

## Periods and Groups; Valence Electrons; Masses

### Periods and Groups

Elements that have the same number of outermost electrons have similar properties, so we put them in *groups*. On the periodic table groups = columns (up and down). You will use mostly groups 1A – 18 A. Hydrogen is in the same group as Lithium.

Elements that have electrons in the same electron levels are in the same period (row) on the Periodic Table. Periods go left and right. Helium is in the same period as Hydrogen.

		Groups		Groups									
		1A	2A	13A	14A	15A	16A	17A	18A				
Periods	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	Transition metals—number of valence electrons varies				13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
	4	19 K	20 Ca					31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr

Thinking like the game “Battleship”, you can find an element by its period and group.

What element is in Period 2 and Group 16A?  
*Period 2 is row 2; Group 16A is Column 16A.*  
*The element is oxygen.*

What element is in Group 13A and Period 3?

What element is in Group 2A and Period 2?

What group and period is Chlorine in?

Group: \_\_\_\_\_ Period: \_\_\_\_\_

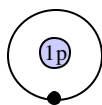
What about Magnesium?

Group: \_\_\_\_\_ Period: \_\_\_\_\_

### Valence Electrons

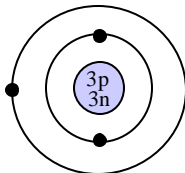
Valence Electrons are the outermost electrons in an atom. Each group (column) has the same number of valence electrons. Valence electrons are the electrons that are involved in chemical bonding.

hydrogen 1



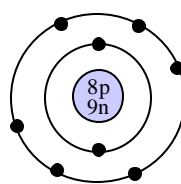
1 valence electron

lithium 6



1 valence electron

oxygen 17



6 valence electrons

Oxygen is in Group 16A and has 6 valence electrons. How many valence electrons will Sulfur have?

How about Selenium?

Hydrogen and Lithium are both in Group 1A—both have 1 valence electrons.

**Octet Rule** – Atoms are more stable that have a full shell of electrons. For most atoms (except H and He) this number is 8 (octet = 8). Atoms want to have 8 valence electrons. “If I 8, I full.” Only Group 18A have a full octet (8 valence electrons) naturally. All other elements will lose, gain, or share to reach 8 electrons.

Name: \_\_\_\_\_

Period: \_\_\_\_\_

**Using the Periodic Table**

The last digit of the Group (column) an element is in is its number of valence electrons.

*Helium is the one exception:  
Helium has 2 valence electrons.*

Ex. Neon is in Group 18A.  
The last digit of 18 is 8.  
Neon has 8 valence electrons.

Beryllium is in Group 2A.  
Beryllium has 2 valence electrons.

Find the valence electrons for the following elements:

Sodium: _____	Helium: _____	Aluminum: _____	Calcium: _____
Chlorine: _____	Boron: _____	Carbon: _____	Sulfur: _____

**Molecular Mass**

Remember: a.m.u. stands for atomic mass units—  
(the unit for the mass of an atom).

To find the mass of a molecule  
add up the masses of the individual atoms.

If there are multiple atoms of an element, multiply by the  
number of atoms (or add up each atom individually).

$$\begin{array}{l} \text{NaCl} \\ = \text{Na} + \text{Cl} \\ = (22.99 + 35.45) \\ = 58.44 \text{ a.m.u.} \end{array}$$

OR

$$\begin{array}{r} \text{Na} \quad 22.99 \text{ a.m.u.} \\ + \text{Cl} \quad + 35.45 \text{ a.m.u.} \\ \hline \text{NaCl} \quad 58.44 \text{ a.m.u.} \end{array}$$

$$\begin{array}{l} \text{H}_2\text{O} \\ = \text{H}_2 + \text{O} \\ = (2 \times 1.01) + (16.00) \\ = (2.02 + 16.00) \\ = 18.02 \text{ a.m.u.} \end{array}$$

OR

$$\begin{array}{r} \text{H} \quad 1.01 \text{ a.m.u.} \\ \text{H} \quad 1.01 \text{ a.m.u.} \\ + \text{O} \quad + 16.00 \text{ a.m.u.} \\ \hline \text{H}_2\text{O} \quad 18.02 \text{ a.m.u.} \end{array}$$

Don't forget units!

Find the molecular mass of MgO.

Find the molecular mass of CO<sub>2</sub>.

Find the molecular mass of CH<sub>4</sub>.

**Quick Review**

What element is K?	What does PO <sub>4</sub> stand for?	What scientist discovered that atoms have distinct energy levels?
How many protons does Copper have?	How many atoms does AgNO <sub>3</sub> have?	How did Rutherford find that atoms are mostly empty space and have a nucleus?
Boron 11 has how many neutrons?	How many full electron levels does Aluminum have?	