STEM IN THE LAB
innovate. explore. discover.

MAKE AN ATOM

Fundamental to physical science is a basic understanding of the atom. Atoms are comprised of protons, neutrons, and electrons. Protons and neutrons are at the center of the atom while electrons live in lobe-shaped clouds outside the nucleus. The number of electrons usually matches the number of protons, yielding a net neutral charge for the atom.
Sometimes an atom has less neutrons or more neutrons than protons. This is called an isotope. If an atom has different numbers of electrons than protons, then it is an ion. If an atom has different numbers of protons, it is a different element all together.
Scientists at Idaho National Laboratory study, create, and use radioactive isotopes like Uranium 234. The 234 means this isotope has an atomic mass of 234 Atomic Mass Units (AMU).

GRADE LEVELS: 3-8

VOCABULARY

Atom – *The basic unit of a chemical element.*

Proton – *A stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron, but of opposite sign.*

Neutron – *A subatomic particle of about the same mass as a proton but without an electric charge, present in all atomic nuclei except those of ordinary hydrogen.*

Electron – *A stable subatomic particle with a charge of negative electricity, found in all atoms and acting as the primary carrier of electricity in solids.*

Orbital – *Each of the actual or potential patterns of electron density that may be formed on an atom or molecule by one or more electrons.*

Ion – *An atom or molecule with a net electric charge due to the loss or gain of one or more electrons.*

Isotope – *Each of two or more forms of the same element that contain equal numbers of protons but different numbers of neutrons in their nuclei, and hence differ in relative atomic mass.*

Atomic Mass – *Approximately equivalent to the number of protons plus the number of neutrons in an atom.*

Atomic Number – *The number of protons in the nucleus of the atom.*

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MATERIALS

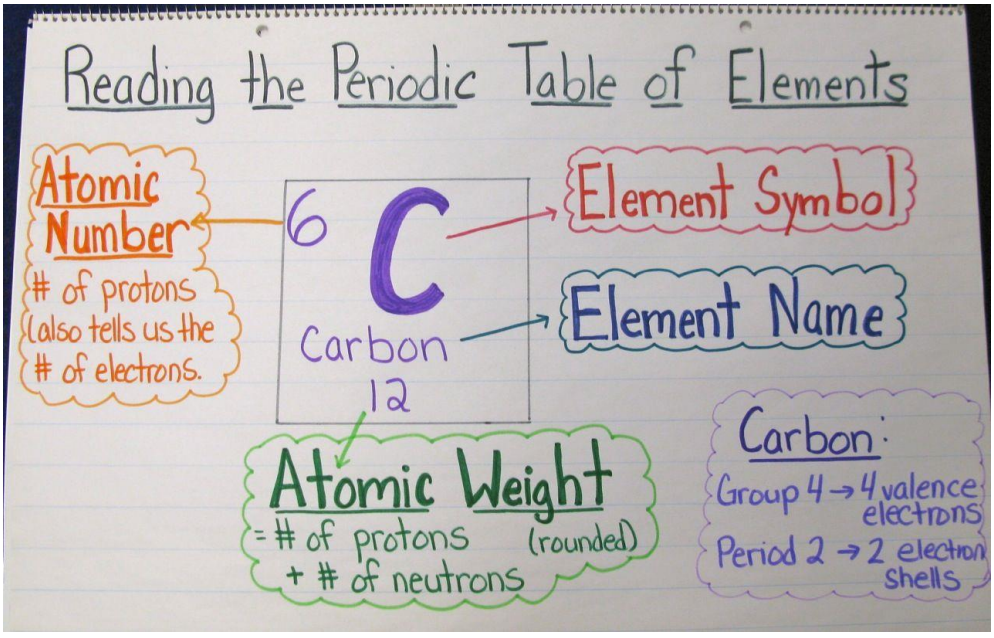
- *Scrap paper*
- *Items to model protons, electrons, and neutrons*
    - *Beans*
    - *Popcorn*
    - *Rice*
    - *Cereal*
- *Glue*
- *Markers*
- *Periodic Table of the Elements*

PROCEDURE

CREATING THE BOHR MODEL OF THE ATOM

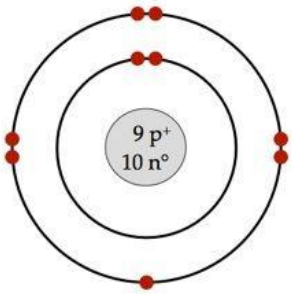
1) *Select an element that you would like to model. It might be best to choose one with a low atomic number to begin with.*
2) *Determine the atomic number of the element. This is the number of protons in the nucleus.*
3) *Determine the number of neutrons. This will be the atomic mass minus the atomic number.*
4) *Determine the number of electrons. This will be equal to the number of protons.*
5) *Determine how many electrons go in each orbital. The first orbital can hold up to two electrons, the second can hold eight, the third can hold 18, and the fourth can hold 32 electrons. You fill the lowest orbitals first and work your way outward.*
6) *Draw the Bohr model of the atom on a sheet of paper big enough that you can glue on all the subatomic particles.*

HOW TO READ THE PERIODIC TABLE



THE SCIENCE BEHIND IT

This is what your Bohr Model for Fluorine might look like.



Fluorine

Of course, you would encourage your students or children to glue on popcorn seeds or beans to model the numbers of protons, neutrons, and electrons.

EXTENSIONS

Why do Elements Bond?

Have your child/students draw the Bohr model for Sodium (Na) and Chlorine (Cl). What do they notice about the outer shells? Some atoms are lacking just one atom to have a complete outer shell. These are called halogens. Some atoms just have one atom in their outer shell. These atoms would like to share that electron. What do you think sodium and chlorine do when they are together? What is NaCl? Can you find some in your house?

RESOURCES

Online interactive periodic table: https://inl.gov/periodic-table/

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