



## Water Water Everywhere: Designing Water Filters

### Lesson 3, Lesson 4

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#### Title: Narrowing the Filter, Opening Possibilities

Grade Level: 3, 4, 5, 6, 7, 8

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Prep Time: Under 15min  
Lesson Time (1): 60 Minutes  
Lesson Time (2): None

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#### Lesson Description:

Students will change the shape of the filter to make observations about volume

#### Strands:

- Geometry
- Measurement and Data
- Mathematical Practices

#### Standards:

- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume
- Solve problems involving measurement and estimation of intervals of time
- Construct viable arguments and critique the reasoning of others
- Model with mathematics

#### Objectives:

- Students will observe that the same volume of material can be stored in differently shaped containers, while remaining the same volume.
- Students will observe that as the width of the cylinder decreases, the height of the material increases.

#### Materials:

- Each group:
  - Cylindrical tubes of various widths. [Note, these will need to be placed in the filter the students made in Lesson 3. The tubes should be transparent, so it may be easiest to use transparency sheets rolled, cut, and taped into cylinders.]
  - Duct tape or packing tape

#### Lesson Plan:

1. Measure out  $\frac{1}{8}$  cup gravel,  $\frac{1}{8}$  cup sand for each of their three cylinder sizes.
2. Fill each container with the sand/gravel mixture as in Lesson 3.

3. Measure the height of the mixture in each cylinder and record it along with the width of the cylinder (small, medium, large).
4. Predict which cylinder will filter water most effectively.
5. Holding the cylinder over a labeled cup, pour 1/4 cup water through each filter.
6. Compare the three types of filtered water, **which is cleanest?** Remember that, in Lesson 4, prices were assigned to materials. **Could narrowing the filter save money?**
7. For higher grades: estimate the area of the crosssection of each cylinder based on the height of the material and its volume. Measure the diameter to check.

**Reflections:**

**How does the width of the cylinder relate to the height of the material? Does water get cleaner when it runs through more filter material? How could you make a more efficient filter if you only had a small amount of filter material? How do engineers think about design as a way to use materials more effectively?**

**Assessment:**

Students will understand that volume remains constant, even as the shape of the container changes. Students will be able to make a connection between the width of a cylinder and the height of material it contains. Students will understand that engineers design to address efficient use of materials, as well as project goals.