

The Basics of Chemical Bonds



Essential Standard 2.2

Understand chemical bonding and chemical interactions.

Learning Objective 2.2.2

Infer the type of chemical bond that occurs, whether covalent, ionic, or metallic, in a given substance.

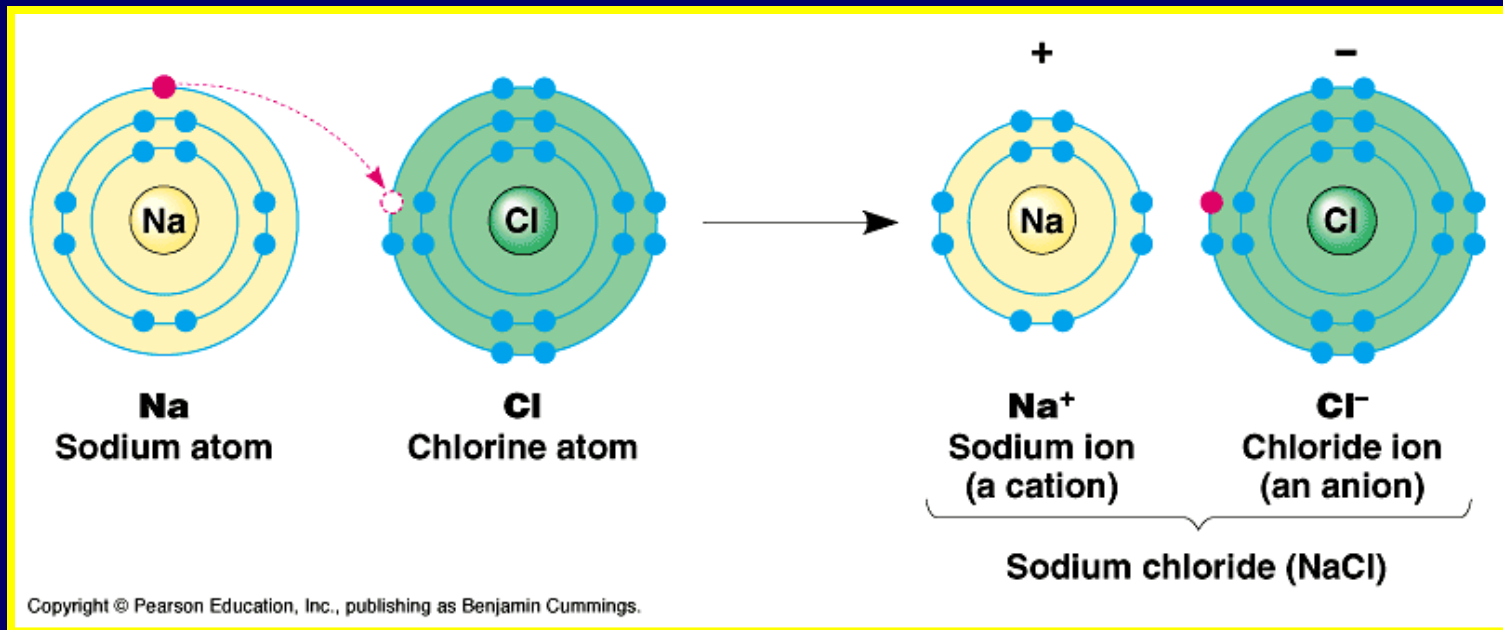
I Can Statements

At the end of this lesson, you should be able to say, with confidence:

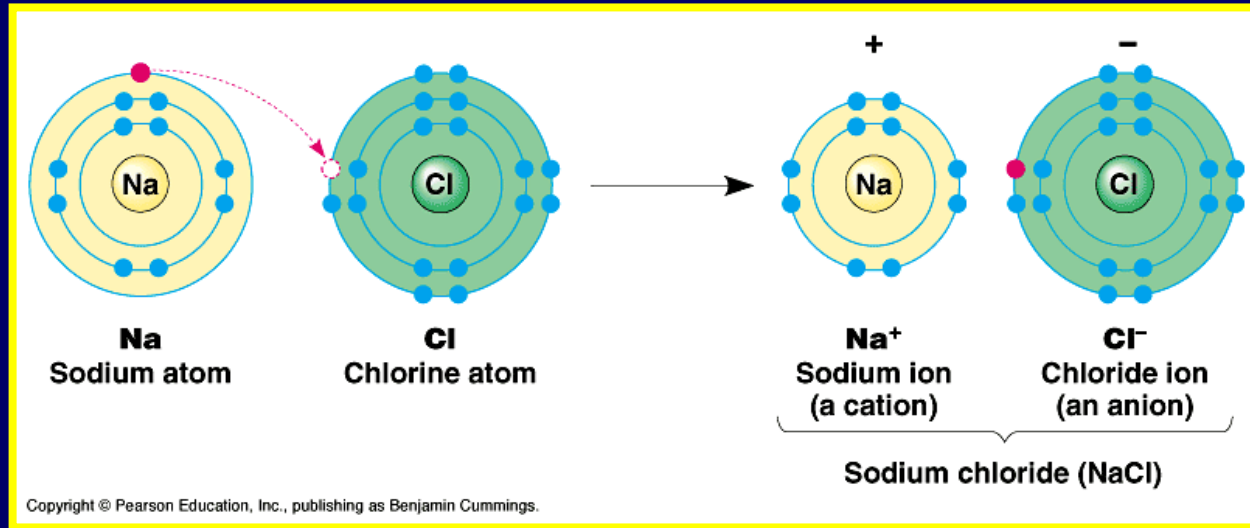
- I can explain how ionic, covalent, and metallic bonds are formed.
- I can identify which compounds are formed by ionic, covalent, and metallic bonds.

Chemical Bonds

When atoms lose, gain, or share valence electrons, a chemical bond is formed between the atoms and a new compound is created.



Ionic Bonds



I'm sweating so much.
I wish I could just give
this blanket away.



Emily

I'm so cold
I wish I could get
a blanket.



Sarah

Emily gives the
blanket to Sarah

Wow, I am so
comfortable now, I am
no longer sweating.



Emily

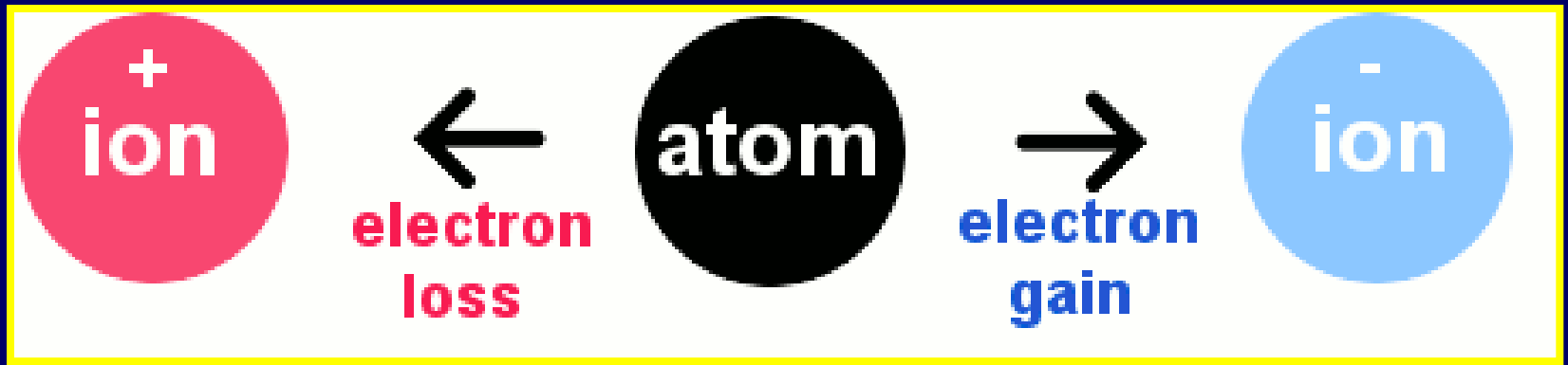
I'm so comfortable
in a blanket now



Sarah

Ions

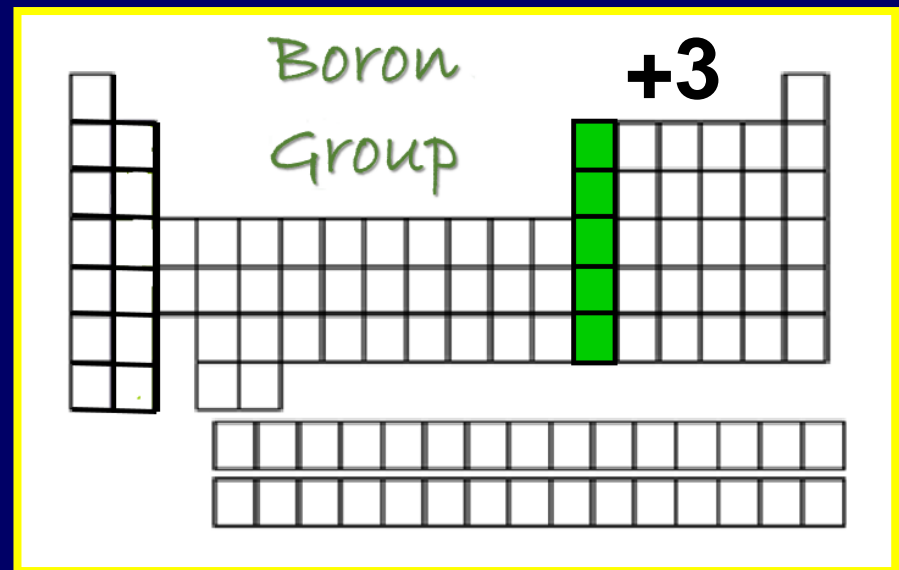
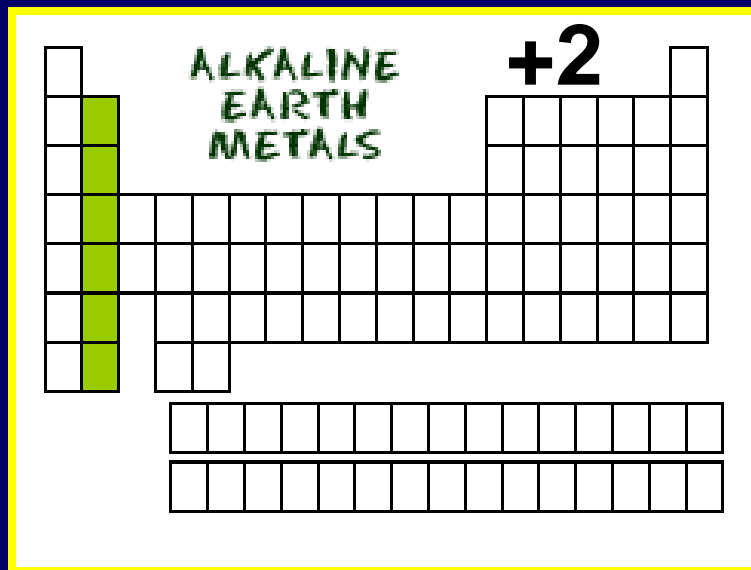
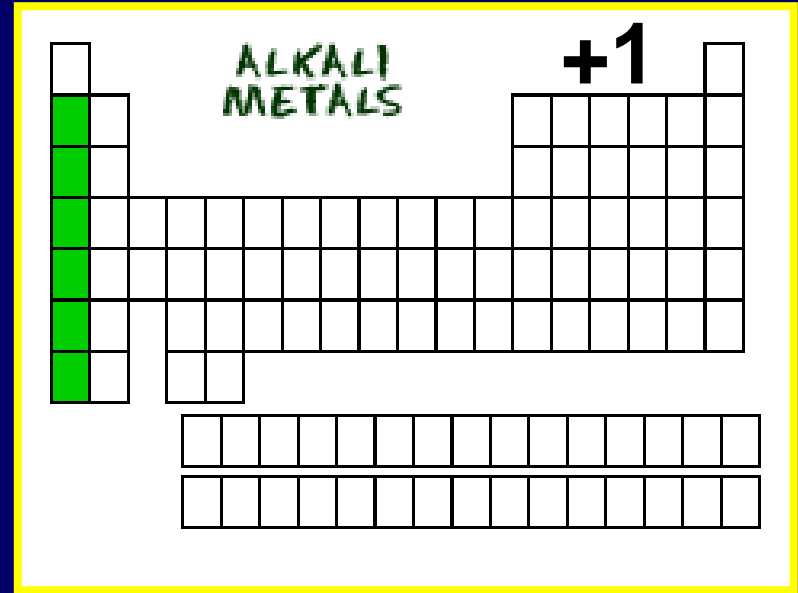
When atoms gain or lose electrons they develop a charge and are called ions.



In other words, an ion is an atom with a positive or negative charge.

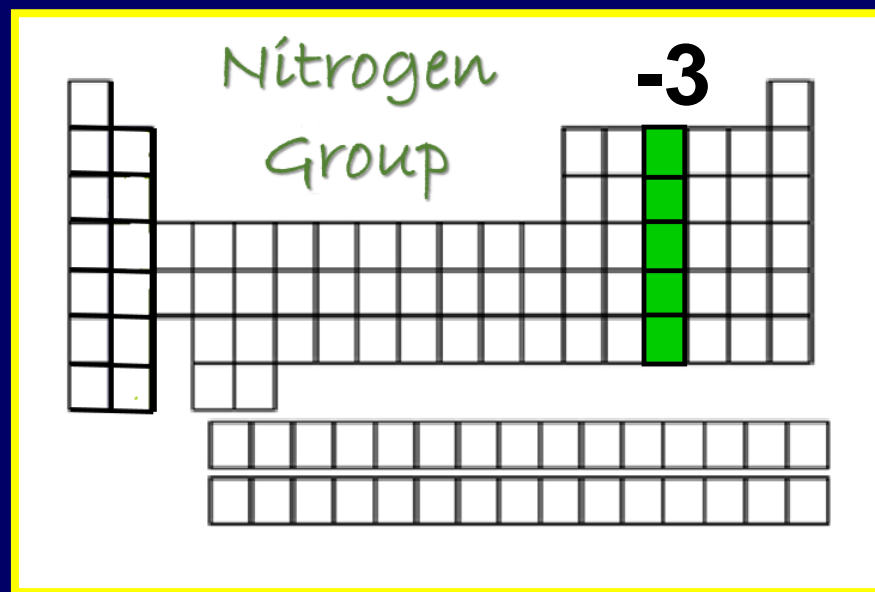
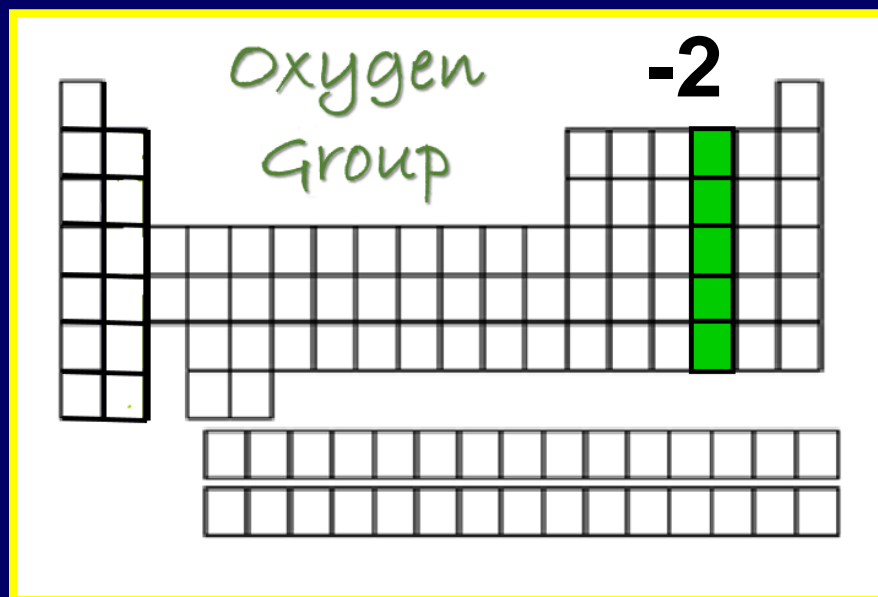
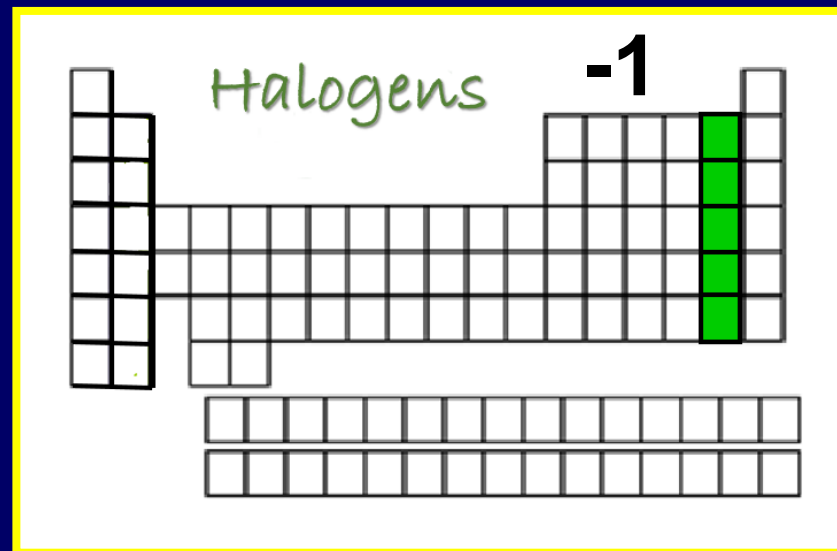
Metals → Positive Ions

Only metals will lose electrons to form positive ions, or cations.



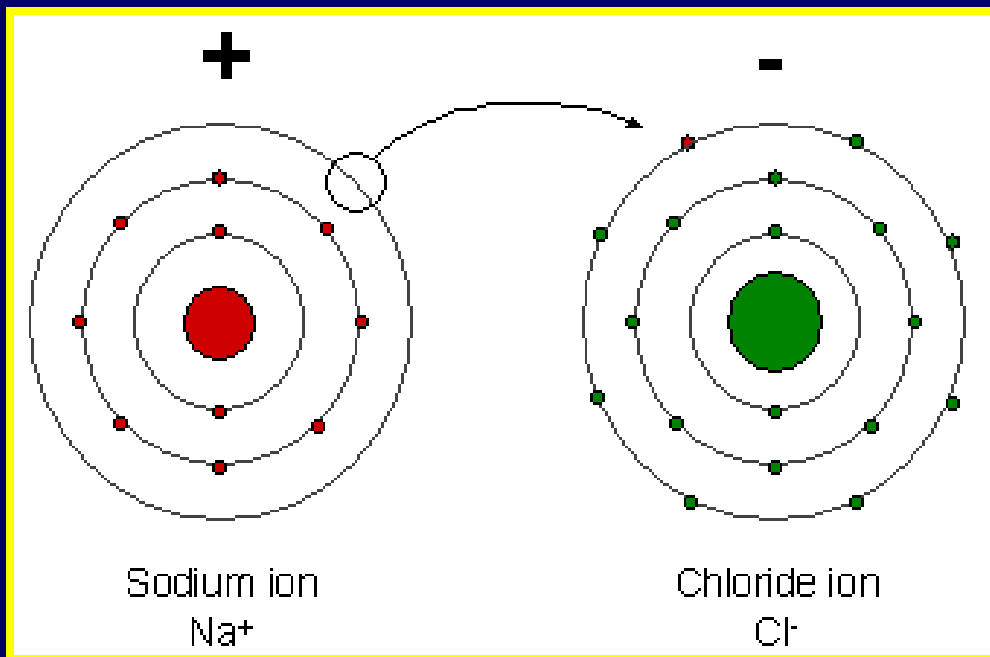
Nonmetals → Negative Ions

Only nonmetals will gain electrons to form negative ions, or anions.



Ion Exchange

In order for an atom to lose an electron, it must first be near an atom that will accept that electron



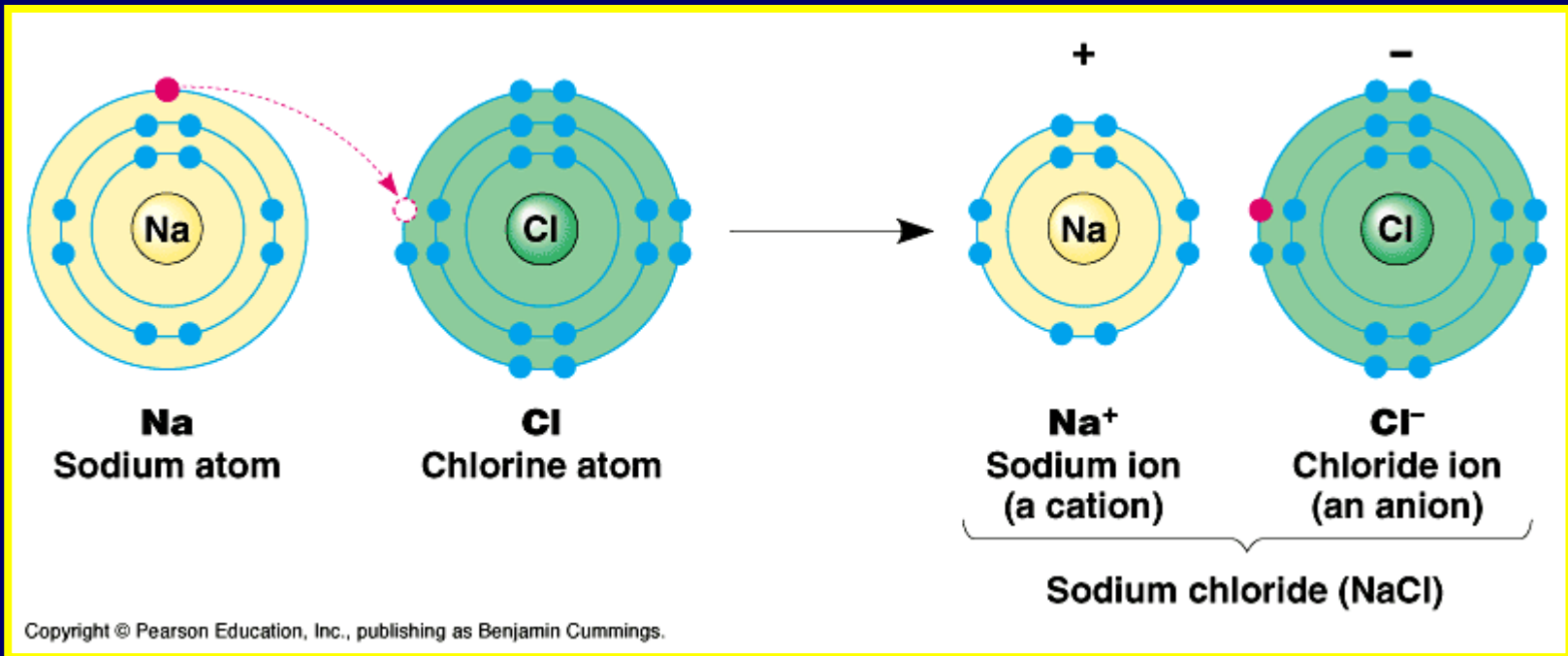
After the electron exchange takes place, the atoms become two oppositely charged ions.

Na+

Cl-

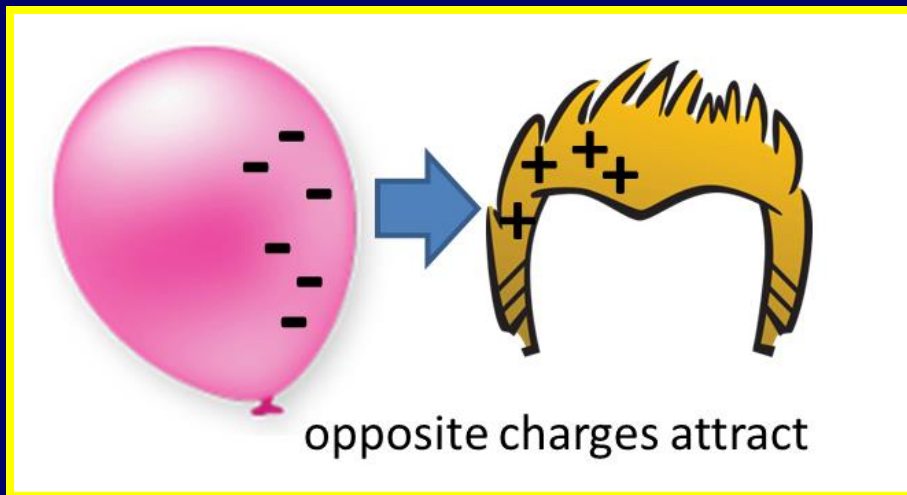
Ionic Bonds

Ions with opposite charges attract each other and join together by forming Ionic Bonds.



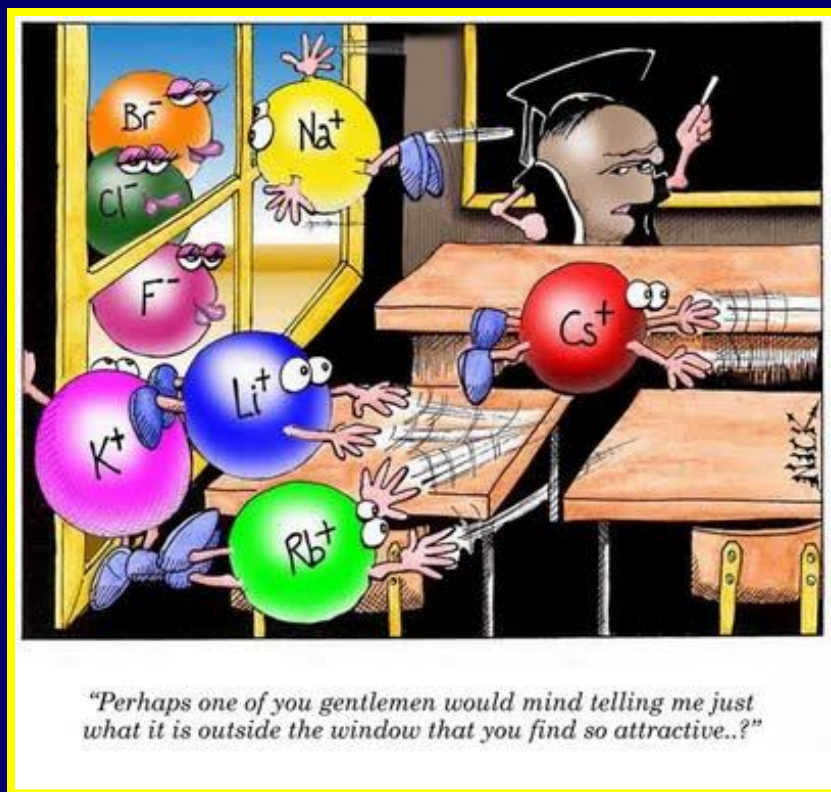
Ionic Bonds

Ions of opposite charges attract each other, just like objects with opposite charges attract each other during static electricity, so it's called an electrostatic attraction.



Ionic Compounds

Ionic compounds always consist of a metal and a non-metal ions that are attracted to each other due to their opposite charges.



Metal

Nonmetal

Covalent Bonds



Sarah, I'm cold.



Emily


I'm cold too



Sarah



Emily and Sarah
share the blanket



A horizontal arrow pointing from the two girls on the left towards the two girls on the right, indicating the action of sharing the blanket.

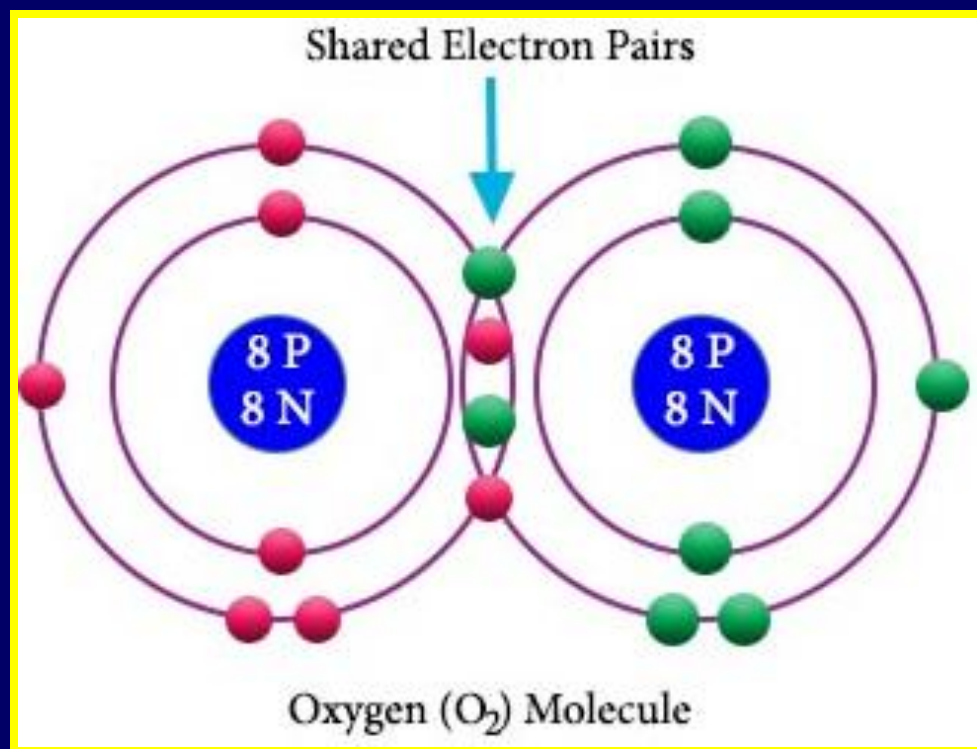
Wow, we both feel so cozy and comfortable after sharing the blanket.



Emily Sarah

Sharing Electrons

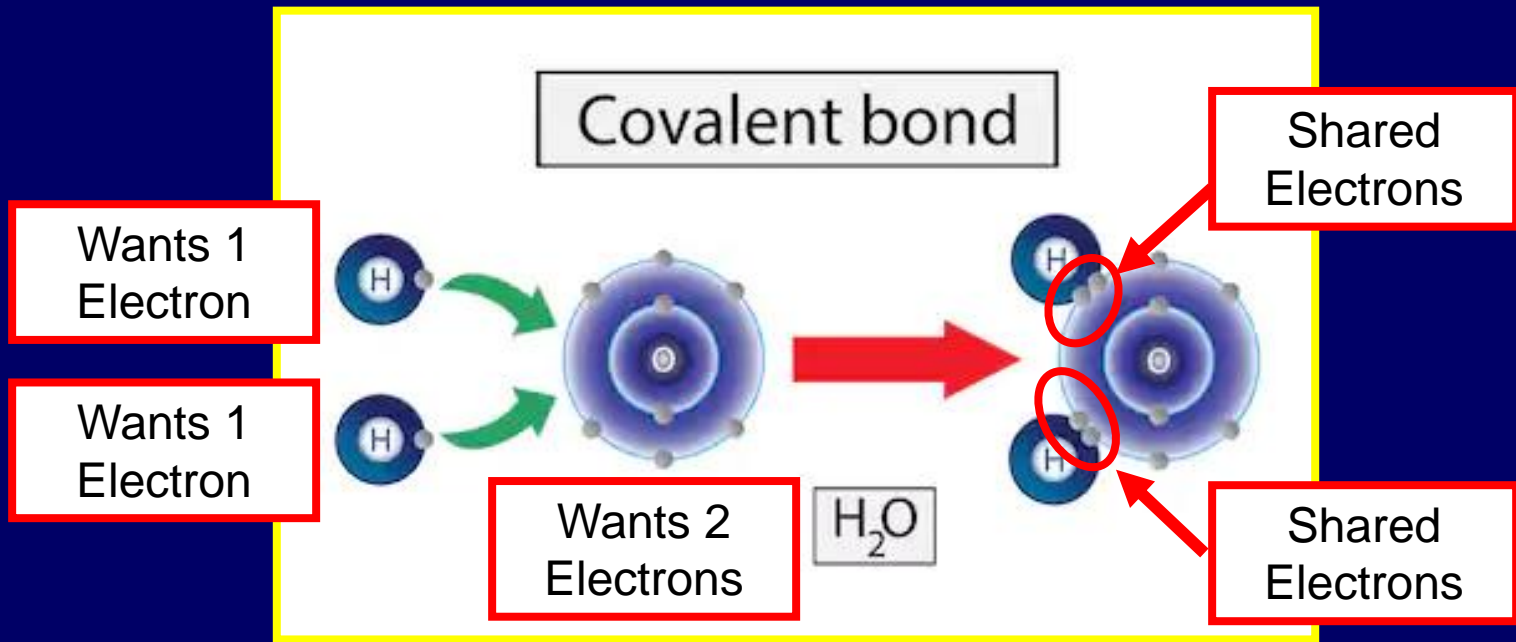
Non-metals are able to share valence electrons.



Since they don't gain or lose electrons, they do not develop a charge and remain neutral.

Covalent Bonds

When atoms join together by sharing valence electrons they form covalent bonds.



Co-workers share the work

Co-valent compounds share valence electrons

Covalent Bonds

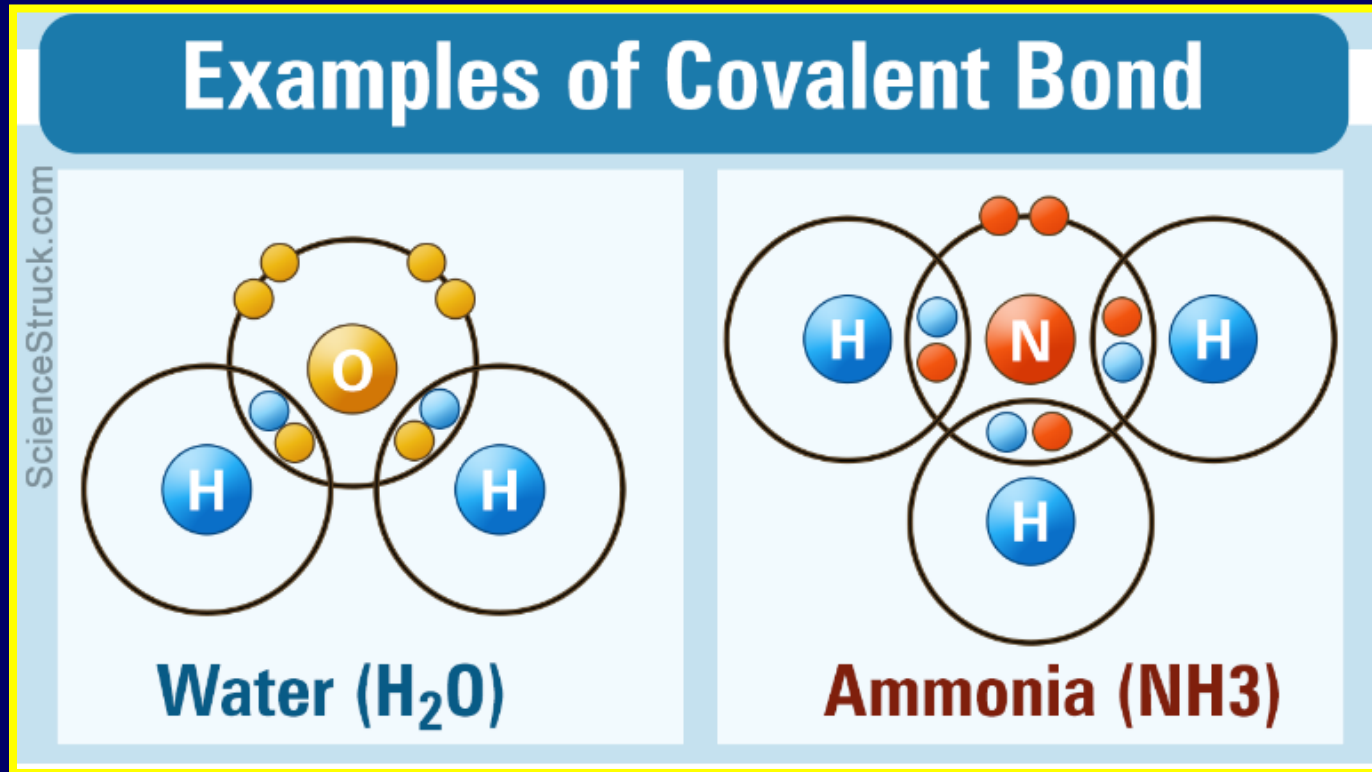
When atoms share valence electrons, those electrons will orbit around each of the atom's nuclei.



Compounds formed with covalent bonds are called molecules.

Covalent Bonds

Only non-metals can form covalent bonds.



Hydrogen, Oxygen, and Nitrogen are all nonmetals.

Metallic Bonds



Metals

When metals bond with other metals, they have a completely different way of forming bonds that makes their bonds very stable and gives metals the properties for which they are known.

Metallic Properties

Conductors

Malleable

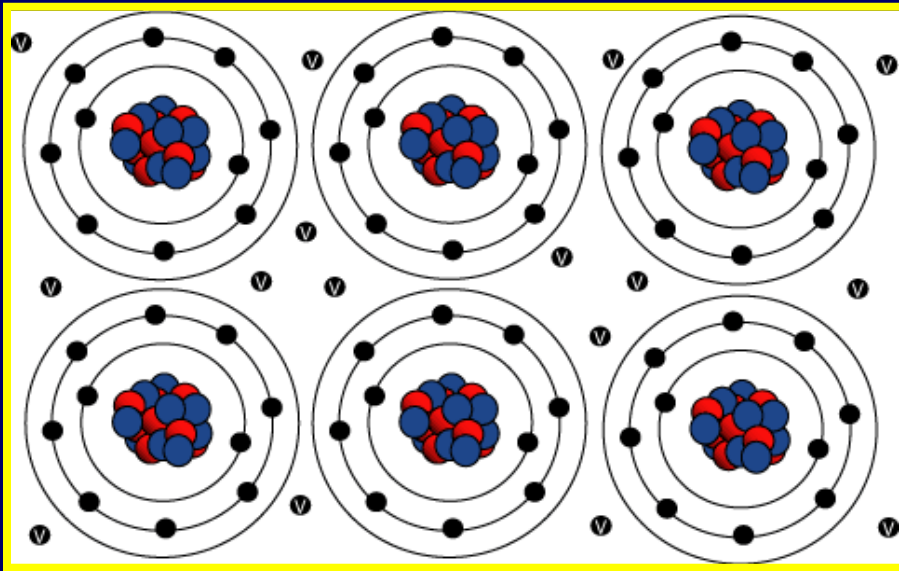
Ductile

Shiny



Metal Valence Electrons

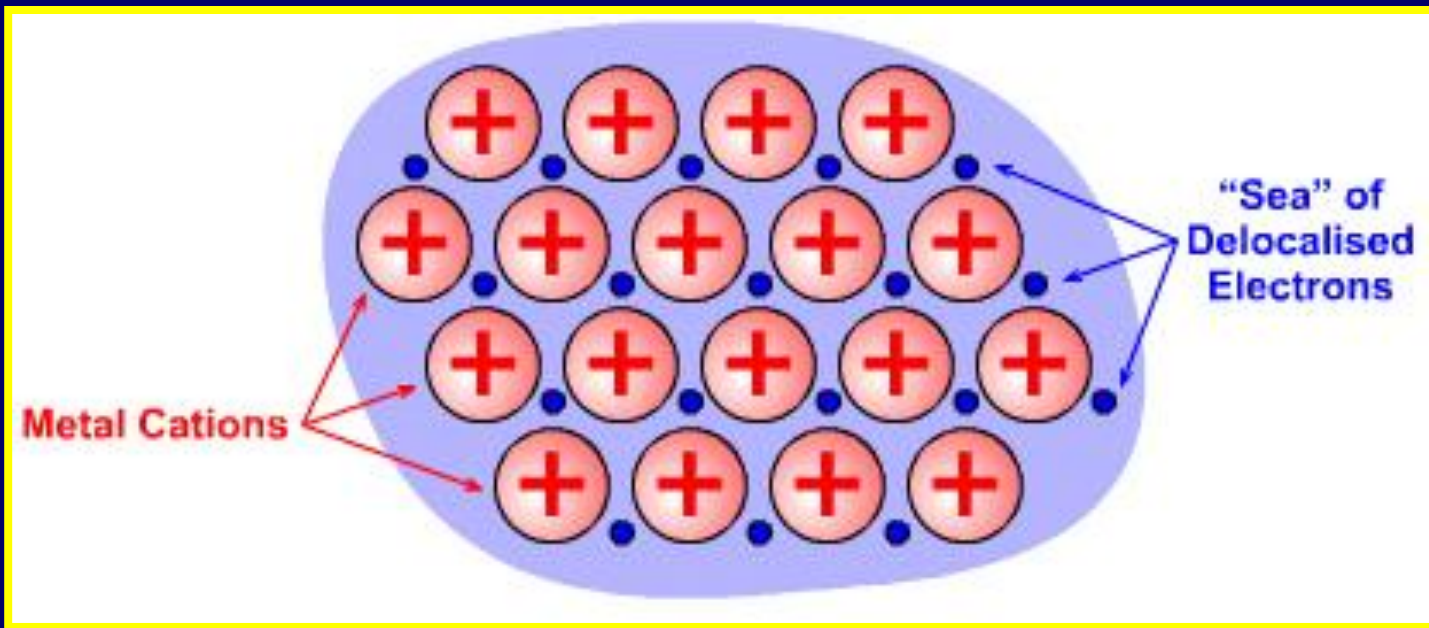
When metals atoms are grouped together, the valence electrons feel just as much attraction to the nuclei of other metals as they do their own nucleus.



As a result, all valence electrons leave their individual atoms.

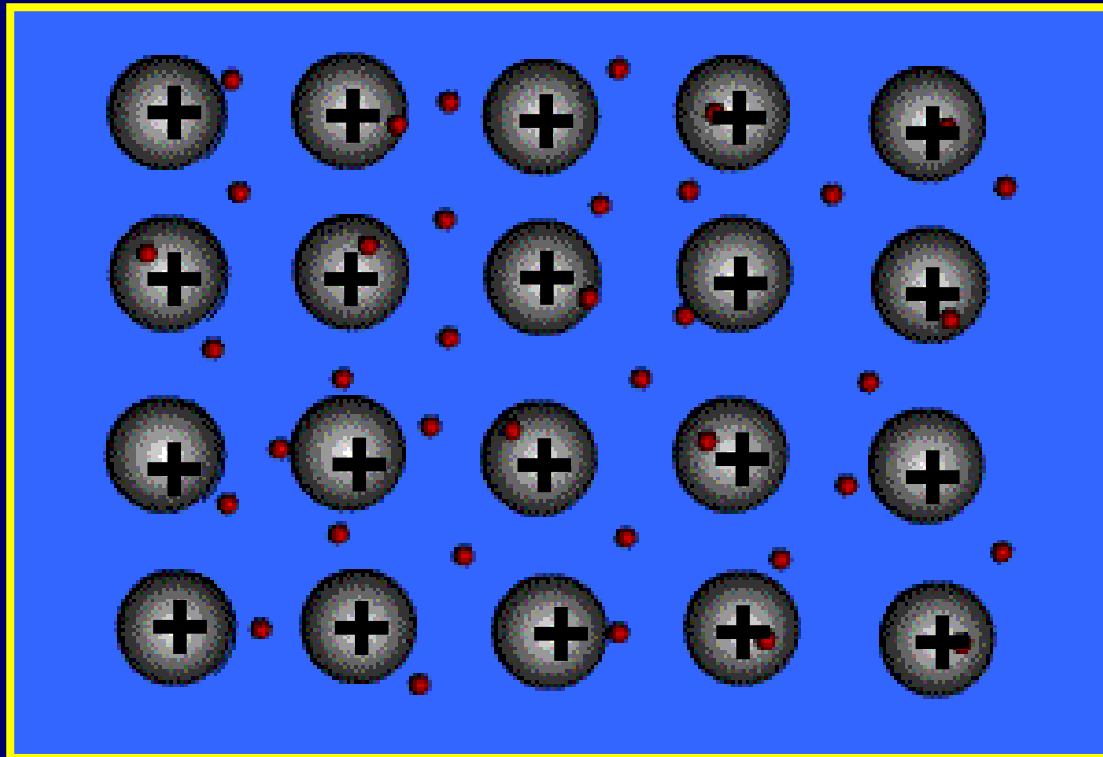
Delocalized Electrons

When the valence electrons leave their individual atoms, it results in a group of positive metal cations surrounded by a sea of “delocalized” electrons.



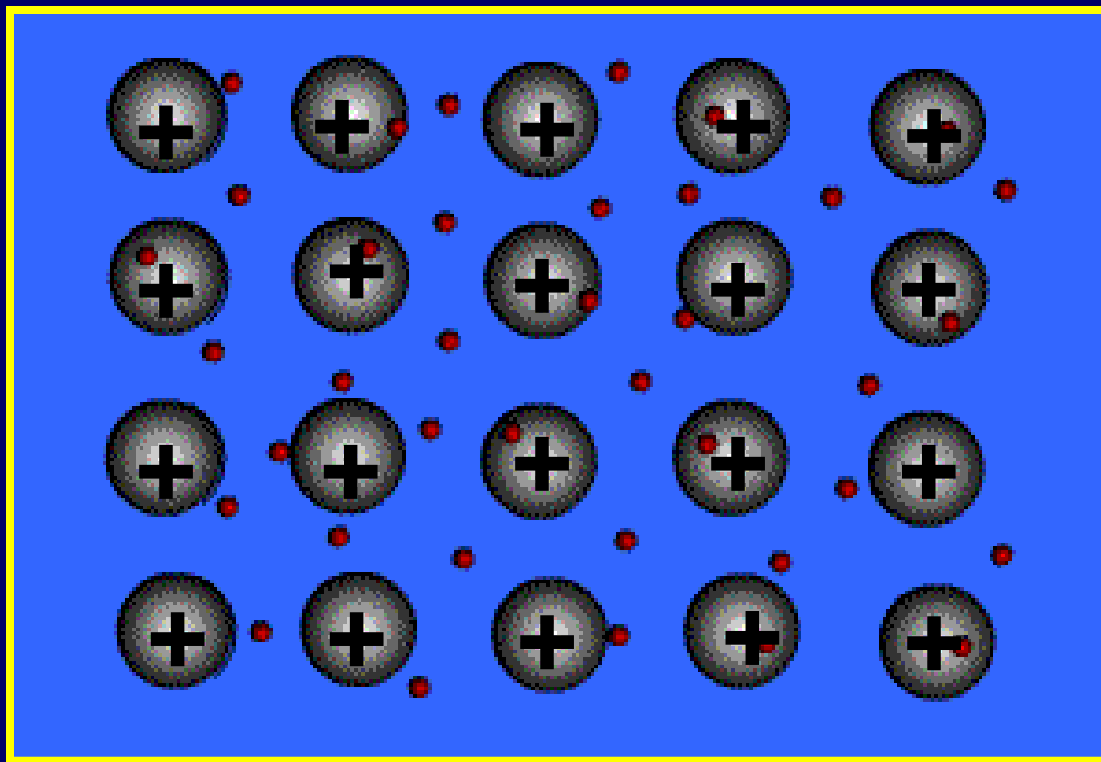
Sea of Electrons

Delocalized electrons no longer belong to any one metal cation, instead they float freely between all of the metal cations forming what is called a “sea of electrons”.



Metallic Bond

The attraction between the sea of electrons and the positively charged nuclei is called a metallic bond.



Metallic Compounds

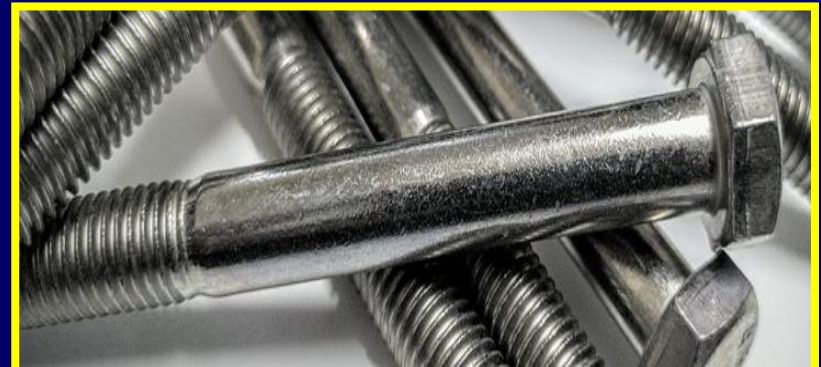
Only metal atoms can form metallic bonds with other metal atoms to create metallic compounds.

Periodic Table

Metals																									
1A	2A		8B										1B	2B	3A	4A	5A	6A	7A	8A					
1 H 1.008	3 Li 6.941	4 Be 9.012											11 Na 23.00	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95	2 He 4.003				
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80								
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3								
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)								
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)	109 Uue (267)																		
Lanthanides		58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0										
Actinides		90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)										



Chrome



Nickel

The End

