

8.1 Writing Chemical Formulas

Chemical formulas show the elements present in a compound and their ratios.

The number one is not written, but all others are written as subscripts.



2 iron 3 oxygen



Ionic Compounds – Transfer of electrons

- Contain metal and non-metal
- Metals are written first, non-metals second
- Charges must balance each other out
- Non-metals are given -ide ending



Covalent Compounds – sharing of electrons

- Contains two non-metals
- The value of the charges does not matter

Examples

3 sodium 1 phosphorus



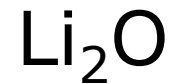
ionic

1 sulfur 2 fluorine



covalent

Examples



2 lithium 1 oxygen

ionic



3 selenium 4 oxygen

covalent

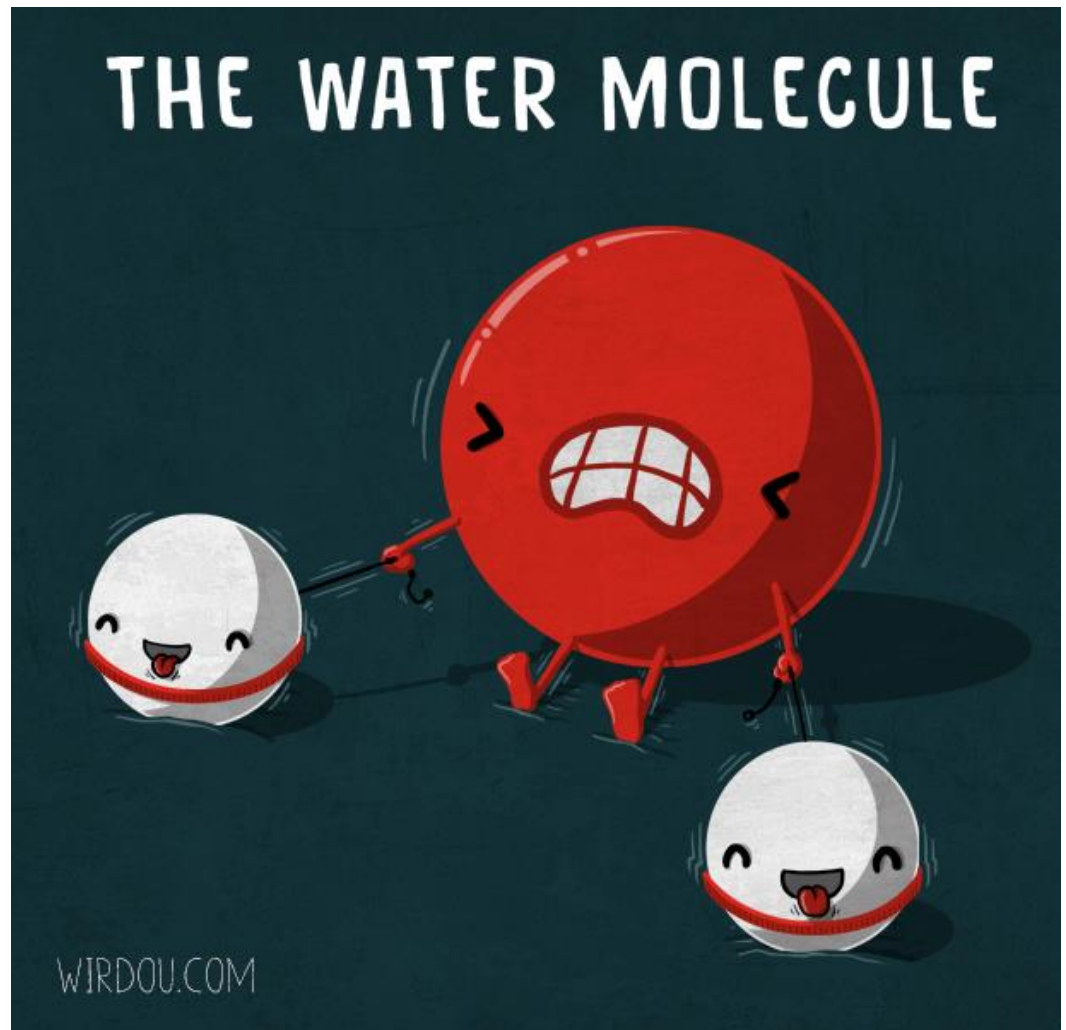
Section 8.2
Ionic Compounds

Elements may combine to form compounds

Elements have **rules** for how they come together and form compounds

Example:

Water
molecules **always**
contain **2 atoms**
of **hydrogen** and
1 atom of oxygen



All the molecules of a particular compound contain the **same types of atoms in exactly the same proportions.**

Table 1 Some Simple Compounds, Their Formulas, and Their Proportions

Formula	Elements	Proportions	Particles
CuS	copper and sulfur	1 to 1	1 copper ion to 1 sulfur ion
Ag ₂ S	silver and sulfur	2 to 1	2 silver ions to 1 sulfur ion
CO ₂	carbon and oxygen	1 to 2	1 carbon atom to 2 oxygen atoms
Al ₂ O ₃	aluminum and oxygen	2 to 3	2 aluminum ions to 3 oxygen ions

Predict the proportions of each element in a compound made of:

Magnesium (Mg) and Fluorine (F)

Magnesium (Mg) and Chlorine (Cl)

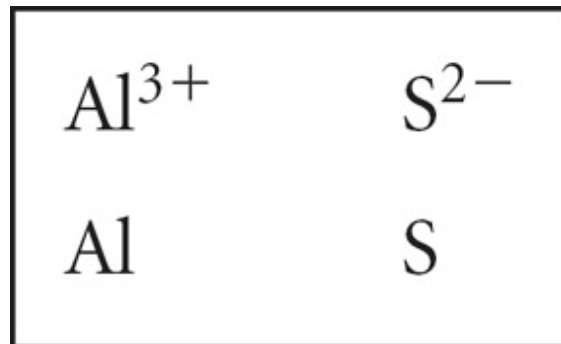
Magnesium (Mg) and Bromine (Br)

What do you notice about the proportions of F, Cl, and Br in each compound? How does this relate to their positions in the Periodic Table?

8.2 Ionic Compounds

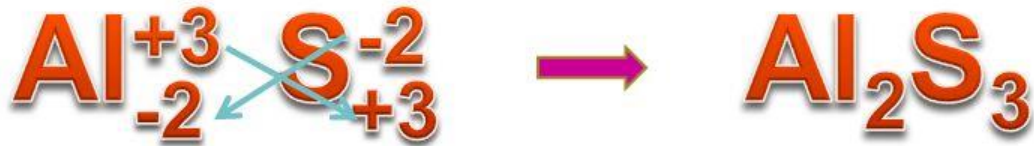
Metals and non-metals **combine** by forming **oppositely charged ions**

To form ions, atoms must **gain** or **lose** specific numbers of electrons

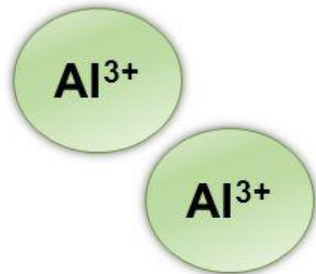


Reason: Total Charges = Zero

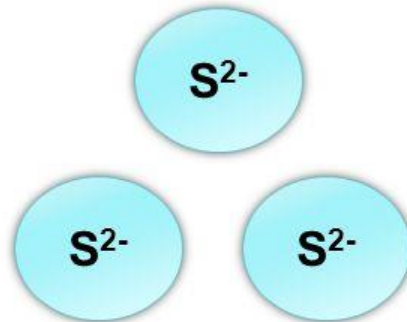
Aluminum Sulfide



Need 2 Al^{+3} ions



Need 3 S^{-2} ions



$$+6 + -6 = 0$$

8.2 Ionic Compounds

To form ionic compounds, the **total number of electrons given up by the metal ions must exactly balance the total number of electrons gained by the non-metal ions**

The **sum of all positive and all negative charges** in the formula of an ionic compound must equal **zero**.

Section 8.3

Naming Ionic and Multivalent Ionic Compounds

8.3. Naming Ionic and Multivalent Ionic Compounds

Metal ions have the same name as the metal element.

Some metals produce ions with **different charges (multivalent ions)**. Each ion is identified with a Roman numeral: Fe^{3+} is iron(III); Fe^{2+} is iron(II).

Polyatomic groups, or polyatomic ions, have special names. For example, CO_3^{2-} is called “carbonate ion.”

8.3. Naming Ionic and Multivalent Ionic Compounds

Ions composed of a **single atom** of a **non-metal** are given the **'ide 'suffix**. The ion of oxygen (O^{2-}) is called the “oxide ion”.

The name of an ionic compound is formed by **combining** the names of the two ions, with the name of the **metal ion written first**.

To name an **ionic compound**: Name of metal + nonmetal*ide*.

E.g. NaCl is sodium chloride

To name a **multivalent compound**: Name of metal + (charge number in Roman numerals) + nonmetal*ide*.

E.g. CuCl₂ is copper (II) chloride

To name a **polyatomic compound**: Name of metal + name of polyatomic.

E.g., CaCO₃ is calcium carbonate

Section 8.4 **Chemical Families**

8.4. Chemical Families

- The elements in Group 1 of the Periodic Table (except hydrogen) are called **alkali metals**.

1																		18
H																		He
Li	Be																	
Na	Mg																	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo	
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

alkali metals alkaline earth metals
noble gases halogens

red = metal blue = metalloid green = non-metal

8.4. Chemical Families

- They are **low-density, soft metals** that react with **water** to form **hydrogen gas** and an **alkaline solution**.

1																			18
H																			He
2																			
Li	Be																		
Na	Mg																		
3																			
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo		
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

alkali metals alkaline earth metals
noble gases halogens

red = metal blue = metalloid green = non-metal

8.4. Chemical Families

- The elements in Group 2 are called **alkaline earth metals**.

The periodic table is color-coded by chemical families and properties. The legend below the table defines the colors:

- alkali metals (blue)
- alkaline earth metals (green)
- noble gases (pink)
- halogens (yellow)
- red = metal
- blue = metalloid
- green = non-metal

1																	18		
H																	He		
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo	
				Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
				Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

8.4. Chemical Families

- They are **low-density, hard metals**, and are commonly found in **minerals**.

The periodic table is color-coded by chemical families. The legend below the table defines the colors:

- red = metal
- blue = metalloid
- green = non-metal

Legend boxes:

- alkali metals (blue)
- alkaline earth metals (green)
- noble gases (red)
- halogens (yellow)

1	2											13	14	15	16	17	18	
H																	He	
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo	
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

8.4 Chemical Families

- The elements in Group 17 are called **halogens**.

1											13	14	15	16	17	18	
H											B	C	N	O	F	He	
Li	Be											Al	Si	P	S	Cl	Ar
Na	Mg	3	4	5	6	7	8	9	10	11	12	Ga	Ge	As	Se	Br	Kr
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	In	Sn	Sb	Te	I	Xe
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Tl	Pb	Bi	Po	At	Rn
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Po	Bi	At	Rn		
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

alkali metals	alkaline earth metals
noble gases	halogens

red = metal
 blue = metalloid
 green = non-metal

