

Marshmallow Molecules - Atoms & Molecules

Grades 1-3

Description: Students learn the difference between atoms and molecules, practice following directions for a science project, use their creativity to design a molecule, and use writing and computer skills.

Materials: For this experiment you will need: a couple of bags of colored marshmallows (they usually come in four different colors) or colored gumdrops, toothpicks and paper plates.

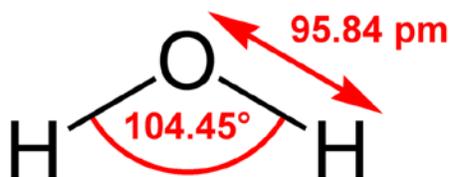
A project the children enjoy is making marshmallow molecules. This activity will help your students understand the difference between an atom and a molecule.

Tell the children that each marshmallow represents an **atom**. Toothpicks are used to join the atoms. When atoms are joined they will form a **molecule**. To begin, each child should receive four different colors of marshmallows: 5 of one color that will represent Hydrogen, 3 of one color that will represent Oxygen, and one each of the third and fourth colors that will represent Carbon and Nitrogen.

Have the children make a water molecule from two hydrogen atoms and one oxygen atom. Make a carbon dioxide molecule from one carbon atom and two oxygen atoms. Make an ammonia molecule from one nitrogen atom and three hydrogen atoms.

Extension: Have your students design a molecule on their own. The children can write a story about the molecule. What is its name? How did they make it? How can it be used? The children can do this on the computer using computer programs such as *Kid Pix* and *Microsoft Works* or the *Fine Artist* and *Creative Writer* programs.

Give the students homework to recreate the molecules at home teaching their parents about molecules and atoms. After they show their parents the marshmallows construction, they should show their parents printouts of their work on the computer. If they have a computer at home they might want to design more molecules on the computer and bring their work back to school. If they don't have a computer or prefer to draw by hand, they should bring their hand drawings to class. Make sure the children label and title their work! They are the molecule inventors!



Marshmallow Molecules - Elements and the Periodic Table

Grades 3-5

Description: Students learn the difference between atoms and molecules, practice following directions for a science project, use their creativity to design a molecule, and use writing and computer skills.

Materials: For this experiment you will need: a couple of bags of colored marshmallows (they usually come in four different colors) or colored gumdrops, toothpicks and paper plates.

If you've got a student in third grade or higher, she can learn to work with the symbols of chemistry. By developing this background knowledge, students can enter a science class with an established handle on the symbols that they're going to be expected to use. It can

also be a boost to the ego to be working on chemistry instead of a remedial subject. Don't worry about atomic weight, number, etc unless and until there's a good reason to do so.

Physical Science often presents the language of chemistry too quickly. Students are expected to instantly assimilate the rules for understanding chemical formulae. Break this process down and use analogies to make the steps comprehensible and even entertaining. Don't move on to the next step until the first process is easy and automatic.

Note that these are "worksheet" style activities. There are wonderful hands-on activities (building molecules with gumdrops and toothpicks, for starters) that help make science *fun* as well as fascinating.

Start with getting to know elements

Spend some time getting familiar with the periodic table. Get to know major elements. People should know that Carbon is an element, that it's in lots of really important molecules as simple as CO_2 ... or in many much bigger molecules that are called "organic." Be sure to clarify the difference between organic chemicals and organic vegetables.

Since your goal is to become familiar with the symbolism and language, you can choose whether or not to include the abstract concept of "elements" as the building blocks of matter.

A typical daily warm-up exercise can be:

What are these elements? Use the periodic table to find their full names.

O B C H

Because we have more than 26 elements, we'd run out of letters. Some elements have to have two letters -- so we use a lower case letter for those extra letters.

What are these elements?

Cl Au Pb Fe

What are elements?

Encourage students to know at least 10 common elements, including at least 3 that are two-letter elements and 3 with common names that don't begin with their element symbol (e.g., Au for gold -- use the mnemonic "Ey! You! Bring the Gold over here!")

Subscripts!

Teach students about subscripts ("sub" means "below" -- and that these little numbers tell you how many of the element just behind it you have.

How many of each atom are in these molecules?

	What element?	How many atoms?
O_2	_____	_____
H_2	_____	_____
O_3	_____	_____
Cl_2	_____	_____

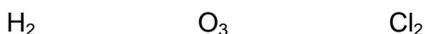
Draw the molecules

Of course, you could build these, too.

Can you draw these molecules? Here's an example:



Try these:



COMPOUNDS

Compounds can be understood through analogies. If you buy a frozen dinner, you get all the parts to the frozen dinner: that slab of chicken, the pile of veggies and the potatoes. If you get the dinner, you get the combination.

Use a car as an analogy for a molecule; for instance, say that you have a Porsche 911 Turbo and ask them how many tires (T), doors (D), and engines (E) they have. Then write on the board:



Ask them if the car would be the same if you changed the number of tires, doors, and engines. Note that if there is no number, then there's one of those things there. (If there weren't any, you wouldn't write it at all.)

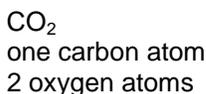
Then state that you can change the number of cars by doing the following:



Have students draw their own analogues -- what would be the formula for a tractor trailer? Could they draw a T₃E?

Apply this system to these compounds.

What elements are in these compounds? How many of each?

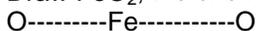


(It's up to you whether you teach students patterns of atom placement in molecules.)

Draw 3CO₂ as three separate CO₂ molecules:



Draw FeO₂, the chemical formula for iron oxide or rust, like this:



Now you draw 3FeO₂ :

Other interesting websites

Periodic Table <http://www.genesismission.org/educate/scimodule/cosmic/ptable.html> (NASA)
Create your own model of the periodic table of elements by reading short descriptions of elements and putting them on the periodic chart yourself, and grouping elements with similar properties. Modules for teaching at either middle school or high school levels are available here with plans for using with or without computers. Teachers guides for a single lesson or an entire module are available online.

<http://www.webelements.com> -- this site by Dr. Mark J. Winter at the University of Sheffield includes a printable periodic table of elements, and a wonderfully coherent and comprehensive database of information about each element; click on it and you're guided to the information. It's Elemental!

<http://education.jlab.org/indexpages/elementgames.html> -- From Jefferson Lab, includes "It's Elemental" - Element Flash Cards. You can limit them to the first 36 elements; you'll be given the symbol and asked for the name (or vice versa). Information about each element is available with a mouse click. There are also concentration games and cloze exercises with reading passages about science topics.

Chemistry Coach <http://www.chemistrycoach.com/home.htm#ChemistryCoach> - Chemistry teacher's comprehensive website. This includes http://www.chemistrycoach.com/periodic_tables.htm#PeriodicTables, with links to over a hundred versions of the periodic table of elements available online.

Mrs. Gibson's Periodic Table Adventure website! <http://web.buddyproject.org/web017/web017/> Mrs. Gibson's Periodic Table Adventure website! This website was created in accordance with the 8th grade chemistry curriculum at Princeton Community Middle School in Princeton, Indiana. This goal of this website is to introduce and explore basic chemistry concepts and to practice these concepts using engaging web-based research and activities. In the culminating activity, students will perform a WebQuest which requires them to research an element using the internet. Once students have researched their elements, students will develop and perform commercials for their elements.

<http://ir.chem.cmu.edu/irproject/applets/pertable/default.asp> has a periodic table java applet where students can click on an element to get its name and information.

[Similar Substances](http://school.discoveryeducation.com/lessonplans/programs/simsubstances/) <http://school.discoveryeducation.com/lessonplans/programs/simsubstances/> this is a good, simple activity in which students explore characteristics and properties of two similar substances (baking soda and cornstarch).

[Elements](http://school.discoveryeducation.com/lessonplans/programs/elements/) - <http://school.discoveryeducation.com/lessonplans/programs/elements/> - this activity outlines getting students familiar with elements, so that they know a little something about chlorine and carbon and neon.

[Marshmallow Molecules](http://henson.austin.apple.com/edres/ellesson/elem-marshmallow.shtml) - <http://henson.austin.apple.com/edres/ellesson/elem-marshmallow.shtml> - a "primary" level activity for building molecules with toothpicks and gumdrops. Hmm... be sure the students know they really *shouldn't* eat ammonia!

[Compound Cooperation](http://www.cctt.org/cctt/lesson/view.asp?LID=597) - <http://www.cctt.org/cctt/lesson/view.asp?LID=597> - several lessons for understanding compounds and molecules.

Vocabulary

Atom – smallest part of an element that still has the characteristics of the element. Atoms are composed of protons, neutrons, and electrons, which do not have characteristics of the element.

Molecules – combinations of 2 or more atoms that are chemically bonded together. A molecule can consist of two or more atoms of the same element (O₂) or of atoms of two or more different elements (H₂O). A molecule is the smallest distinct part of an element or compound.

Elements are a type of atom that is distinguished by the number protons in its nucleus (atomic number). There are 117 elements on the Periodic Table, 25 of them relate to living things. Elements are the building blocks of matter. When two or more elements combine, they form what is called a **compound**.

A **chemical compound** is a type of molecule made up of more than one element that are chemically bonded together. For instance, water (H₂O) is a compound, whereas diatomic hydrogen (H₂) is not. Most of the atoms that make up the Earth's crust and living organisms are in compound form.