into smaller pieces?

* a. erosion
* b. weathering
* c. sloping
* d. lifting

2. All of the following are typical agents of erosion *except*:

* a. sound.
* b. moving water.
* c. wind.
* d. gravity.

3. A large boulder falls from a cliff and breaks into many smaller pieces. The smaller pieces of the rock are then moved to a new location by moving water. This is an example of:

* a. erosion, only.
* b. weathering, only.
* c. both erosion and weathering.
* d. neither erosion nor weathering.

4. Liquid water settles into the crack of a large rock. The water freezes and the large rock splits into two smaller rocks. This is an example of:

* a. erosion, only.
* b. weathering, only.
* c. both erosion and weathering.
* d. neither erosion nor weathering.

5. Material A has a small volume and small mass, while material B has a small volume, but a much larger mass. Which material, A or B, would be expected to undergo greater movement due to erosion?

* a. material A
* b. material B
* c. materials A and B would undergo similar rates of movement due to erosion

6. As the steepness of a slope increases, the erosion of materials on the slope is expected to:

* a. decrease.
* b. increase.
* c. remain constant.

7. The application of ground cover on a slope is more likely to reduce the rate of erosion on the slope than a reinforced retaining wall.

* a. true
* b. false

8. Soil lifts are most similar to:

* a. sand bags.
* b. elevators.
* c. small trees.
* d. small bushes.

### **Engineering Connection**

Civil and geotechnical engineers carefully investigate the soil in the surrounding area where structures are going to be built so they can best plan for the future safety of the structures. Civil engineering projects such as skyscrapers, bridges and highways require solid foundations, and preferably placement in areas that are not susceptible to erosion. Engineers must also be knowledgeable of the types of construction materials that can resist water erosion. Engineering solutions to erosion problems may include the extension of foundation systems, installation of vegetation, and modifying the water flow or direction. The erosion table demonstration in this activity shows students how water can move soil and how erosion can affect buildings.