

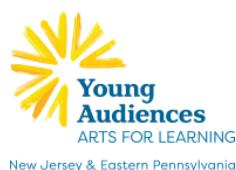
Study Guide for Teachers

Hip Hop Fundamentals *Breaking: The Laws of Physics* Hip Hop Fundamentals

Young Audiences

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ABOUT THE PROGRAM

Dynamic breakdancing and lots of audience interaction introduce students to the concepts of the molecular properties of water in three stages of matter: Solid, Liquid, and Gas.

LEARNING GOALS

Breaking: The Laws of Physics presents some basic facts which can be reinforced in the classroom.

- Physics is the study of Matter and Energy.
- Matter means 'stuff'. The universe is made of matter.
- Energy is the only thing which can change the state of matter.
- States of Matter define how molecules move and interact with each other. Essentially, states of matter define how molecules dance.
- In our 'experiments', the water molecules will always be water molecules. They will move differently in each state, but they will always be H₂O.

Facts about molecular properties can be easily bolstered by classroom activities, mirroring the dances Hip Hop Fundamentals facilitates during the show. In your classroom, students can pretend to be molecules and dance/move according to various energy.

BACKGROUND INFORMATION FOR STUDENTS

Hip-hop is a cultural movement that began among urban youth in New York City, and has since spread around the world. Elements of the hip-hop arts include dance, rap (music, rhythm and poetry), and graffiti art. Hip-hop began in the mid-1970's as inner-city Black and Latino youths began to develop new styles of music, dance, and painting that emerged from their urban environment.

This program uses the high energy of hip hop dance to provide basic knowledge about the three stages of matter: solid, liquid and gas.

VOCABULARY WORDS

PHYSICS	LIQUID
MATTER	GAS
MOLECULE	FREEZE
ENERGY	VAPORIZE
STATE	BOIL
SOLID	CONDENSE
SUBLIMATE	

BEFORE THE PROGRAM

Create as much space as possible in your classroom or activity area.

All of your students are now water molecules, and the dance area is their container.

As a class, you can conduct 'experiments' to see how water molecules behave at various energy levels (various temperatures). Depending on the age of your students, keep the scientific information age appropriate, but still always remain as true as possible to science. Younger students (such as 1st-3rd grades) could simply learn that everything is made of matter, matter is made of molecules, and molecules move faster when heat is added.

Now that your students have become molecules, let's explore how they move!

ARTIST INFORMATION

Hip Hop Fundamentals are a diverse group of professional dancers dedicated to teaching youth empowerment, social issues, and academic content through Breaking/B-Boying, the world's first Hip Hop dance. We firmly believe that youth learn best when they are having fun. Our dynamic and interactive performances and workshops are guaranteed to empower, engage, and educate youth of all ages. Since 2004, the company has performed hundreds of shows across the United States. They were featured in Columbia University's collective 2014 book *Advocating Creatively*, as well as articles in *Dance Studio Magazine*. In October 2013 Hip Hop Fundamentals presented at the TEDx conference in Bermuda, lecturing on the power of creative education and Hip Hop as an educational tool.

AFTER THE PROGRAM

SOLID

As the classroom teacher, you can guide your students through the activity through questions.

What would FROZEN water molecules move like?

Give the group students an opportunity to create their own movement or poses around their first instincts or thoughts. It is important for students to have the opportunity to create without too much instruction at first. For each state of matter, the class can learn the scientific definition of the molecular properties: *Molecular Properties of a solid*

In a solid, the particles can vibrate, but they cannot move from one place to another. Molecules occupy an ordered crystal lattice, vibrating about their equilibrium positions.

Unpacking this definition can then inform how the dance movement can be revised. Of course, you may use your textbook's definitions of states of matter to keep information age appropriate and aligned with your classroom goals.

How would we change the movement given what we now know about the molecular properties of a solid? Are molecules allowed to touch/interact with each other? Are they completely still? Should they be close to each other or far away? Are they grouped together in an organized fashion or randomly? You can also have students assign different musical choices to each state of matter. Should the 'solid' music be slow or fast? Should it have a lot of energy or a little? What could an appropriate song be?

LIQUID

One form of energy is HEAT. If we add energy from the molecules, we can MELT the ice to make liquid water. For each state of matter, allow your students to explore, learn/review the scientific molecular properties, and then revise their dance.

In a liquid, the force of attraction is still strong enough that the particles are held close to each other but they are now free to move.

Molecules condense into a mass of definite volume (but variable shape)...A definition like this may appear to be complicated, but you can lead your students through each sentence to unpack meaning which can inform their dance. How would we dance liquid water, given what we know about its molecular properties? Should molecules be dancing quickly or slowly? Are they all doing the same thing or should they be doing different movements? Do they interact with each other? Do they fill the container? What could the 'liquid' music be? Once your class has established their liquid and solid dances, this opens up the activity to more questions:

How would we change the state of water? What would happen if we cooled the water? What temperature would it have to be for the state of liquid water to change?

GAS

What would happen to the water molecules if we added HEAT energy? Liquid BOILS or VAPORIZES to become a GAS.

So what would a GAS dance look like?

A gas takes up a lot more space (occupies a greater volume) than the boiling liquid it came from. Gaseous state: molecules are far apart and in rapid random motion, occupying full volume of container. In a gas, the particles move fast in random directions. There is no force of attraction between the particles.

You should use scientific terminology in terms of changes in state:

- Liquid FREEZES to Solid
- Liquid VAPORIZES to Gas.
- Gas CONDENSES to Liquid
- Gas DEPOSES to Solid
- Solid MELTS