

Interactive Notes-“States Of Matter”

Materials (per group of 4 students):

Demo 1	1- zipper bag with 2 spoonfuls of sodium hydrogen carbonate (baking soda) 25ml - acetic acid (vinegar) - in a closed container (to avoid spills)
Demo 2	1-penny 1-dropper 1-narrow-neck bottle (the penny must cover the entire opening) 1-600ml (or larger) beaker
Demo 3	1-250 ml beaker- half-filled with ice water
Demo 4	1-dropper with food coloring (any dark color); placed in a plastic bag so it won't leak
...and	4-note sheets

Additional Teacher Materials:

PowerPoint

4-1000ml flasks of near-boiling water

1-pair- hot gloves

cooler with ice

2 tennis balls (optional)

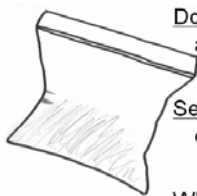
Beforehand:

- Set out all materials *the day before*. This one will take longer to set up for than you might expect. Leave yourself time to realize you're missing something, and to practice a new demonstration, research something or even make a change. In the morning, read through the slides and notes one last time. Relax and have fun along with your students. Remember- you're only as effective as your plan.
- Insert page and paragraph numbers from relevant pages in your textbook at the bottom of slides 1 and 2 if you choose to have the class read from it together. This is a good way to connect with your textbook as well as transition into the next demo. You can also delete these page inserts, or Copy and Paste them onto later slides if needed.
- As with any other demonstration, try these out ahead of time for yourself so you know how they work best and so you know what to expect.
- Print extra copies of the notes pages on paper for yourself, students that are slow writers or can't see well, and for absentees. Click "File" → "Print" → then where it says "Print what:" select "Handouts" → and then "OK".
- In preparation for demo #1 it would be a *very* good idea to get all the baggies with baking soda ready the day before, and all (or as many of) the 25-mL of vinegar vials poured. You've got better things to do during notes day than to deal with these. Pour about 5 extra of each also- you'll need them for one reason or another.

Things to do the morning of:

- Put 4- 1000ml flasks of water on a hot plate to 225° Celsius about an hour before your first class. This is enough hot water to last 2 classes. *NEVER leave a dry flask/beaker on a hot plate, and make sure you turn it off at the end of the day.*
- Fill the cooler with ice. Just before your first class comes in put the ice and water in the 250 mL beaker for each group.

Interactive Notes: The States of Matter



Do: Mixed baking soda and vinegar in a bag.

See: A chemical reaction occurred, creating lots of gas (CO₂).

What's Happening: Gases have more **energy** than solids and liquids. The atoms are so active they collide and start spreading apart. Gases take up about 50x more space than liquids.

Read p. 11 together
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Interactive Science Teacher

1.

Have student #1 (of the 4) pour vinegar into the bag of baking soda and quickly seal it shut, trapping all the gas.

This is a good introductory demo because it involves all three states and gives you a chance to mention anything you want to about any of them.

It's fun to tease students at the beginning by telling them, with great caution in your voice, to be careful handling the explosive sodium hydrogen carbonate. Smile and tell them its common name- baking soda. Then try and do the same with acetic acid (vinegar).

Before students pour in the vinegar to begin the reaction, have them first zip the bag halfway shut which will allow them to close it quicker and with more ease.

Regular sandwich bags do a good job in this demo, but some will leak air and liquid. Freezer bags (quart size) do a better job.

When you get to the last section of the notes, remind students how small their powder initially was, and so was their liquid. Then look at the bag full of air!

After the demo tell students to not open the bag and release the air. We'll need it inflated for demo #3.

This demo would also be a good time to introduce them to the concept of a chemical change (Where's the baking soda and vinegar? Long gone!). On top of that, have them feel the bag as the reaction happens (it's cold!). This is an endothermic chemical reaction, which needs heat from its surroundings to occur. When you touched it and it felt cold, some of your heat caused that reaction to happen.

The chemical formula for the reaction: $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CO}_2 + \text{NaCO}_3 + \text{H}_2\text{O}$

(end of Teacher Notes preview)

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Interactive Notes: The States of Matter



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Read p. 1 together

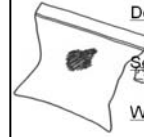


Do: Placed a penny on top of a heated bottle.

See: The penny flapped up and down.

What's Happening: The heat excited the air in the bottle, and it sped up & expanded. Pressure built up until it was strong enough to push up on the penny.

Read p. 1 together



Do: Touched an ice cube to the baggie.

See: A small cloud formed on the inside.

What's Happening: Where the ice touched, water vapor inside the baggie lost energy, slowed down, and condensed. Removing energy from a gas causes it to become a liquid and then a solid.

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Do: Put food coloring in hot and cold water.

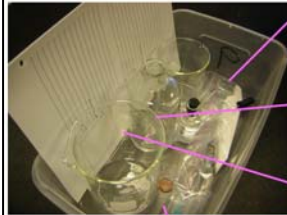
See: The coloring spread much faster in the hot.

What's Happening: The atoms in gases and liquids are always randomly moving around each other. The hotter (more energetic) they are, the faster they move. This is called **Brownian Motion**.

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Clean Up- this is what your box needs to look like in 5 minutes.



- Person 1**
 - Throw away inflated bag
 - Get new bag
 - Put empty vial on back lab table
 - Get new vinegar vial
- Person 2**
 - Empty big beaker, put bottle inside of it
 - Make sure penny is in box
- Person 3**
 - Count 4 new note sheets
- Person 4**
 - Empty and rinse the small beaker. Half-fill it with tap water, then put ice in it.
 - Make sure dropper with coloring is in bag and has coloring in it

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◆ Student Handout

Name _____ Date ____/____/____

Do: _____

See: _____

What's happening: _____

Do: _____

See: _____

What's happening: _____

◆ Drawings & Pictures

		
Drawing-Baggie With Ice	Drawing-Flapping Penny	Drawing-Hot & Cold Beakers
		
Drawing-Inflated Baggie	Pic-Flapping Penny	Pic-Hot And Cold Beaker:
		
Pic-Inflated Baggie	Pic-Refill Piles, Bags & Bottles Prepared	Pic-Student Materials