

Conserving-Matter Setup (Teacher Master)

1. Physical-Change Bags

Materials (per Group)

- Lego bricks for making water molecules
 - 10 red Legos (2 × 4")
 - 20 white Legos (2 × 2")
- 2 sealable, quart-sized plastic bags (identical type and brand)
- 2 rubber bands (identical type and brand)
- 2 unopened, 8-oz bottles of water (1 frozen and 1 at room temperature)

For each group of four students:

Prepare sealable plastic bags according to the following directions. The bags and rubber bands must be identical, so make sure to use the same type and brand.

a. Lego physical-change bags:

- Using white and red Lego bricks, assemble 5 models of water molecules* and bind the molecules together with a rubber band.
- Place the Lego water molecules in one plastic bag and label it **Solid Water (Ice)**.
- Using the white and red Lego bricks, assemble 5 more models of water molecules. **DO NOT** bind these molecules together with a rubber band, but place a loose rubber band in the plastic bag. This rubber band should be identical to the first rubber band.
- Place the Lego water molecules in the second plastic bag and label it **Liquid Water**.

*A Lego water-molecule model



Photo courtesy of BSCS

b. Melting physical-change bags:

- Place half of the 8-oz water bottles in the freezer overnight.
- Each group will need 1 bottle of room-temperature water and 1 bottle of frozen water.

2. Chemical-Change Bags

Materials (per Group)

- Lego bricks for making molecules
 - 2 lime-green Legos (2 × 4")
 - 10 white Legos (2 × 2")
 - 6 black Legos (2 × 4")
 - 10 red Legos (2 × 4")
- 4 quart-sized, sealable freezer bags (identical type and brand)

- White vinegar
- Baking soda
- 2 clear-plastic vials with snap-on caps (1-oz portion cups with lids work well)
- 2 measuring spoons (1 teaspoon and 1 tablespoon)

For each group of four students:

Prepare sealable plastic bags according to the following directions. The bags must be identical, so make sure to use the same type and brand.

a. Lego chemical-change bags:

- Assemble one Lego model of a vinegar molecule and one Lego model of a baking-soda molecule.

Vinegar Molecule

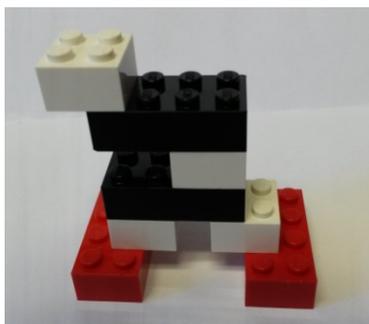


Photo courtesy of BSCS

Baking-Soda Molecule

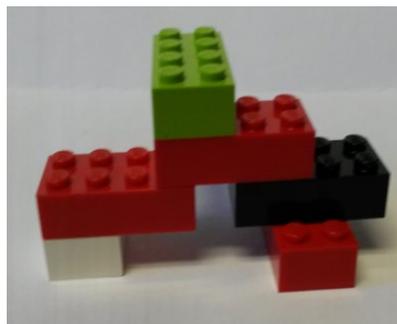


Photo courtesy of BSCS

- Place these molecules in a sealable plastic bag and label it **Vinegar and Baking Soda**.
- Next, assemble one Lego model of a water molecule, one model of a carbon-dioxide molecule, and one model of a sodium-acetate molecule.

Water Molecule

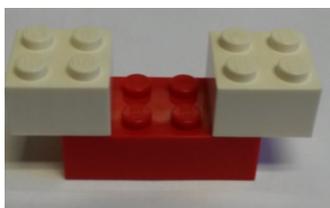


Photo courtesy of BSCS

Carbon-Dioxide Molecule

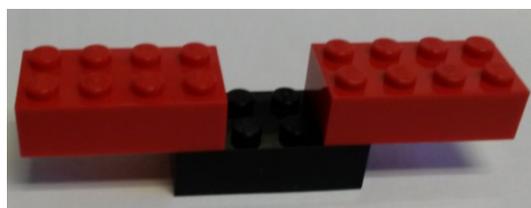


Photo courtesy of BSCS

Sodium-Acetate Molecule



Photo courtesy of BSCS

Note: Don't be concerned about building the sodium-acetate molecule exactly as shown in the photo. The important thing is to use the Lego baking-soda and vinegar atoms to build the water, carbon-dioxide, and sodium-acetate molecules. After making the water and carbon-dioxide molecules, the leftover Lego bricks should be the ones you'll need to build the sodium-acetate model.

- Place these molecules in a sealable plastic bag and label it **Water, Carbon Dioxide, and Sodium Acetate**.
- Each group will need one of each bag.

b. Chemical-change reaction bags:

- Assemble **2 plastic freezer bags** containing the following ingredients:
 - 1 teaspoon of baking soda
 - 2 tablespoons of vinegar
- Measure these ingredients carefully so that each bag contains the same amount of baking soda and vinegar.
- Place 1 teaspoon of baking soda in one sealable, quart-sized freezer bag.
- Place 2 tablespoons of vinegar in a plastic vial and secure the snap-on cap.
- Wipe off any residual vinegar on the outside of the vial.
- Place the vial in the bag with the baking soda.
- Remove as much air from the bag as you can before sealing it.
- Assemble another bag exactly like the first bag.
- Each group will need two identical bags.