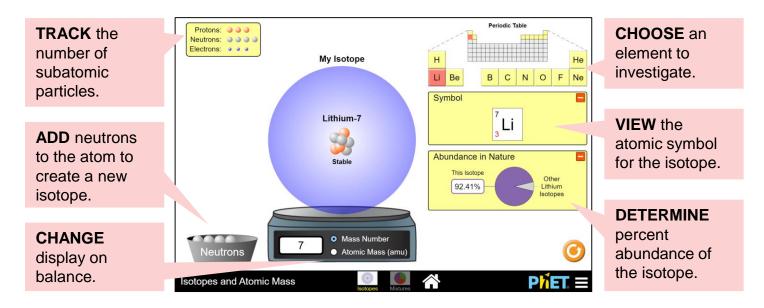


# **Isotopes and Atomic Mass**

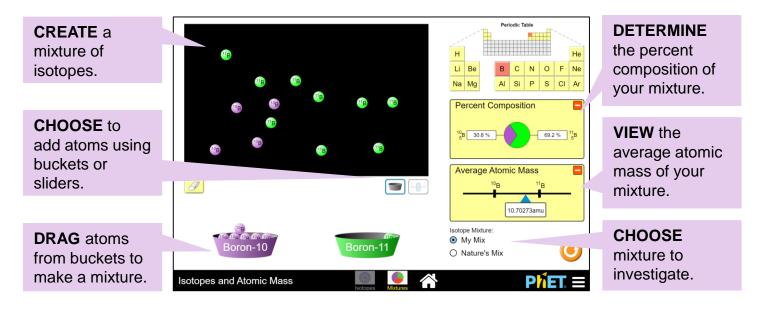
#### **Isotopes Screen**

Students build isotopes and investigate the atomic mass, mass number, and relative abundance of the isotope.



#### **Mixtures Screen**

Students create mixtures of using stable isotopes of the selected element, investigate how average atomic mass is calculated, and compare their mixtures to a view of an actual mixture of isotopes.



## **Insights into Student Use**

- In college interviews, students wanted to select other common elements such as gold; investigation into other elements could be incorporated as part of an activity.
- On the Mixtures screen, students attempted to match Nature's Mix using My Mix view. This is not possible for all elements shown in the simulation.
- Students who need additional practice in interpreting atomic symbols, calculating mass number, or identifying the number of protons, neutrons, and electrons can investigate these concepts using the *Build an Atom* simulation.

## **Model Simplifications**

- If you make an isotope that is not listed as stable in the NIST table, the nucleus shakes and the word "Unstable" appears under the nucleus.
- The atomic mass is relative to <sup>12</sup>C, which has an atomic mass of 12 amu by definition. The atomic mass is shown only for stable isotopes, with the exception of <sup>3</sup>H and <sup>14</sup>C.
- The Mixtures screen shows only stable isotopes of a given element. Students can use these stable isotopes to investigate the relationship between percent abundance and average atomic mass of an element.
- In the Mixtures screen, the average atomic mass and percent abundance of each isotope are calculated based on the isotopes placed on the black screen using the buckets or sliders.
- In the Mixtures screen, Nature's Mix is not always shown as the exact ratio for some elements (for example, the exact ratio for helium would take 1 <sup>3</sup>He isotope and 999,999 <sup>4</sup>He isotopes).
- While the size of different atoms is not a main learning goal, the sim shows the relative electron cloud size for each element.

## **Suggestions for Use**

#### Middle School

- What is an isotope? Be sure to include the following key terms in your explanation: mass number, protons, neutrons, electrons, element, atom.
- What particles determine the mass number of an atom? Why is the mass number always a whole number?
- Using the Mixtures screen, create a mixture of isotopes of boron that match the average atomic mass on the periodic table (10.811 amu). Which isotope is more abundant: boron-10 or boron-11?

### **High School**

- Calculate the mass number and write the name and atomic symbol for these isotopes of hydrogen: protium (0 neutrons), deuterium (1 neutron), and tritium (2 neutrons).
- Your friend claims, "The chance of finding a specific isotope of an element is the same for all isotopes of that element". Explain if you agree or disagree with your friend using evidence from the simulation.
- Explain the relationship between isotope stability and percent abundance. Are unstable isotopes very abundant? Why or why not?
- Write a mathematical expression to show how the average atomic mass of an element is calculated.
- Identify relationships between the number of neutrons in an atom and the stability of the atom. Why might an atom be stable or unstable?
- Two stable isotopes of bromine exist in nature, bromine-79 and bromine-81, and the average atomic mass of bromine is 79.901. Predict the percent abundance of each isotope of bromine.