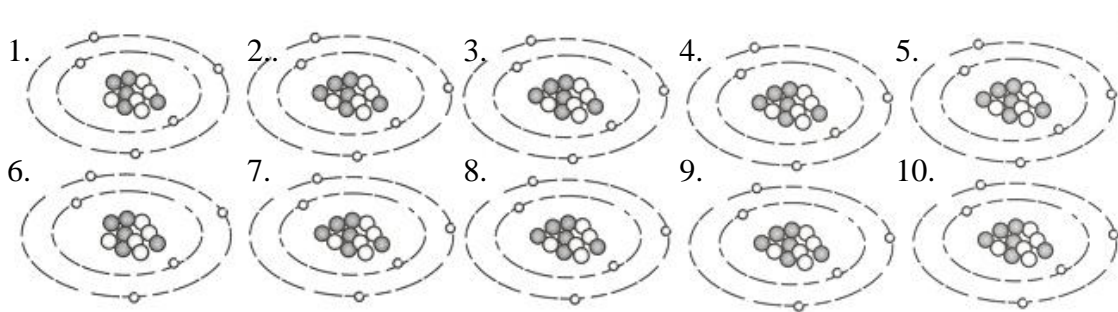


## Isotopes

**Purpose:** In this lesson you will investigate isotopes and how they affect atomic mass. A proton weighs 1.0 amu (atomic mass units) and a neutron weighs 1.0 amu (atomic mass units).

**Complete the following:**

Let's say you were able to isolate ten atoms of the element **boron**. Below is a drawing representing the structures of the different boron atoms you would find. (**Note** that the size of the nucleus has been hugely exaggerated in these drawings so that you can count the protons and neutrons.)



1.

boron atom	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10
# protons										
# neutrons										
# electrons										

2. How many different isotopes (versions) of boron are above? How are they different?

3. How many of each type of isotope are present in the sample of ten atoms?

4. What is the atomic mass of each type of isotope? How did you arrive at your answer?

5. a) Calculate the average atomic mass of the ten boron atoms above. Show your work!

b) How does your answer compare to the atomic mass of boron listed in the periodic table?

6. Imagine you were able to examine 100 atoms of boron (vs. just the 10 above).

a) What isotopes (versions) would you expect to find?

b) How many atoms of each type would you expect to find in a sample of 100 atoms?

c) Express your answer in percentages.

7. Fill in the following table. Look carefully at the atomic mass in order to estimate the number of neutrons in each case. You will need your periodic table.

Element	Chemical Symbol	Atomic Number	Avg. Atomic Mass	# of protons	# of electrons	# of neutrons
Lithium			6.94			___ or ___
Vanadium	V	23				___ or ___
Argon	Ar		39.9			18, 20, or 22

8. Looking above at #7, how many isotopes (versions) does argon have? How do they differ?
9. Which isotope (version) of argon is most commonly found? Explain your reasoning.
10. If you somehow managed to have a single atom of lithium isolated, how many neutrons will it *probably* have in its nucleus? Explain.
11. Explain why the atomic masses listed in the periodic table are not usually whole numbers.
12. Identify all the numbers in the following methods of distinguishing isotopes:  
Hyphen notation                      Nuclear Notation  
 Oxygen - 17                               $^{17}_{8}O$
13. Which of the subatomic particles (protons, neutrons, or electrons) ALWAYS identifies an element, and thus can NEVER change for that element?

14.

Hyphen Notation	Atomic #	Average Atomic mass	Mass #	# of Protons	# of Electrons	# of Neutrons	Nuclear Notation
Example Hydrogen-1	1	1.01	1	1	1	0	$^1_1H$
Hydrogen-2							
_____ - ____							$^3_1H$
Fluorine-19							
Argon-__			40				
_____ - ____				18		20	
_____ - ____							$^{36}_{18}Ar$

