Study Guide for Teachers

Box of Light

Burble, Fizz, KaBoom!

presented by

Young Audiences New Jersey &
Eastern Pennsylvania
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ABOUT THE PROGRAM

Burble, Fizz, KaBoom! explores molecules, phases of matter (solids, liquids, gases), chemical solutions, and reactions in a series of fun, active demonstrations using volunteers from the audience. Every concept in the show has a physical mnemonic device that helps the audience remember the concept and vocabulary word. It's a fun and informative introduction to science that gets students actively involved—and it doesn't underestimate the value of a good clean mess!

LEARNING GOALS

Students will
• receive a basic introduction to chemistry.
• explore the different phases of matter, including solids, liquids, and gases.
• participate in demonstrations that illustrate phase changes, solutions, and reactions.
• experience the excitement and fun of science.

ARTIST INFORMATION

Burble, Fizz, KaBoom!'s performer, Rand Whipple, is Box of Light's founding director. Whipple has over 30 years of experience performing for school audiences. He has performed in 13 countries on four continents and has been presented numerous times by the Smithsonian's Discover Theater.

BACKGROUND INFORMATION FOR STUDENTS

What Is Chemistry?
If science was a tree, chemistry would be one of the branches. The simplest definition of chemistry is that it's what we do when we mix things together to see what happens. In a more complex definition, chemistry is the study and manipulation of the molecules that make up everything on and in our earth.

Molecules Are Pieces of Everything
Molecules are the smallest piece of something that is still that thing. Molecules are made up of smaller parts called atoms. When mixed together, molecules can remain themselves or change into another material through a chemical reaction. While molecules can exist in different phases (solids, liquids, gases) each molecule remains itself, regardless of the phase.

Solids, Liquids, and Gases
Molecules do not chemically change when they physically change. A molecule has a solid phase (it can break), a liquid phase (it flows), or a gaseous phase (its molecules spread apart until they fill their container.) When molecules get colder, they vibrate more slowly and gather closer together. As they warm, they vibrate faster and spread apart. When we heat up or cool down a material, it can freeze, melt, or evaporate. These are phase changes.

BEFORE THE PROGRAM

1. Have a discussion about what the students are about to see. It's good to discuss theater etiquette and participation etiquette. Make sure to talk about the difference between seeing a live performance and watching a performance by an actor on television or in the movies. Students need to know that they are an important part of the show they are about to see. The performer wants everyone in the audience to be able to hear and enjoy the program, so they need to make sure to give their full attention during the performance and not distract others.

2. Introduce solids, liquids, and gases. Using water as an example, ask the students how the different phases of water (ice, liquid water, vapor) are different. Do they feel different? Do they look different? What has to happen to make water change from one phase to another?

VOCABULARY WORDS

Atom: The basic unit or building block of a molecule.
Chemical reaction: When molecules swap atoms or electrons, they turn into a different molecule. They have undergone a chemical reaction.
Chemical solution: When molecules are mixed in a liquid but stay themselves (in saltwater the salt is still salt, the water is still water), they are said to be in solution.
Chemistry: The branch of science that studies the molecules that make up our world, how they react to one another, and how they combine and change to make new materials.
Dissolve: To break apart in a liquid.
Gas: In their gaseous phase, molecules float away from one another. Gas molecules will expand to fill their container, whether that container is a jar or the atmosphere of the earth.
Hypothesis: Basically, a guess, with a lot of knowledge to back up that guess. An hypothesis is a puzzle that has a piece missing. A scientist devises an experiment to find that missing piece.
Liquid: In their liquid phase, molecules are fluid and will flow. In their liquid phase, molecules will be farther apart than in their solid phase but closer than in their gaseous phase.
Molecule: The smallest part of something that is still that thing. A molecule is made of two or more atoms held together by a chemical bond.
Phases of matter: We experience molecules in one of three phases or states: solids, liquids, or gases. Molecules vibrate faster or slower and move apart or together as they move from phase to phase.
Solid: The coldest phase of matter. A solid can be broken (if you have a hard enough hammer). Molecules are closest together in their solid phase.
Volume: The amount of space a material fills.

AFTER THE PROGRAM

1. Hold a follow-up discussion. This is a good method for the students to process their learning experience. Here are some good questions to start with: What was your favorite part of the performance? Why? Was anything surprising to you? Why? How did the experiments make you feel? Did any of the experiments remind you of anything you've experienced before?

2. Floating paper clip. You can float a paper clip on the surface of a glass of water. It helps if the paper clip is a little greasy so the water doesn't stick to it (rub it on your nose or forehead). Place the paper clip on a fork and lower it slowly into the water. The paper clip is supported by the surface-tension skin of the water.

3. Gas to liquid: Condensation in a bag. Run a small piece of cloth under a tap to make it wet and then squeeze it to remove the excess water. Place the cloth inside a plastic bag. Trap some air inside the bag and seal it with a rubber band. Leave the bag in a warm place, such as on a radiator or in direct sunlight, for one hour.
What happens?
Water droplets form on the inside surface of the bag.
How? Water evaporates from the wet cloth so that the air inside the bag contains lots of water vapor. The inside surface of the bag is cool enough to change the water vapor back into liquid water.
To modify the experiment to make the water droplets form faster, you can make the surface of the bag colder (for example by placing ice cubes next to it). This will make condensation occur faster.

RESOURCES

Activities at the Exploratorium
www.exploratorium.edu/explore/activities

Chem4Kids
www.chem4kids.com

Science for Kids
www.sciencekids.co.nz/chemistry.html

The Franklin Institute Online
www.fi.edu

Crystal Chatterton, *Awesome Science Experiments for Kids.*

Tom Robinson, *The Everything Kids' Science Experiments Book.*