

## Teacher Guide: Element Builder



### Learning Objectives

Students will...

- Compare the sizes, charges, and relative positions of the subatomic particles: protons, neutrons, and electrons.
- Relate an atom's number of protons to its charge, name, and atomic number.
- Calculate the mass number of an atom by summing the protons and neutrons.
- Understand the definition of isotope.
- Observe how electrons fill the first three energy levels.
- Create an electron dot diagram for each of the first 20 elements.



### Vocabulary

atom, atomic number, electron, electron dot diagram, element, energy level, ion, isotope, mass number, neutron, nucleus, periodic table, proton, radioactive, valence electrons

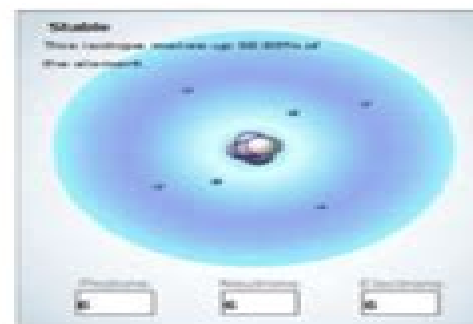


### Lesson Overview

The *Element Builder Gizmo™* allows students to construct atoms by adding protons, neutrons, and electrons. As they add particles, students can see the atomic number, mass number, charge, and electron dot diagram of the element.

The Student Exploration sheet contains two activities and an Extension:

- **Activity A** – Students determine the mass number and atomic number of an atom.
- **Activity B** – Students observe electron arrangements and create electron dot diagrams.
- **Extension** – Students see how valence electrons relate to the periodic table of elements.



Model of a carbon atom



### Suggested Lesson Sequence

#### 1. Pre-Gizmo activity

(📅 1 – 2 weeks)

Atoms are too tiny to see, yet much about their structure had been deduced by the early part of the twentieth century. The development of atomic theory is one of the central narratives of physics and well worth learning more about.

Divide the class into groups and assign to each group one of the critical scientists involved in atomic theory. These could include Democritus, John Dalton, Dmitri Mendeleev, J.J. Thomson, Robert Millikan, Ernest Rutherford, Marie Curie, James Chadwick, Niels Bohr, Enrico Fermi, and others (see **Selected Web Resources**).

After researching their scientist via the Internet, students can present their findings with posters, atom models, and even reenactments of famous experiments.

# Element Builder Guide

**A Gutmann**



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