

2.7 What Kinds of Chemical Elements Exist? (1.7)

In the periodic table, the elements are arranged according to similarities in their properties. The elements are listed in order of increasing atomic number as you read from left to right across a period and from top to bottom down a group. In this arrangement, there is a periodic repetition in the chemical and physical properties of the elements. This idea is called the periodic law - (properties of the elements repeat as they are arranged by atomic number). In this section you will learn the general behavior and trends within the periodic table that result from this arrangement in order to predict the properties of the elements.

Metals, Nonmetals, and Metalloids

1 H																	7 He						
3 Li	4 Be																	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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						
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						
55 Cs	56 Ba	57 La	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						
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn												

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	71 Lu
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	103 Lr

The division of the periodic table into metals and non-metals. The metalloids are most of the elements along the line drawn. Additionally, the element hydrogen is a NONMETAL, even though it is on the left side of the periodic table.

There is a progression from metals to nonmetals across each row of elements in the periodic table. The diagonal line at the right side of the table separates the elements into two groups: the metals and the non-metals. The elements that are on the left of this line tend to be metals, while those to the right tend to be non-metals (with the exception of hydrogen which is a nonmetal). The elements that are directly on the diagonal line are metalloids, with some exceptions. Aluminum touches the line, but is considered a metal. Metallic character generally increases from top to bottom down a group and right to left across a period, meaning that francium (Fr) has the most metallic character of all of the discovered elements.

Most of the chemical elements are **metals**. Most metals have the common properties of being shiny, very dense, and having high melting points. Metals tend to be **ductile** (can be drawn out into thin wires) and **malleable** (can be hammered into thin sheets). Metals are good conductors of heat and electricity. All metals are solids at room temperature except for mercury. In chemical reactions, metals easily lose electrons to form positive ions. Examples of metals are silver, gold, and zinc.

Nonmetals are generally brittle, dull, have low melting points, and they are generally poor conductors of heat and electricity. In chemical reactions, they tend to gain electrons to form negative ions. Examples of nonmetals are hydrogen, carbon, and nitrogen.

Metalloids have properties of both metals and nonmetals. Metalloids can be shiny or dull. Electricity and heat can travel through metalloids, although not as easily as they can through metals. They are also called semimetals. They are typically semi-conductors, which means that they are elements that conduct electricity better than insulators, but not as well as conductors. They are valuable in the computer chip industry. Examples of metalloids are silicon and boron.

Metals	Nonmetals	Metalloids
<ul style="list-style-type: none"> • Shiny • Dense • High melting point • High boiling point • Ductile • Malleable • Conduct electricity • Solids at room temperature (except mercury) • Lose electrons to form positive ions 	<ul style="list-style-type: none"> • Dull • Brittle • Low melting point • Low boiling point • Can be gases, liquids, or solids at room temperature • Not usually electrical conductors • Most common elements found in living things • Gain electrons to form negative ions 	<ul style="list-style-type: none"> • Can be shiny or dull • Can gain or lose electrons • Semiconductors • Useful in computers and electronics
Gold, silver, zinc, iron, potassium	Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur	Silicon, gallium, boron