



# Up, Up, the Water Goes

How could you transport water uphill without electricity? The Archimedes screw is a simple device that gets its name from the famous Ancient Greek mathematician, even though it was in use long before his time!

Engineer a device that moves water from one location to another as you explore the physics of simple machines and the power of making work easier.

## TEKS:

SCI 4.6 D: The student is expected to design a descriptive investigation to explore the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

SCI 6.7 B: The student is expected to identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

SCI 6.8 E: The student is expected to investigate how inclined planes can be used to change the amount of force to move an object.

## Materials:

- Bowl (shorter than a 16-ounce plastic cup)
- Clear packing tape
- Food coloring
- Large yogurt container, or similar (~32 ounces)
- Paper towels
- 16-ounce plastic cup
- Plastic tubing (3/8-inch inner diameter; 48 inches long)
- Water (enough to fill bowl  $\frac{3}{4}$  full)

## How To:

1. Wrap the plastic tubing around the outside of the yogurt container in a spiral, starting at the very top of the container and ending at the very bottom.

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2. Secure the plastic tubing with clear packing tape, making sure that you do not cover up the ends.



3. Fill your bowl up  $\frac{3}{4}$  of the way with water and add about 10 drops of food coloring. Place paper towels underneath your bowl and a 16-ounce plastic cup next to it so that any water that flows from the top of the tube will land in the cup.
4. Now it's time to test your Archimedes screw! Place one end of the screw into the bowl of water and, depending on which direction you wrapped the tubing, spin the screw clockwise or counter-clockwise until you see water begin to flow into the tubing. Keep rotating the screw until the water gets all the way to the top of the tubing and falls into the plastic cup. This process will continue until the water level in the bowl gets low enough that the bottom of the screw is unable to fill with water anymore.

### STEM Explanation:

The use of an Archimedes screw dates all the way back to 250 BC. Archimedes, a Greek philosopher and scientist, saw the water screw being used by the Egyptians on a visit there. He introduced the water screw in Greece and historians later mis-attributed the invention to him. A screw is a type of simple machine, and is the combination of an inclined plane and a cylinder. Simple machines make work easier, and the Archimedes screw makes moving materials in an upward direction much more efficient. In this activity, as your screw turned, it scooped up water then air in a continuous cycle. Both air and water take up space, so this process forced them both up and out of the screw, into the cup above. Today, similar devices are used to drain water out of mines, lift wastewater in treatment plants, move solids such as coal and grain, or irrigate agricultural fields without electrical pumps.

### Career Connection:

*Engineering physicists* develop a thorough understanding of the fundamentals of physics and the application of this knowledge to practical problems. They apply scientific principles, mathematics, and problem solving skills to equipment design, technology development, and optics applications.

### Resource:

<https://explorable.com/archimedes-screw>

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