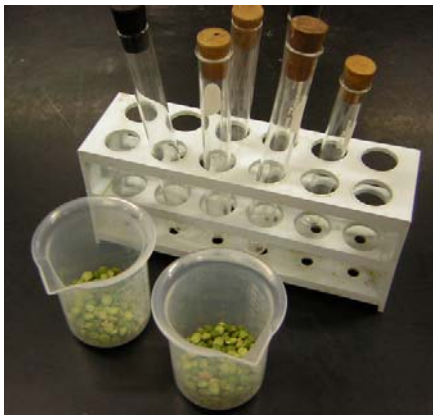
Teacher Notes- “Solids, Liquids, & Gases- Build, See, & Compare”

Trying to teach the states of matter without anything to aid the imagination doesn't do enough to help students fully understanding how the atoms behave in each state.

In this lesson students will be reading about the states of matter from the text, but the test tubes, split peas, and analogies will make it feel more like a mini-lab. What they hear, do, and see will show them exactly what atoms are like in the 3 different states.



Materials per group of 4 students (students will work in pairs today):
6- test tubes
6- stoppers
2-beakers (100 ml or larger; small cups would also work)
1- test tube rack (or something to rest test tubes in)
1- bag of split peas from the grocery store
1-ice cube

Additionally:
1 bar-Ivory soap (fresh; soap older than a couple of months will not work)
1 paper plate
Microwave oven
Magic wand (a meter stick will do)
1 cold and 1 warm can of soda
PowerPoint- “Putting Split Peas In Test Tube”

Beforehand:

1. Put just enough split peas in the beaker for students to do this activity, otherwise you’re inviting more mess and problems. Fill a test tube 1 1/2 times so you can see how much each group needs for the day. Each beaker should have about 50ml of split peas.

2. Set out test tubes, stoppers, & split peas *the day before*. Leave yourself time to realize you’re missing something (did you buy fresh Ivory soap?), research something or even make a change. In the morning, read through the notes one last time. Relax and have fun along with your students. Remember- you’re only as effective as your plan.

3. Locate the section in your book (or something you can run off and give students) that discusses the 3 main states of matter. It would also be helpful if there were a couple of “warm-up” paragraphs leading up to it, possibly on atoms or matter in general.

Look over the reading- you may want to skip over a few unnecessary paragraphs. Anything off the main topic of solids, liquids, and gases (like crystals) is not your priority today.

4. Make a random list of student readers, if you want. This is one less decision you'll have to make during class, and will keep you from calling on the same hands that always go up.

5. Fill a cooler with ice.

6. Put a microwave oven somewhere in your room for the Ivory soap demonstration.

7. This activity can adapt to be used with classes that run 25-45 minutes. It is presented in its barest form, so there's plenty of room to add to it. At the end is a list of "accessories", which are further topics you can add on which will lengthen and deepen the discussion.

8. As you read the lesson, don't at all feel obligated to do all the talking points. The intent was to give you the feel and flow of the lesson as it was intended. Make whatever changes will help you feel more comfortable. You may, in fact, decide that there's too much going on for you as is written. If that's the case, start cutting things out you feel aren't necessary and would overwhelm you.

Procedure:

1. If you are using the PowerPoint "Putting Split Peas In Test Tubes", start it now. It will guide you and your students through the class period.

2. Begin class by having students get their materials, with instructions not to touch anything yet.

3. Then put an ice cube in front of each group. As soon as you put it down, they'll be observing it, wondering what's going on.*[1a]

4. Introduce the lesson:

"Students, the topic of the day is the states of matter. The ice cube I just put in front of you is exhibiting all 3 states- solid, liquid, and gas. It's just a simple ice cube, but the things going on inside of it right now are amazing.

We're going to be reading from your textbook today. In fact, go ahead and be turning to page _____. You can tell by the materials out today that things are going to be different. Instead of just reading and talking, we'll read a little, do a little, then read some more, do more, and so on.

Beneath your ice cube right now is a little puddle of water. See it? You know that came from the ice, right? (right)
But *how* did that happen? One minute it's ice. The next it's liquid water. What caused the change? (not sure)

Insert page number

Think of it this way- if I had not taken your ice cube out of the cooler it would still be ice in there. And when it was taken out, it started melting. So, what it comes down to is- what's the difference between the inside of this cooler and our classroom here? (it's warmer in the classroom)

Touch the ice cube- how does it feel? (cold?)
Yes, cold. Have you ever wondered why ice is cold?
Cold means there's little energy. And the colder it is, the less energy it has. Feel that ice cube one more time. And this time instead of thinking 'that's cold', I want you to think 'there's very little energy in there'.

These are all clues that we're going to looking into and getting answers about. Let's read our first section."

5. Now it's time to the introductory paragraphs from the textbook (don't yet read about solids, liquids, and gases). Call on your first few random student readers to read the first couple of introductory paragraphs aloud. Stop when you get to the section on solids.

6. Before reading about solids students are going to make a test tube representation of a solid. Have each student group take their first of 3 test tubes and fill it to the very top with split peas. It helps when pouring if the test tube is down in their closed hand so it forms a little bowl- that helps the peas to slide in. Take a few peas out at a time until the stopper fits snug enough to hold all the peas without allowing any of them to move at all.

7. Examine the contents of the full test tube:

"Look carefully at the split peas inside your test tube. Notice what happens when you turn it to the side, then upside down, then to the other side. Does anything ever change in there? (no)

They're packed in there pretty tight, huh?
Those split peas represent atoms, and atoms can move as much as their energy allows. Since these aren't moving, they must not have much energy.
But here's the thing- they are *capable* of moving around, but they *can't*.*[2]

Take another glance at your ice cube. Frozen water, right? Remember all those split peas packed in your test tube? That's what the atoms in your ice are like."

8. Call on your next few random readers to read about solids.*[3]

(end of Teacher Notes preview)

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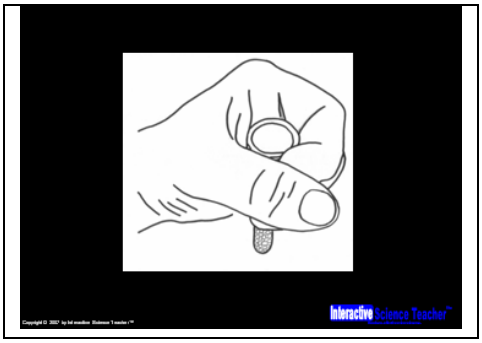

♦ Drawings & Pictures

Drawing-Test Tube In Hand

Gas-1

Ivory-After

Ivory-Before Microwave

Liquid-Half Full

Picture-Test Tube In Hand To Fill

Solid-Full

Student Materials

♦ *Quick* Notes

Teacher *Quick* Notes- "Solids, Liquids, & Gases-Build, See, & Compare"

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1- test tube rack
1- bag of split peas from the grocery store

PowerPoint-"Putting Split Peas In Tube" (optional; located in Resources folder)

Procedure:
1. Pepper students with questions to put them in the right frame of mind. Put in some easy ones to build their confidence, then work your way up.
2. Have students fill test tube #1 with split peas until it's so full that when they stopper it shut and shake it they hear nothing. This is shown on slide 1 in the PowerPoint.
3. Referring to the now-full test tube, talk to the students about how the peas are behaving, then relate that to how solids behave.
4. Read the section from the book on solids.
5. Fill test tube #2 halfway and stopper shut. Talk them through this and compare with liquids. Read the liquids section.
6. Put just 1 pea inside the 3rd test tube and stopper. Discuss of how this one is most like a gas. Read the gas section.