

## More Power to You!

### Summary

This hands-on activity demonstrates Newton's third law of motion: For every action, there is always an opposite and equal reaction.



**Time Required** 45 minutes

**Expendable Cost per Group** \$0 (common classroom and household items)

### Materials List

Each group needs:

- Plastic soda bottle with cap (ask students to bring from home)
- Plastic drinking straw
- Modeling clay
- 1 tablespoon baking soda
- 4-inch square of tissue paper
- $\frac{1}{4}$  cup vinegar
- Tub of water

### Procedure

1. Fill a tub of water.
2. Poke a hole near a bottom edge of the bottle.
3. Insert a plastic drinking straw in the hole, leaving only about one inch sticking out of the bottle. Seal the hole around the straw with modeling clay.
4. Pour a tablespoon of baking soda into tissue paper. Wrap the tissue paper around the baking soda, and twist the ends like a candy wrapper.
5. Pour  $\frac{1}{4}$  cup of vinegar into the top of the bottle, tilting the bottle so that the vinegar does not drain out of the straw.
6. Set the boat in the water and slip the baking soda packet into the bottle. Seal it **QUICKLY** by twisting the cap on. Watch the boat speed along the water!
7. Mixing the baking soda with vinegar creates carbon dioxide gas, which rapidly leaves the sealed bottle due to pressure. The carbon dioxide leaving the bottle is an action force, which pushes against the water under the boat, causing the reaction of the boat moving forward.

### Activity Reference

Hauser, Jill Frankel. Gizmos and Gadgets: Creating Science Contraptions that Work (and Knowing Why). Charlotte, VT: Williamson Publishing, 1999. (Activity adapted from Hauser.)