Community in the Classroom Presentation Plan

Lesson Name Air pressure and you
Presenter(s) Peter Combs

Grade Level 5th **Standards Connection(s)** Earth Science: atmosphere, air pressure; Physical Science: Properties of gasses

Teaser:
Your opportunity to tell teachers and kids what's going to be fun and interesting about your visit!

The air around us isn't just empty space. It's filled with a mixture of gasses that are pushing on us all the time. Air takes up space, and the amount it pushes on us depends on the speed its moving. In this fun-filled hour we'll show that this is all true, and think about what air pressure is and does!

Vocabulary/Definitions:
3 – 6 important (new) words

1. *Gas: A state of matter where molecules bounce around freely*
2. *Molecule: The smallest, single particle of a substance that still has the same chemical properties*
3. *Pressure: Force pushing evenly on a surface*
4. *Bernoulli Effect: Moving air has lower pressure on its sides compared to air that's standing still*

Materials:
What will you bring with you?
What should students have ready (pencils, paper, scissors)?

Will Bring: Balloons, dish tub, glasses, index cards, thumbtacks, thread spools, string, tape

Classroom Set-up:
Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed

Chalkboard/whiteboard, water; Need ~5-10 minutes setup time to fill the dish tub with water.

Classroom Visit

1. Personal Introduction: 5 Minutes
Who are you? What do you want to share with students and why? How will you connect this with students' interests and experiences?

I'm Peter, a graduate student in Biophysics at UC Berkeley. When I was your age, I watched TV shows like Bill Nye the Science Guy and Mr. Wizards World. They were all about showing you different ways that you, yourself, could test out scientific ideas, and they did a good job of getting you to understand what's really going on, and that's what got me hooked on science, especially physics.

Once I got into college, I took a biology class that really looked at things as tiny molecules, and that really got me excited about biology. To really understand biology, we need to understand things at the really, *really* microscopic scale. My research is all about trying to understand how just one molecule at a time works.

Topic Introduction: 5 Minutes

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What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge…

One of the first places that we, as scientists, really got to understand the microscopic scale of things was looking at gasses, like Air. Does anyone know what's in air? (78% nitrogen, 21% oxygen, .038% CO2, ~1% water vapor, ~1% other stuff—draw a pie chart, water and other are about as thin as the chalk/marker lines) Is there the same amount of air everywhere? Why do mountain climbers and airplanes need air masks?

2. Learning Experience(s): 30-40 Minutes

What will you do, what will kids do? Demonstrations, hands-on activities, images, games, discussion, writing, measuring… Describe in order, including instructions to kids.

Demonstration 1: Does air weigh anything? Tape two empty balloons to either end of a yard stick, then tape a string to the center of the yard stick so the yard stick balances from the string. Then, while blowing up the balloon, ask the students to predict whether the inflated balloon will be heavier or lighter than the empty one, and say why. Show that the balloon is, now, heavier. Then, use a pin and tape to deflate the balloon, show that it's back to balanced.

Demonstration 2: Does air push on us at all? Fill a glass with water, wetting the rim. Then, put an index card onto the rim, and then quickly turn it upside down. In this demonstration, air pressure is pushing on the card, but only on the side exposed to air. The other side has the weight of the water, which is less than the air pressure (14 psi! Would not work for a column 32 feet long).

In stations:

Activity 1: Can we move air around? In the tub of water, have students fill up one of the glasses underneath the water, then take the other glass, push it down into the water so it stays full of air, then "pour" the air between glasses. Here, water in the first glass is pushed out by the air in the second glass.

Activity 2: Can we change the air pressure in certain places? Give each student a strip of paper, and have them blow. The strip of paper should rise up. Also have two ping-pong balls suspended by string a few inches apart. Blowing between the balls causes them to come together towards each other. Hovering card trick: put a pin through the center of a card, then have the point of the pin go through the center of a spool of thread. Students blowing as hard as they can through the central hole of the spool cannot blow the card off. These three activities demonstrate the Bernoulli effect.

3. Wrap-up: Sharing Experiences 5-10 Minutes

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

Briefly (1-2 minutes) explain about the molecular view of gasses: lots of tiny particles bouncing around at high speed. This is not obvious, and took a long time, historically, to convince ourselves this is true.

(Atomic hypothesis: If, in some cataclysm, all scientific knowledge were to be destroyed, and only one sentence passed on to the next generation of creatures, what statement would contain the most information in the fewest words? I believe it is the *atomic hypothesis* (or atomic *fact*, or whatever you wish to call it) that ***all things are made of atoms — little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another.*** In that one sentence you will see an *enormous* amount of information about the world, if just a little imagination and thinking are applied.)

Ask what people learned today.

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Why don't people feel the air pressure around them? (normally, they're used to it. What about changing altitudes... ever notice your ears pop when flying on an airplane or driving through the mountains? What happens to bags of chips in the mountains?)

Do you think the Bernoulli effect can be used for anything? (Airplanes!)

4. Connections & Close: 5 Minutes

What else might kids relate this to from their real-life experience? How can they learn more? Thanks and good-bye! Clean-up.

Wind and weather depend a lot on air pressure. Drinking straws use air pressure too!

Lots of great simulations online: PHET.colorado.edu

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about _____?"
List or attach examples of activities, websites, connections for additional learning.
Attach worksheets, hand-outs, visuals used in classroom presentation.

Write a letter to me explaining "What I learned about air and pressure."

http://kids.earth.nasa.gov/archive/air_pressure/index.html
http://www.kids-science-experiments.com/cat_pressure.html
http://www.rcn27.dial.pipex.com/cloudsrus/pressure.html
http://phet.colorado.edu/simulations/sims.php?sim=Gas_Properties

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