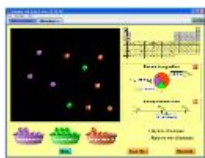


Atoms & Isotopes PhET Lab



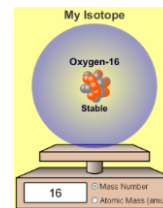
Isotopes and Atomic Mass

Procedure : PhET → Play with the Sims → Chemistry → Isotopes and Atomic Mass

Run Now!

Take some time and play with the simulation. Imagine you are manipulating atoms! EXCITING! Then answer the questions below.

Be sure to activate **Symbol** and **Abundance in Nature**



Questions: (Use the Make Isotopes Tab for this part)

1. Click on Boron. Draw the symbol of the most abundant isotope of Boron in the box to the right

a. # of protons: _____ b. # of neutrons: _____ c. # of electrons _____

2. By adding and removing neutrons, find the second most abundant isotope of Boron in nature.

a. # of protons: _____ b. # of neutrons: _____ c. # of electrons _____

3. How many stable isotopes does Neon have? Draw the symbol notation for each stable isotope in the boxes below. (hint: you might not need all of the boxes)

4. Click on the Beryllium atom. How many stable isotopes does it have? _____

5. What happens if you add a neutron to Beryllium? _____

6. What do you think happens to an unstable to an unstable isotope? _____

7. Complete the table below. Use the simulation to help you

Isotope Name	Atomic Number	# of Protons	# of Neutrons	Mass Number	Stable? (Y/N)	Symbol notation
Helium-3						
Helium-5	2			5		
Oxygen-16						
		8	10	18		
		10		20		
Neon-23						

8. An isotope is an atom of the _____ element that has a _____ number of neutrons.

Isotopes and Atomic Mass

1. To begin, select the Make Isotopes tab and expand the Symbol and Abundance in Nature menus.

The simulation interface shows the following details:

- Protons:** 1 (red dot)
- Neutrons:** 0 (blue dots)
- Electrons:** 1 (blue dot)
- My Isotope:** Hydrogen-1, Stable
- Balance Scale:** 1 Neutrons, Mass Number: 1, Atomic Mass (amu): 1
- Symbol:** ${}^1_1\text{H}$
- Abundance in Nature:** This Isotope: 99.9885%, Other Hydrogen Isotopes: 0.0115%
- Reset All** button

2. Add neutrons to the hydrogen isotope. How does adding neutrons affect the isotope symbol?

3. As neutrons are added, comment on the stability of the isotope.

4. How does the stability of an isotope relate to its abundance in nature? Why might this be the case?

5. Play around with the sim until you are comfortable with the relationship between neutrons, mass number, symbol, and abundance in nature. You can select a new element by using the periodic table at the top right. Write at least three conclusions from your exploration.

6. Complete the following table. This information will be important later.

Isotope	Symbol	Abundance in Nature	Mass Number	Atomic Mass (amu)
Hydrogen -1 <i>Protium</i>				
Hydrogen -2 <i>Deuterium</i>				
Hydrogen -3 <i>Tritium</i>				

7. Next, select the Mix Isotopes tab and make sure your screen looks like this before proceeding.

8. Drag hydrogen isotopes (purple and green atoms) into the black box. Notice how the percent composition and average atomic mass data changes. As you add more atoms to the box, record at least three different observations. You may add as many of each isotope (color) as you like.

9. After completing Step 8, Reset All. In order to discover the relationship between percent composition and average atomic mass, it is helpful to be more systematic when choosing the number of atoms in the simulation. Complete the following table by adding purple and green atoms to the black box. In order to add larger amounts, Click “More” and use the slider bar or numerically enter data.

# of atoms Hydrogen-1 Purple	# of atoms Hydrogen-2 Green	% Hydrogen-1 Purple	% Hydrogen-2 Green	Average Atomic Mass (amu)
1	1			
5	5			
5	10			
10	5			
1	10			
10	1			
20	1			
50	1			

10. The **average atomic mass** for hydrogen is listed as 1.007 amu on the periodic table. Predict the combination of purple and green atoms required to achieve this mass.

11. Check your prediction by clicking on “Nature’s mix of isotopes”.

12. Carbon has an average atomic mass of 12.011 amu (as given on the periodic table). Which isotope of carbon do you think is most abundant: carbon-12 or carbon-13? Explain your answer. Check your response by using the sim to select carbon and clicking on “Nature’s mix of isotopes”.

13. Boron has an average atomic mass of 10.81 amu (as given on the periodic table). Which isotope of boron do you think is most abundant: boron-10 or boron-11? Explain your answer. Check your response by using the sim to select boron and clicking on “Nature’s mix of isotopes”.

14. Define the term **average atomic mass** using your own words.

Homework DUE next class Period

READ pp. 63-66 and DO exercises on p. 66 (#1-4 and 7)