Name:_____ Date:_____ Class:_____

Student Worksheet

How can Nanoparticles move from Land to Ocean? – Runoff Lab

Safety

The water testing kit contains chemicals that irritate the eyes and can be harmful if swallowed. If eye exposure occurs, flush with water for 15 minutes and get medical help.

Introduction

Your favorite beach is closed due to water contamination. A sign states that swimming in the water is dangerous. You don't see any trash on the beach…what's the problem? You will model the process of *runoff*—the way tiny pollutants can reach the ocean from land. Some of these pollutants are on the nanoscale ($1x10^{-9}$ meter) and are of concern to environmentalist because of their small size. They are concerned that they may react differently with the environment and because we can't see them, people will not be aware of the possible danger. Can tiny pollutants reach your beach?

Materials

- a bag of clay
- a metal tray
- a bag of sand
- a bag of rocks
- spray bottle
- distilled water
- fertilizer
- spoon
- plastic micropipette
- water testing kit

Question:

How can small-scale pollutants move from land to the ocean?

Make a Prediction

_____

_____

_____

Procedure

Group members 1–2: Build a large, hollow, clay mountain.

1. Build a large, clay mountain structure that will occupy about one-third of the container.
2. Carve a channel in the mountain to resemble a stream. If the clay dries, spray it with water.

Group members 3–4: Build the model beach and land.

3. Wash the disposable metal pan thoroughly to remove any dust or powder-like substances.

Development and distribution partially funded by the National Science Foundation

NNIN Document: NNIN-1265
Rev: 08/2012

4. Fill half of the container with 1/4 inch of sand.
5. Cover the other half of the tray with 1/2 inch of rocks. The rocks should be taller than the sand.

All together: Finish the model.

6. Place the mountain on top of the rocks. The mountain's streams/rivers should face the sand.
7. Add 1/2 inch of distilled water to the container on the sand to model ocean water.
8. **STOP:** Your model is complete. Wait for your teacher to give instructions on how to use the water testing kit by taking a baseline measurement of the water in your spray bottle (distilled water) together as a class. Record this measurement in the table below.
9. Add a tablespoon of fertilizer atop the mountain.
10. Spray water 100 times over the mountain. Use the spray setting that allows the water to evenly disperse and more accurately simulates precipitation (rain). Notice where the water (and fertilizer) goes during the "rainstorm".
11. Take a small sample of the runoff water using a micropipette.
12. Divide sample equally into the 4 small test tubes provided with the water testing kit.
13. Follow the kit directions to test for pH, ammonia, nitrates, and nitrites. The drops come out easier (and measurements are more accurate) if you hold the chemical bottles straight up and down and do not tilt them.

Record Your Observations

Water Testing Results

	pH	Ammonia (ppm)	Nitrite (ppm)	Nitrate (ppm)
Uncontaminated water				
After precipitation (your results)				

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Draw a picture of your runoff model in the space below. Draw arrows and describe the flow of pollution from the mountain to the ocean.

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Analyze the Results

Compare the results of the initial testing to the testing done after the precipitation. Explain how the pH changes, and whether the nitrate, nitrite, and ammonia increased or decreased.

Draw Conclusions

1. How can small-scale pollution (nanoparticles) travel from a mountain to an ocean?

2. Landfills break down trash into their smallest components over time – many at the nanoscale. If there was a landfill at the top of a mountain without any sort of containment, where could these nanoparticles end up? How? Be sure to use at least 2 terms from the *water cycle*.

3. What is the best way to test ocean water for possible contamination after a rain?

4. How might the pollution affect the marine ecosystems in those bodies of water?

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NNIN Document: NNIN-1265

Rev: 08/2012