PhET Tips for Teachers

# Build an Atom

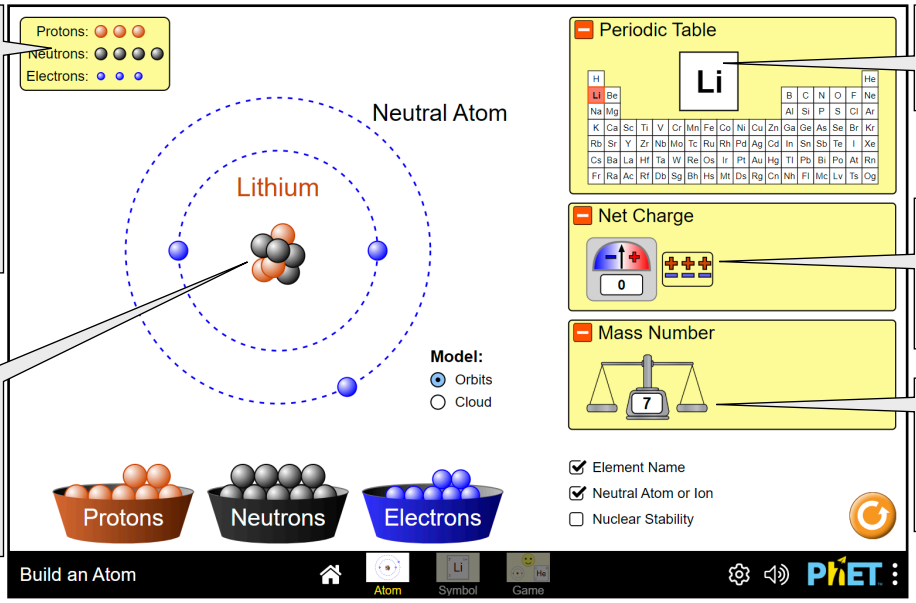
The ***Build an Atom*** simulation allows students to flexibly explore how changing the number of protons, neutrons, and electrons influences the element, charge, and mass of the atom built.

## Atom Screen

Build atoms and determine how the identity, net charge, and mass of an atom or ion is determined.

**TRACK** the number of the protons, neutrons, and electrons in your atom

**BUILD** an atom using protons, neutrons, and electrons




**IDENTIFY** the element

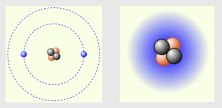
**CALCULATE** the net charge on the atom/ ion

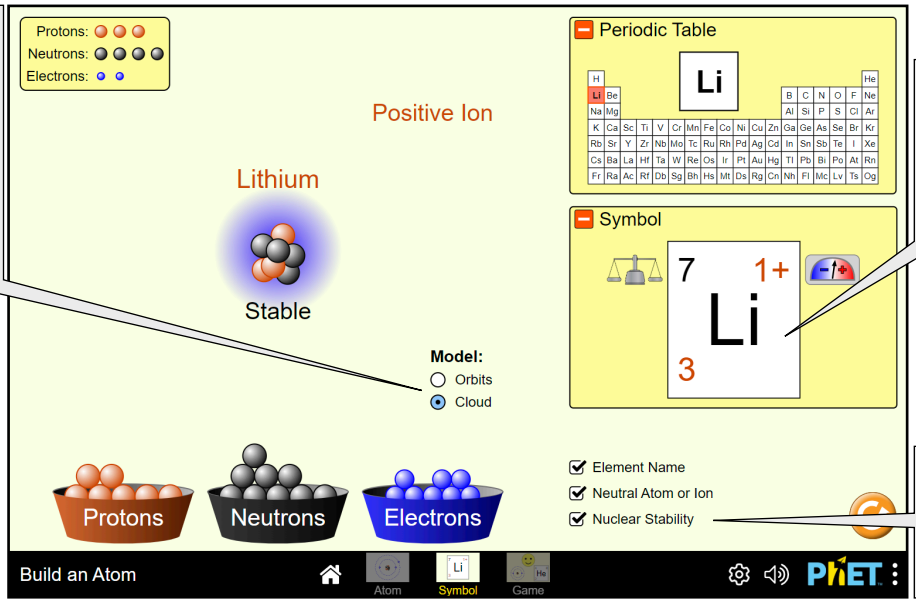
**DETERMINE** the mass of the atom/ion

## Symbol Screen

Interpret atomic symbols by building atoms using protons, neutrons and electrons.

**SHOW** electron cloud model of atom/ion.






**INVESTIGATE** information provided by atomic symbols

**DETERMINE** the stability of atom/ ion created.

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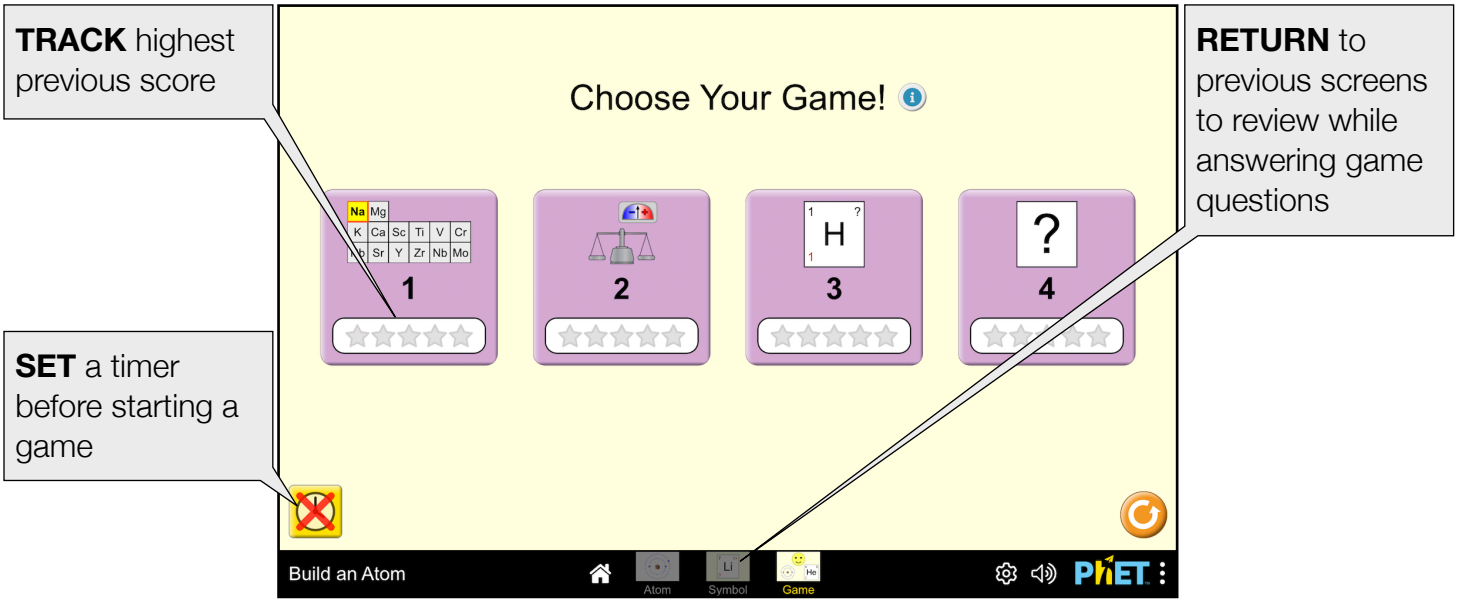
## Game Screen

Students are presented with 5 challenge questions in each game.
**Game 1 –** Identify elements based on subatomic particles
**Game 2 –** Calculate the mass number or charge of an atom or ion
**Game 3** – Fill in missing atomic symbol information
**Game 4** – Mixed review




## Suggestions for Use

### Sample Challenge Prompts

- Write a mathematical equation to show how the mass number of an atom is calculated.
- Describe the location of protons, neutrons, and electrons in an atom.
- Write a mathematical expression to explain how to calculate the net charge of an atom/ion.
- Explain how to use an atomic symbol to determine the number of protons, neutrons, and electrons in an atom/ion.

## Model Simplifications

- Although the title of the sim is “Build an Atom”, students can build both neutral atoms and ions.
- The nucleus is magnified to allow students to see the number of protons and neutrons.
- The radii of the orbits in the Bohr model are not in the correct ratio.
- In the “Cloud” model, the shape of the cloud is not meant to represent orbitals and the size of the cloud does not represent actual atomic or ionic radii. The cloud simply gets larger and darker as the number of electrons in the cloud increases.
- We define “Stable” as an isotope whose half-life is too long to be measured. The nucleus of an “Unstable” atom vibrates but does not fall apart.
- Students can create ions that are not found in nature (for example, $He^{+2}$). Students can still reach suggested learning goals related to net charge on ions even if not all ions they create exist in nature.
- Excited states are not allowed in the sim. In the Bohr model, if a core electron is removed, an outer electron will move to the inner shell. The sim does not show the subsequent release of a photon due to this electron movement.

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- The Symbol representation uses the standard isotope notation with the mass number on the top and the atomic number on the bottom. This may differ from how the data is displayed in some periodic tables (atomic number at the top). Students who are unfamiliar with the isotope notation may require additional scaffolding.

## Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '`?`' to the sim URL, and separating each query parameter with a '`&`'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

For example, in Build an Atom, if you only want to include the 1st and 2nd screens (`screens=1,2`), with the 2nd screen open by default (`initialScreen=2`) use:
https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_all.html?screens=1,2&initialScreen=2

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_all.html?locale=es&screens=1,2&initialScreen=2

⚙ Indicates this customization can be accessed from the Preferences menu within the simulation.

| Query Parameter and Description | Example Links |
|---|---|
| `gameLevels` - specifies which levels appear in the game. | `gameLevels=2,3` |
| `screens` - specifies which screens are included in the sim and their order. Each screen should be separated by a comma. For more information, visit the Help Center. | `screens=1`<br>`screens=2,1` |
| `initialScreen` - opens the sim directly to the specified screen, bypassing the home screen. | `initialScreen=1`<br>`initialScreen=3` |
| ⚙`locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html". | `locale=es` (Spanish)<br>`locale=fr` (French) |
| `audio` - if muted, audio is muted by default. If disabled, all audio is permanently turned off. | `audio=muted`<br>`audio=disabled` |
| `allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`. | `allowLinks=false` |
| `supportsPanAndZoom` - when `false`, disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is `true`. | `supportsPanAndZoom=false` |

See all published activities for Build an Atom here.
For more tips on using PhET sims with your students, see Tips for Using PhET.
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