...going one step further

BRIGHT of Sweden

W19900/W19901

Atomic Structure

Objective:

Develop a visual conceptualization of atomic structure based on theory and knowledge of fundamental particles.

a. Identify the three fundamental particles of an atom when given the charge, mass, atomic number, and location of the particle.

b. Determine the number of protons, electrons, or neutrons in an element when given the atomic number and the atomic mass of the element.

c. Identify isotopes of an element.

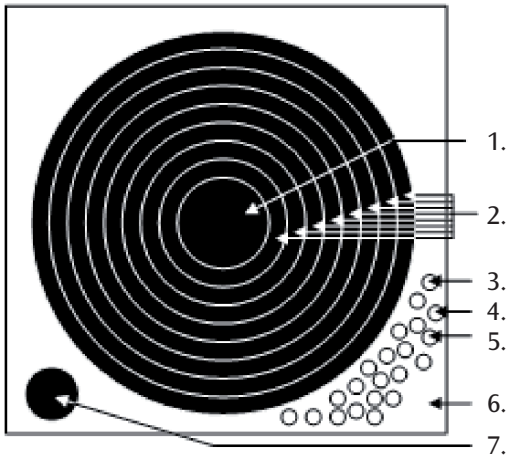
d. Draw the electron-dot (Lewis) structure of elements.

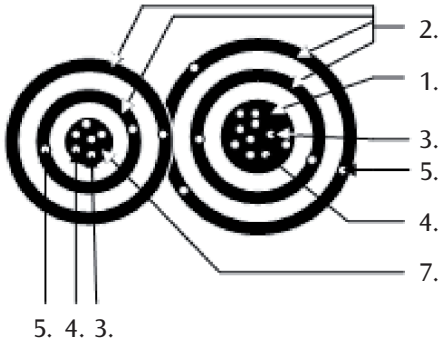
Materials: BRIGHT Teacher Atom, BRIGHT Atom, periodic table, activity sheet

Teacher Atom:
With Teacher Atom you get 2 atomic nucleuses of different sizes, 8 electron shells and protons, electrons and neutrons. All parts can be used separately.

Place an atomic nucleus and at the whiteboard and an optional number of electron shells outside of it. Use every other electron shell from the board to each nucleus (2, 4, 6 and 8 to the larger nucleus; 1, 3, 5 and 7 to the smaller nucleus). Place elementary particles in the right positions; protons and neutrons in the atomic nucleus and electrons at the electron shells. To present ions, place both atomic nucleuses with electron shells at the whiteboard, next to each other, and place the elementary particles at the electron shells. The electrons can be moved from one atom to the other by hand.

All parts of the Teacher Atom are magnetic, and can easily be moved at the surface.





Description:

1. Atomic nucleus, larger
2. 8 electron shells
3. Protons
4. Neutrons
5. Electrons
6. Storage board
7. Atomic nucleus, smaller

Procedure:
Present the concepts to class using the Teacher Atom. Place the BRIGHT Atom before you and group protons, neutrons, and electrons together on a flat surface.

Activities:

1. **Fill in the following chart for each subatomic particle:**

	charge	mass	location
proton			
electron			
neutron			

2. **Define <u>atomic number</u>.**

3. **Define <u>atomic mass</u>.**

4. **Using the BRIGHT Atom, place 8 protons and 8 neutrons in the nucleus. How many electrons will be present in this atom? _____ Place the electrons in the proper orbital. How many electrons will be in the first orbital?____ How many electrons will be in the second orbital?____ In the space below, draw the electron dot diagram of this atom.**

   Identify this atom using the periodic table:_____

5. **Assemble the following atoms using the model and draw the electron dot diagram for each:**

	#protons	#neutrons	#electrons	Atomic number	Atomic mass	diagram
hydrogen						
calcium						
boron						
helium						
nitrogen						
iron						
carbon						

6. Given the information below, construct each atom using the BRIGHT atom model and then identify the atom using the periodic table.

name	#protons	#neutrons	#electrons	Atomic number	Atomic mass
	12	12			
			9		18
				5	
	13	13			
potassium					
				18	
neon					

7. Atoms of the same element that have different masses are called <u>isotopes</u>. Using the BRIGHT Atom, construct carbon-12. How many neutrons does this atom have in its nucleus?___ Now, using the model, make the necessary adjustments to show carbon-14. How many neutrons does this atom have in its nucleus? ___

8. Atoms in which the number of electrons does not equal the number of protons are called <u>ions</u>. Using the model, construct the cation Na+. How does it differ from Na and Na++?

Does the atomic number change?
Does the atomic mass change?
Which of the three would be most reactive?

9. Define <u>covalent bond</u>:

10. Define <u>ionic bond</u>:

11. Using the models, make the following compounds and tell if the bonds between them are <u>covalent</u> or <u>ionic</u>:

	Bond	diagram
NaCl		
HCl		

12. Carbon is one of the most common elements found in nature. construct this atom with the model. Explain why it is so readily reactive in living systems. (hint: How many electrons are in its outer shell?)

How many electrons can it accommodate in the outer shell?

Explain how this model illustrates the <u>Octet Rule</u>.