

THE PERIODIC TABLE

STRUCTURE OF THE PERIODIC TABLE

- The periodic table is arranged in order of increasing _____ number.
- Elements in vertical columns showed similar properties.
- On the periodic table a period, sometimes also called a _____, consists of the elements in a horizontal row.
- A _____, sometimes also called a family, consists of the elements in a vertical column.

METALS, NONMETALS, and METALLOIDS

There are 3 main regions of the table: metals, nonmetals and metalloids. Color the periodic table at the bottom of the page and make a key.

hydrogen 1 H 1.0079																	helium 2 He 4.0026						
lithium 3 Li 6.941	beryllium 4 Be 9.0122																	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305																	aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80						
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29						
cesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]					
francium 87 Fr [223]	radium 88 Ra [226]	** 89-102	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	unnilium 110 Uun [271]	ununium 111 Uuu [272]	unbibium 112 Uub [277]											

* Lanthanide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
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** Actinide series

actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]
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METALS	NONMETALS	METALLOIDS
<ul style="list-style-type: none"> ● have luster (are _____) ● conduct heat and electricity ● usually bend without breaking (_____) ● are ductile (can be drawn out into a wire) ● mostly have one, two, or three valence electrons ● tend to _____ electrons in order to achieve the stability of a filled octet ● are solids at room temperature, except mercury ● most have extremely high _____ points ● Reactivity increases as you go _____ a group and left across a period. 	<ul style="list-style-type: none"> ● do not conduct electricity and are much poorer conductors of heat than metals ● Many are _____ at room temperature. ● Those that are solids lack the luster of metals and are _____. ● melting points tend to be lower than those of metals ● With the exception of carbon, nonmetals have five, six, seven, or eight valence electrons. ● tend to _____ electrons in order to achieve the stability of a filled octet ● Reactivity for nonmetals increases as you go left to right and _____ the periodic table. 	<ul style="list-style-type: none"> ● have some chemical and _____ properties of metals and other properties of nonmetals ● lie along the border between metals and nonmetals on the periodic table

1. Consult the “Activity Series of Metals” in the Chemistry Reference Tables to determine the more active metal.

- a) cobalt (Co) or manganese (Mn) _____ b) barium (Ba) or sodium (Na) _____

2. Consult the “Activity Series of Halogens” in the Chemistry Reference Tables to determine the less active nonmetal.

- a) fluorine (F₂) or chlorine (Cl₂) _____ b) chlorine (Cl₂) or iodine (I₂) _____

GROUP NAMES, VALENCE ELECTRONS, and IONS

- Groups 1, 2, and 13 - 18 (Group A elements) are called _____ (main group) elements.
- Groups 3 - 12 (Group ____ elements) are called transition elements.
- Group 1 elements are called the _____ metals and have one valence electron. They form 1+ ions after _____ the one valence electron.
- Group 2 elements are called the alkaline _____ metals and have two valence electrons. They form _____ ions after losing the two valence electrons.
- Group 17 elements are called the _____. They have seven valence electrons. They form 1- ions after _____ one more electron.
- Group 18 elements are called the _____ gases. Group 18 elements have eight valence electrons, except for helium which only has two. The noble gases, with a full complement of valence electrons, are generally unreactive.

Valence Electrons in Each Group

1																				2
1	2													3	4	5	6	7	8	
1	2													3	4	5	6	7	8	
1	2													3	4	5	6	7	8	
1	2													3	4	5	6	7	8	
1	2													3	4	5	6			

1. How many valence electrons are in an atom of each of the following elements?

- a) Magnesium (Mg) _____
- b) Selenium (Se) _____
- c) Tin (Sn) _____

2. Match each element in Column A with the best matching description in Column B. Each Column A element may match more than one description from Column B.

Column A

1. strontium
2. chromium
3. iodine

Column B

- a. halogen
- b. alkaline earth metal
- c. representative element
- d. transition element

PERIODIC TRENDS

The **atomic radius** of a chemical element is a measure of the size of its atoms, usually the mean or typical distance from the _____ to the boundary of the surrounding cloud of electrons. Atomic size is influenced by two factors. (1) Energy Level – A higher energy level is farther away.

(2) Charge on nucleus - More charge (_____) pulls electrons in closer.

- **As you go down a group, atoms get bigger.**
- **As you go across a period, the radius gets smaller.**

3. (a) State why atoms get bigger as you go down a group on the periodic table. _____

(b) State why the radius decreases across a period. _____

4. Choose the element from the pair with the larger atomic radius.

- a) lithium (Li) or beryllium (Be) _____ b) silicon (Si) or tin (Sn) _____

5. Choose the element from the pair with the smaller atomic radius.

- a) silver (Ag) or gold (Au) _____ b) cesium (Cs) or barium (Ba) _____

Ionic radius is the radius of an atom's ion. When an atom gains or loses one or more _____, it becomes an ion. Recall that metals tend to lose electrons in order to achieve the stability of a filled octet. As a result, metals tend to form _____ which are positive ions. A cation has a _____ radius than its neutral atom. Nonmetals tend to gain electrons in order to achieve the stability of a filled octet. As a result, nonmetals tend to form anions which are _____ ions. An anion has a larger radius than its neutral atom.

6. Choose the element from the pair with the smaller radius.

- a) silver (Ag) or the silver ion (Ag^{1+}) _____ b) oxygen (O) or the oxygen ion (O^{2-}) _____

7. For each of the following pairs, predict which atom is larger.

- a) Mg, Sr _____ b) Sr, Sn _____ c) Ge, Sn _____
d) Ge, Br _____ e) Cr, W _____

8. For each of the following pairs, predict which atom or ion is larger.

- a) Mg, Mg^{2+} _____ b) S, S^{2-} _____ c) Ca^{2+} , Ba^{2+} _____
d) Cl^- , I^- _____ e) Na^+ , Al^{3+} _____

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Ionization energy (IE) is the amount of energy required to completely _____ an electron from a gaseous atom. Removing one electron makes a 1+ ion. The energy required to do this is called the first ionization energy. Greater _____ charge (# of protons) means greater IE. The _____ the distance from the nucleus, the greater the IE.

- **As you go down a group, first IE decreases.**
- **IE generally increases from left to right.**

9. (a) State why ionization energy decreases as you go down a group. _____

(b) State why ionization energy increases across a period. _____

10. Choose the element from the pair with the greater ionization energy.

- a) silver (Ag) or iodine (I) _____ b) oxygen (O) or selenium (Se) _____

11. Choose the element from the pair with the smaller ionization energy.

- a) chromium (Cr) or tungsten (W) _____ b) sodium (Na) or magnesium (Mg) _____

Electronegativity is the tendency for an atom to attract a pair of electrons to itself when it is chemically combined with another element. Large electronegativity means the atom pulls the electron toward it.

- **Electronegativity decreases down a group.**
- **As you go across a row, electronegativity increases.**

12. (a) State why electronegativity decreases as you go down a group. _____

(b) State why electronegativity increases across a period. _____

13. Choose the element from the pair with the greater electronegativity.

- a) sodium (Na) or rubidium (Rb) _____ b) selenium (Se) or bromine (Br) _____

14. Choose the element from the pair with the smaller electronegativity.

- a) magnesium (Mg) or calcium (Ca) _____ b) nitrogen (N) or oxygen (O) _____

TREND	Top to Bottom	Left to Right
Atomic Radius	increase	
Ionization Energy		
Electronegativity		

Electron affinity is the energy change that accompanies a gaseous atom when it _____ an electron to form a gaseous ion.

Metals and the Periodic Trends

Recall again that metals tend to lose electrons in order to achieve the stability of a filled octet. Therefore as metallic character increases toward francium (Fr) ionization energy, electronegativity, and electron affinity _____.