Ground Reinforcement Student Worksheet

Aim

Investigate how reinforcement methods (geogrids, fabric strips, simulated piles) affect ground stability compared to unreinforced ground.

Materials

Per small group:

- Dry sand or fine gravel
- Plastic container or tray
- Fabric strips (simulate geotextile)
- Cardboard strips or mesh (simulate geogrid)
- Wooden skewers or matchsticks (simulate piles)
- Cardboard strip (simulate pile cap)
- Small weight (or full water bottle)

Method

1. Unreinforced Test
    - Fill container with sand and create a slope at one end
    - Apply load (small weight) on top.
    - Observe settlement and spreading/collapse of the slope.

2. Reinforced Test
    - Repeat with fabric strips layered in the sand.
    - Repeat with cardboard grid or mesh placed in the sand.
    - Insert skewers or matchsticks vertically (simulate piles).
    - Apply a cap to the piles.
    - Apply same load and observe differences.

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Results

Setup	Observation
Unreinforced	
Fabric strips	
Cardboard grid	
Skewers (piles)	

Rank Effectiveness: Rank reinforcement methods from most to least effective (1–4) based on your observations.

Discussion

1. Why does reinforcement reduce soil movement?

2. Which reinforcement method was most effective? Why?

3. Where might engineers use these techniques in real life?

Extension

Activity 1: Design and outline your own experiment to investigate how different factors affect a slope's stability.

Your experiment design must include:

1. A specific question you want to test
   Examples:
   - *How does grain size (sand vs gravel) affect the stability of a slope?*
   - *How does moisture content change the slope's resistance to collapse?*
   - *How does slope angle influence the likelihood of failure?*
   - *How does adding vegetation (simulated with toothpicks or straws) affect slope stability?*

2. A hypothesis
   A simple prediction of what you expect to happen and why (based on rock/soil properties and the rock cycle).
   Example:
   I predict that wetter sand will be stronger, unless it is fully saturated.

3. Independent variable (the thing you will change)
   Some possibilities:
   - Slope angle
   - Grain size (fine vs coarse)
   - Moisture content
   - Type of reinforcement
   - Amount of compaction

4. Dependent variable (what you will measure)
   Some possibilities:
   - Amount of slope movement
   - Distance of material spread
   - Height loss
   - Visual observation of collapse pattern

5. Materials list
   These must be items that are safe and accessible in class—e.g., sand, gravel, water, trays, rulers, protractors, straws, fabric strips, measuring cups.

6. Method
   Students must outline the steps clearly enough that another group could repeat their experiment.
   This should include:
   - How they will build the slope
   - How they will apply load or trigger movement
   - How they will keep tests fair and consistent
   - How they will measure changes

7. Safety considerations
   Students must identify and address any risks (e.g., slippery sand, careful handling of tools, spill management).

8. Expected results or data table format
   Students should sketch the type of data they will collect (e.g., table comparing slope movement under different moisture levels).

Activity 2: Research real-world applications of geogrids and piles in highway construction or slope stabilisation.

Activity 3: Research ancient use of geogrids

Activity 4: Have a competition to see who can build the highest sandcastle using fixed amounts of sand and reinforcing materials