

Build an Atom

Learning Objectives: Students will be able to

1. Make atom models that show stable atoms or ions.
2. Use information about the number of protons, neutrons, and electrons to
 - Identify an element and its position on the periodic table
 - Draw models of atoms
 - Determine if the model is for a neutral atom or an ion.
3. Predict how addition or subtraction of a proton, neutron, or electron will change the element, the charge, and the mass of their atom or ion.
4. Define proton, neutron, electron, atom, and ion.

Directions:

1. Explore the *Build an Atom* simulation with your partner.

See what you can do and what happens. Talk about what you find with your partner.

Build an Atom Simulation

The simulation interface includes the following components:

- Atom Model:** A central red 'x' representing the nucleus, surrounded by two concentric dashed circles representing electron shells.
- Particle Sources:** Three bowls at the bottom: a red bowl for Protons, a grey bowl for Neutrons, and a blue bowl for Electrons.
- Element Selection:** A periodic table under the heading "Element" with a red minus sign in the top right corner.
- Attributes:** Three input fields on the right: "Symbol" (with a green plus sign), "Mass" (with a green plus sign), and "Charge" (with a green plus sign).
- Model Options:** A "Model:" section with two radio buttons: "orbits" (selected) and "cloud".
- Controls:** A "Show Labels" checkbox and a "Reset All" button at the bottom right.
- Statistics:** A box in the top left corner with labels for "electrons:", "protons:", and "neutrons:".

2. Using **Build an Atom**, talk with your partner as you play with the parts of atoms to find ...

A. What parts go in the center of the atom? _____

B. You can call the center of the atom, the **nucleus**. Most atoms in our environment have a **stable** nucleus.

Play around, and write down three examples of atoms that create a **stable nucleus** and include a drawing of your nucleus.

	What is in your nucleus?	Draw your nucleus	What <u>Element</u> is it?
Your 1 st example			
Your 2 nd example			
Your 3 rd example			

C. Everything around us is made up of different elements. The air has Oxygen and Nitrogen. Plants and people have lots of Carbon. Helium is in balloons. Hydrogen is in water.

Play until you discover a rule for what determines the name of the **element** you build. What did you find determines the element?

Test your idea by identifying the element for the 3 cases. **Circle** the information you use to determine the element. Do you need all of the information given?

	Atom or Ion has ..	What <u>Element</u> is it?	Circle where it is on the periodic table?
1 st example	# of protons: 6 # of neutrons: 6 # of electrons: 6		
2 nd example	# of protons: 7 # of neutrons: 7 # of electrons: 6		
3 rd example	# of protons: 6 # of neutrons: 7 # of electrons: 7		

3. Play until you discover some good rules about the **charge** of your atom or ion.

What is a rule for making

1) An atom with 0 extra charge? You can call this a “neutral atom”:

2) A “positive ion” (+ ion) with extra positive charge?

3) A “negative ion” (- ion) with extra negative charge?

What in the sim helped you decide if the atom had a positive, negative, or 0 charge?

Explain how you used it:

Write down three examples of atoms or ions (1 neutral with 0 extra charge, 1 with a positive charge, and 1 with a negative charge) that show your rules work and include a drawing of your atom.

(All of your examples should also have a stable nucleus.)

	What is in your atom or ions?	Draw your atom or ion	What is the charge?	Is it a neutral atom, positive ion, or negative ion?
Your 1 st example	# of protons: # of neutrons: # of electrons:			
Your 2 nd example	# of protons: # of neutrons: # of electrons:			
Your 3 rd example	# of protons: # of neutrons: # of electrons:			

4. Play until you discover some good rules about the **mass** of your atom or ion.

Which particles are heavy and which are light?

What is a rule for determining the mass?

5. Using all of your rules, figure out what changes for each of these changes to an atom or ion. You can test your ideas with the simulation. If you have new ideas, rewrite your rules.

Type of Change	What else will this change? (Write YES or NO)
<u>Add a proton</u>	The element? ____ If so, how does it change? _____ The position on the periodic table? ____ If so, how does it change? _____ The charge? ____ If so, how does it change? _____ The mass? ____ If so, how does it change? _____
<u>Take away a neutron</u>	The element? ____ If so, how does it change? _____ The position on the periodic table? ____ If so, how does it change? _____ The charge? ____ If so, how does it change? _____ The mass? ____ If so, how does it change? _____
<u>Take away an electron</u>	The element? ____ If so, how does it change? _____ The position on the periodic table? ____ If so, how does it change? _____ The charge? ____ If so, how does it change? _____ The mass? ____ If so, how does it change? _____
<u>Add an electron</u>	The element? ____ If so, how does it change? _____ The position on the periodic table? ____ If so, how does it change? _____ The charge? ____ If so, how does it change? _____ The mass? ____ If so, how does it change? _____

6. Design challenges:

Design a positive ion with a charge of +2:

of protons:
 # of neutrons:
 # of electrons:

What element is your ion? _____
 What mass is your ion? _____
 Is the nucleus of your ion stable or unstable? _____

Design a neutral, stable atom with a mass of 7:

of protons:
 # of neutrons:
 # of electrons:

What element is your atom? _____
 What is the charge of you atom? _____

7. **Group Discussion.** Create definitions for the words that list their important aspects and functions. Use evidence from the simulation to support your definitions: proton, neutron, electron, atom, ion, charge, neutral, mass, and element.