

WHELMERS Student Activity | Grades 3–5

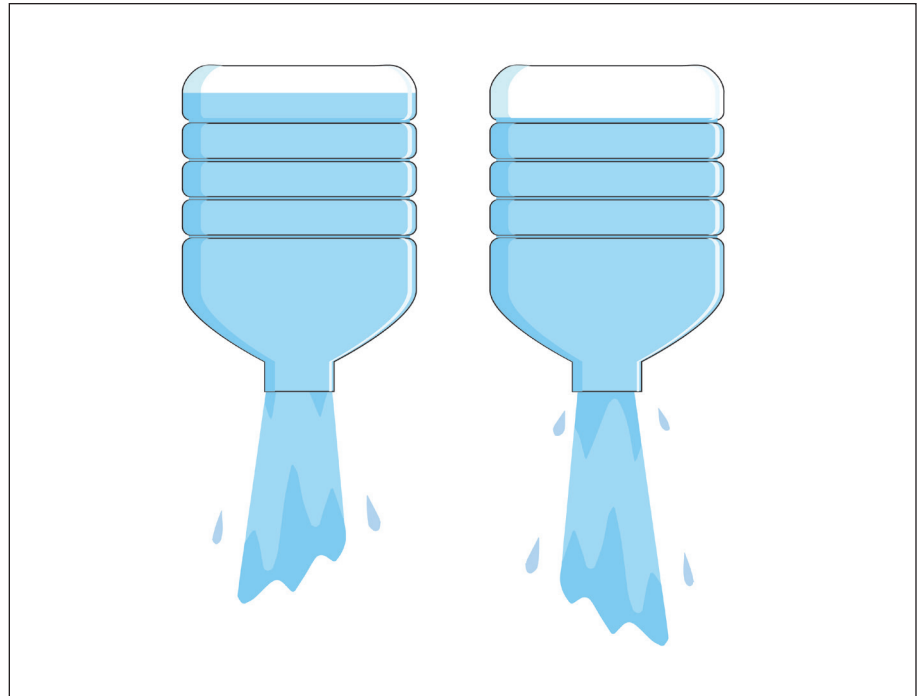
Water Jug Race

WHAT YOU NEED:

- Two or more identical 1-gallon (or larger) **glass** jugs- plastic jugs will not work

DESCRIPTION

First one to empty the jug, wins! It's not as easy as it sounds!



NEXT GENERATION SCIENCE STANDARDS

- **PS2.A: Forces and Motion**
 - Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
 - The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.

(Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

- **PS2.B: Types of Interactions**

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)

- **PS3.C: Relationship Between Energy and Forces**

- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

WHAT YOU DO

1. Make sure the glass jugs are identical in size and shape. Remember, plastic jugs will not work. Their flexibility will affect the outcome of the race.
2. Fill all the jugs with the same amount of water.
3. Race to empty the water out of the jugs as fast as possible. Try different techniques to get the water out.
4. First one to empty their jug, wins!

WHAT HAPPENS

You'll notice that just holding the jug upside down with no additional movements does not work. That's because the flow of more dense water exiting the bottle is slowed as the water collides with the less dense air entering the bottle. In most cases, players who swirl their jug, creating a vortex, win the race. The vortex creates a large inner pathway for air to enter the bottle as water escapes. Also, just shaking the bottle causes the water to travel up and down many times. This increases the distance it must travel before leaving the bottle, which takes longer. For the same reason, swirling the bottle too much will also slow the exit of the water out of the bottle.

WHERE IN THE WORLD

A vortex is found in the spiraling motion liquid. It can also be in the spiraling motion of air around a center of rotation. Think about these real-world examples of a vortex.

- A tornado
- Water going down a drain in the bathtub
- A toilet flushing
- A dust devil

Can you picture the rotation taking place in the center of each? What are some other examples of a vortex?