

Fun With Atoms and Molecules

4-H Project:
Science

Life Skill:
Acquiring and evaluating
information

National Education Standard:
NS.K-4.2 Physical Science
Properties of Objects and
Materials

Success Indicator:
Describe the basic structure
of atoms and molecules.

Time Involved:
20–30 minutes

Suggested Group Size:
2–30 children

Two hydrogens are walking along a street. The first one says, “Hey! I think I lost an electron!” The second one replies, “Are you sure?” The first one then says, “Yeah, I’m POSITIVE.”

A neutron walks into a restaurant and orders a soda. After finishing the drink the neutron asks the waiter, “How much?” The waiter replies, “For you, no charge.”

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Everything is made of atoms and molecules but they’re too small to see. Chemistry includes understanding the complex nature of atoms and molecules. In this activity, children will easily learn the basic structure of atoms and molecules by “acting out” the parts.

Getting started

First, read the through this lesson and gather necessary materials. If you need more information about the topic, refer to “Background Information” below.

Do the Activity

Part 1 – Making Atoms

Give children the correct number of paper signs needed to “build” the following atoms (see “Background Information” to understand how the atoms are built):

- 1.** Hydrogen: Atomic number = 1, Atomic Weight = 1.00.
 - There is one proton, one electron, no neutrons needed to make this atom.
 - To make an atom of hydrogen, one child holds a Proton sign, while one other child holds an Electron sign and walks in a circle around the Proton. This is how a hydrogen atom is organized.
- 2.** Helium (Atomic number = 2, Atomic Weight = 4.00).
 - There are 2 protons, 2 electrons and 2 neutrons needed to make this atom.
 - They huddle together to form the atom’s nucleus, while another child holds an Electron sign and walks in a circle around the Proton and Neutron. This is how a helium atom is organized.
- 3.** Oxygen (Atomic number = 8, Atomic Weight = 15.99).
 - There are 8 protons, 8 electrons and 8 neutrons needed to make this atom.
 - It will take 24 children to model this atom. If there aren’t enough children, “stand-ins” (such as chairs) could be used to mark the Neutrons or Protons because they don’t move.
 - To make an atom of oxygen, eight (8) children hold Proton signs, while eight (8) other children hold Neutron signs. They huddle together to form the atom’s nucleus.
 - Eight other children hold Electron signs. Put them into four (4) pairs, one pair for each orbit around the nucleus.
 - Each pair of Electrons will be on opposite sides of a circle (so the circle is balanced).
 - The first pair of Electrons orbits around the nucleus, just like in the Helium and Hydrogen atoms.



Materials Needed

- 24 sheets of paper labeled and divided as follows:
 - 8 sheets labeled “Proton (+)”
 - 8 sheets labeled “Neutron (Neutral)”
 - 8 sheets labeled “Electron (-)”
- 3 sheets of paper, labeled separately as follows:
 - O, Oxygen
 - Na, Sodium
 - Cl, Chlorine
- 2 sheets of paper labeled “H, Hydrogen”

- But, Oxygen has another shell with six (6) more electrons, so the next pair of Electrons orbit around the nucleus in a wider circle, beyond the first shell of electrons orbiting the nucleus.
- The third pair of Electrons orbit in a still wider circle, beyond the first two orbits as they walk in a circle around the nucleus.
- The outermost pair of Electrons orbit around all the others. This is how an oxygen atom is organized.
- Oxygen is a much bigger atom than Hydrogen and Helium! But there are others that are much bigger yet!

Talking it Over

Share What You Did:

- How would you describe what everyone was doing?

Process What's Important:

- How did the way an atom was organized look like the planets in our solar system? (Electrons are like planets, which orbit around the sun, in this case the Protons and Neutrons.)
- Discuss: In reality, an atom is so small that it needs to be magnified millions of times using a special "electron microscope" to see one. Planets are so big but far away that they need a telescope to see them well. Another difference is that an atom is actually three dimensional, not two. In other words, the electrons orbit around the nucleus on many levels, not "flat" like a compact disc spins. They form a "cloud" around the nucleus.

Generalize to Your Life:

- What differences are there?

Apply What You Learned:

- What other things in the world are organized in a pattern?

Activity Summary

Everything in the universe is made up of chemicals. All chemicals are formed from atoms and molecules. There are more than 100 known elements. Scientists organize them in a list called the "Periodic Table of the Elements." If you wanted to, you could "model" all the elements the same way!

Part 2 – Making a Molecule

1. Atoms combine to form molecules. For example, water is a molecule made up of two hydrogen atoms and one oxygen atom. That's why it's called H₂O.
2. Because it can get complex to put all the Protons, Neutrons, and Electrons together (children) to act out a molecule, this process can be simplified.
3. Give a sign marked "H, Hydrogen" to two children and a sign marked "O, Oxygen" to one child. Have the three children stand together, with the Oxygen atom forming the base of a "V" shape. This is how a water molecule is organized.
4. As one more example, give a sign marked "Na, Sodium" to one child and a sign marked "Cl, Chlorine" to another. Have them stand together. Ask them if they know what molecule they made. The molecule is Sodium Chloride. Do they know what that is? (It's table salt!)

Background Information

The Atom

An atom, also called an element, is the building block of matter. Each is so small that it can only be seen magnified by about 15 million times using an electron microscope. An atom is arranged like the solar system, with the nucleus like the sun, and electrons orbiting like planets. The nucleus is made up of protons (positively charged) and neutrons (no charge). Electrons (negatively charged) equal the number of protons in the atom.

The atomic number is the number of protons and, therefore, also the number of electrons. It is possible to know the number of neutrons by subtracting the atomic number (of protons) from the atomic weight (rounded to a whole number). Any slight extra weight is from electrons and other subatomic particles that have very little mass.

Electrons rotate around the nucleus in a shell of orbitals, which form an "electron cloud" around the nucleus. Larger atoms have more than one electron "shell." The number of protons and how filled the atom is with electrons in its outermost shell, determines the properties of an element, such as metallic or non-metallic. A combination of atoms is called a molecule. Molecules are how atoms are found in nature, such as two hydrogen atoms combining with one oxygen atom to form H₂O, known as water.

More Challenges



Explore the types of elements in the world, their properties and uses. For example, consider Copper (Cu), Nitrogen (N), Iron (Fe), Uranium (U), Mercury (Hg), Neon (Ne), Calcium (Ca), Gold (Au), Sulfur (S).