

Experiment 1

Atoms and the Periodic Table

You will need The Introduction to Chemistry Model Set.

Things To Know:

All matter is composed of elements. An element is a pure substance made of only one type of atom. Atoms of each element have a certain number of protons, electrons and neutrons. For example, carbon has six protons and six neutrons in the nucleus and six electrons moving outside the nucleus. Atoms can combine to form molecules as simple as water or as complex as DNA.

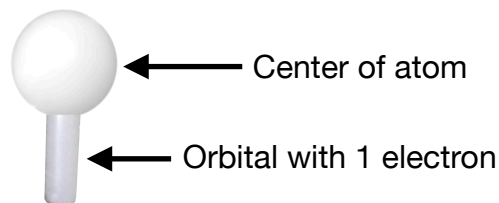
All elements are arranged in rows and columns on the periodic table as shown in Figure 1. Let's learn about elements 1-10 on the periodic table. The first element in the periodic table is hydrogen with the symbol H. Hydrogen has atomic number 1. The hydrogen atom has one proton in the nucleus and one electron outside the nucleus in 1s orbital

Figure 1: The Periodic Table

Group Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	* 71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	* 103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
			* 57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
			* 89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No		

of the first energy level. The proton has a charge of +1 and the electron's charge is -1. The sum of the charges is zero and the hydrogen atom is neutral. The model for hydrogen is shown in Figure 2.

Figure 2: The Hydrogen Model



The first energy level is full when it contains 2 electrons. The hydrogen atom will lose, gain, or share an electron to fill the first energy level. Hydrogen is a colorless gas. Hydrogen and the other elements in the first column of the periodic table are very reactive.

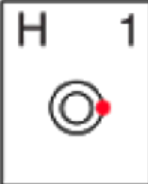
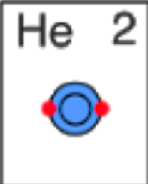

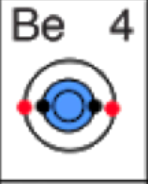
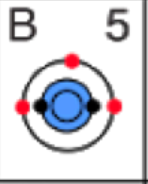
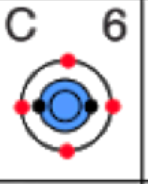
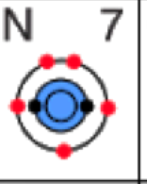
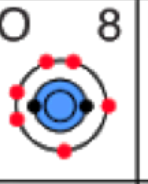
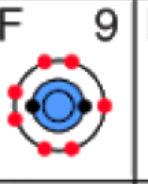
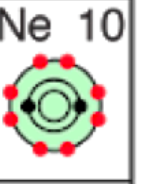
Helium, He, has atomic number 2 with two protons in the nucleus. The helium atom has two electrons in the first energy level. Helium and the other elements in the last column of the periodic table are non-reactive and are called noble gases. Because the noble gases are non-reactive, there are no models for them in the Introductory Chemistry Model Set.

The first element in the second row of the periodic table is lithium, Li. The lithium atom has two electrons in the first energy level and one electron in the second energy level. All elements in the second row of the periodic table have electrons in the first two energy levels. The outermost energy level is called the valence level. The reactivity of any element is determined by the number of unpaired valence electrons. Lithium is very reactive metal because it donates its outer electron to join with nonmetal atoms. The sphere of the model represents the atomic core. The atomic core is all of the atom except the valence electron. The pole represents the valence electron.

What To Do:

1. Using Figure 3, study the atom diagrams for each of the elements in the first two rows of the periodic table. The red dots in the atom diagrams represent valence electrons.
2. Record the symbol of the element and the number of **unpaired** valence electrons in Activity Table 1. For example, nitrogen has five valence electrons. Two of the electrons are in a pair and three of the electrons are unpaired.
3. Using the Introduction to Chemistry Model Set, examine the atom models to determine the relationship between the number of unpaired valence electrons and the number of poles on the atom models. Complete Activity Table 1 by recording the number of poles on each atom model.
4. Look at the pictures of the elements to learn about the physical characteristics of each element.

Figure 3: Atoms, Elements and the Periodic Table

	1A	2A	3A	4A	5A	6A	7A	8A
n	H 1							He 2
1								
2	Li 3	Be 4	B 5	C 6	N 7	O 8	F 9	Ne 10
								

Lithium
(battery)



Beryllium
(parts for airplanes)



Boron
(soap)



**Carbon
(diamond and graphite)**



Nitrogen, Oxygen and Fluorine (gases)



Activity Table 1: Atoms

Atom	Symbol	Number of Unpaired Valence Electrons	Number of Poles on Atom Model	Color of Atom Model
Lithium		1		Silver
Beryllium				Green
Boron	B		3	Black
Carbon			4	Black
Nitrogen		3		Blue
Oxygen				Red
Fluorine			1	Yellow

Discussion Questions for Experiment 1

1. What is an atom?
2. What are the different parts of an atom?
3. Where are the parts of the atom located?
4. What is an element?
5. How are the elements in the same row of the periodic table alike?
6. How are the elements in the same column of the periodic table alike?
7. How can you use the periodic table to predict reactivity?
8. What are noble gases? Name _____