

Physical Science Unit 5 Crash Course

Chapter 5 and 6

(The Periodic Table and Chemical Bonds)



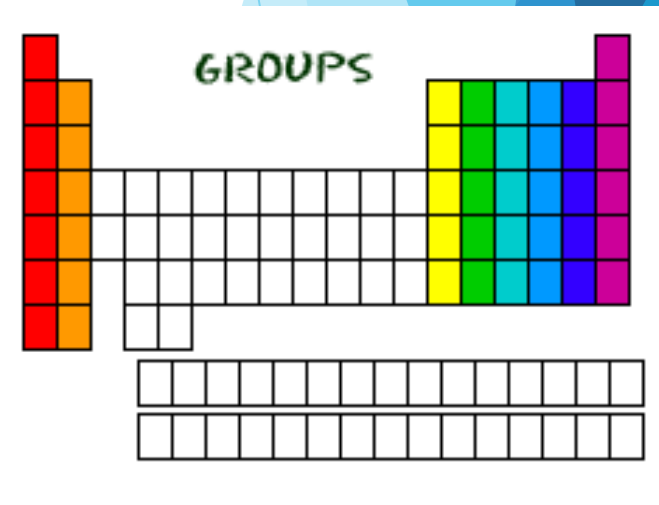
Chapter 5 - The Periodic Table

- ▶ A periodic table is an arrangement of elements in columns, based on a set of properties that repeat from row to row.
- ▶ Mendeleev arranged the elements into rows in order of increasing mass so that elements with similar properties were in the same column.
- ▶ He used the properties of elements located near the blank spaces in his table to predict properties for undiscovered elements.
- ▶ The close matches between Mendeleev's predictions and the actual properties of new elements showed how useful his periodic table could be.

H = 1			Ti = 50	Zr = 90	? = 180
	Be = 9,4	Mg = 24	V = 51	Nb = 94	Ta = 182
	B = 11	Al = 27,4	Cr = 52	Mo = 96	W = 186
	C = 12	Si = 28	Mn = 55	Rh = 104,4	Pt = 197,4
	N = 14	P = 31	Fe = 56	Ru = 104,4	Ir = 198
	O = 16	S = 32	Ni = 59	Pd = 106,6	Os = 199
	F = 19	Cl = 35,5	Co = 59	Ag = 108	Hg = 200
Li = 7	Na = 23	K = 39	Cu = 63,4	Cd = 112	
		Ca = 40	Zn = 65,2	U = 116	Au = 197?
		? = 45	As = 75	Sn = 118	
		?Er = 56	Sc = 79,4	Sb = 122	Bi = 210?
		?Yt = 60	Br = 80	Te = 128?	
		Zn = 75,6	Rb = 85,4	J = 127	
			Sr = 87,6	Cs = 133	Tl = 204
			Ce = 92	Ba = 137	Pb = 207
			Di = 95		
			Th = 118?		

Chapter 5 - The Periodic Table

- ▶ In the modern periodic table, elements are arranged by increasing atomic number (number of protons).
- ▶ Each row in the table of elements is a period.
- ▶ The number of elements per period varies because the maximum number of electrons increases from energy level to energy level.
- ▶ Each column on the periodic table is called a group.
- ▶ The elements within a group have similar properties.



Chapter 5 - The Periodic Table

- ▶ The pattern of repeating properties across a period when the elements are arranged in order of increasing atomic number is called the periodic law.
- ▶ Atomic mass is a value that depends on the distribution of an element's isotopes in nature and the masses of those isotopes.
- ▶ Elements are classified as metals, nonmetals, and metalloids.

Metals, Nonmetals, and Metalloids

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	—	Uuq	—	—	—	—
Lanthanide Series																	
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu				
Actinide Series																	
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr				

metals

metalloids

nonmetals

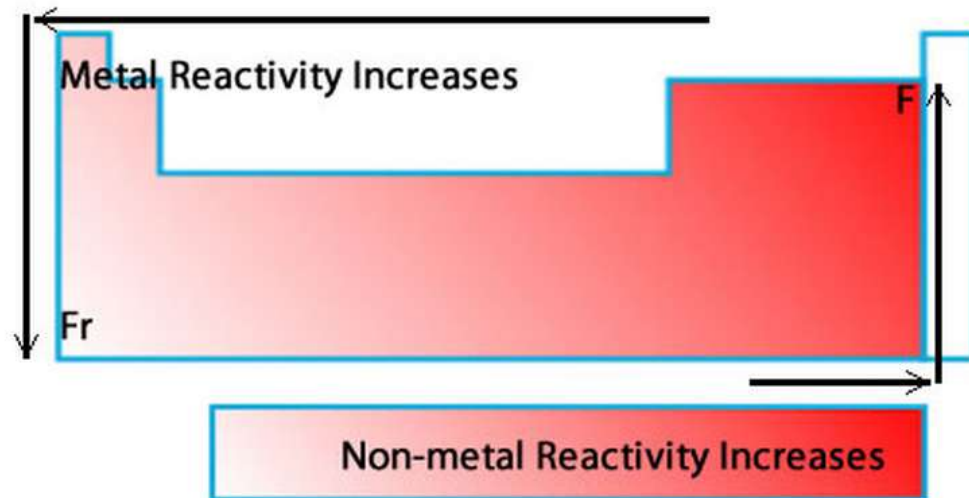
Chapter 5 - The Periodic Table

- ▶ The majority of the elements on the periodic table are classified as metals.
- ▶ Metals are elements that are shiny, good conductors of electric current and heat, solid at room temperature (except mercury), malleable, and ductile (they can be drawn into wires).
- ▶ Nonmetals are elements that are poor conductors of heat and electric current, have low boiling points, are brittle, and tend to be gases.



Chapter 5 - The Periodic Table

- ▶ Reactivity increases to the left in a row across the metals and increases down in a group of the metals.
- ▶ Reactivity increases to the right in a row across the nonmetals (except the noble gases are unreactive) and decreases down a group in the nonmetals.



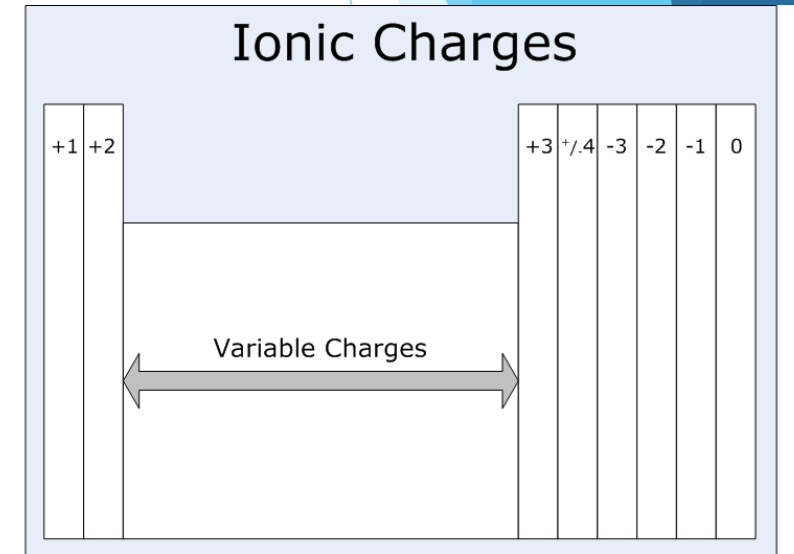
Chapter 5 - The Periodic Table

		Alkali Metal										Alkaline earth metal		Transition Metal										Metalloids					Non Metals					Noble Gas
		Lanthanide										Actinide					Other Metals																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																	
1A	2A	3B	4B	5B	6B	7B	VIII		9B	10B	11B	12B	3A	4A	5A	6A	7A	8A																
1 H 1.0079																		2 He 4.0026																
3 Li 6.941	4 Be 9.0122												5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180																
11 Na 22.990	12 Mg 24.305												13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948																
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38		31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.796																
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.96	43 Tc 98.00	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41		49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29																
55 Cs 132.91	56 Ba 137.33		72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59		81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222																
87 Fr 223	88 Ra 226		104 Rf 261	105 Db 268	106 Sg 271	107 Bh 272	108 Hs 277	109 Mt 278	110 Ds 281	111 Rg 286	112 Cn 285		113 Uut -	114 Fl 287	115 Uup -	116 Lv 291	117 Uus -	118 Uuo -																

57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97
89 Ac 227	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237	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 262

Chapter 6 - Chemical Bonding

- ▶ When the highest occupied energy level of an atom is filled with electrons, the atom is stable and not likely to react.
- ▶ The noble gases have stable electron configurations with eight valence electrons (or two in the case of helium).
- ▶ Some elements achieve stable electron configurations through the transfer of electrons between atoms.
- ▶ An atom that has a net positive or negative charge is called an ion.

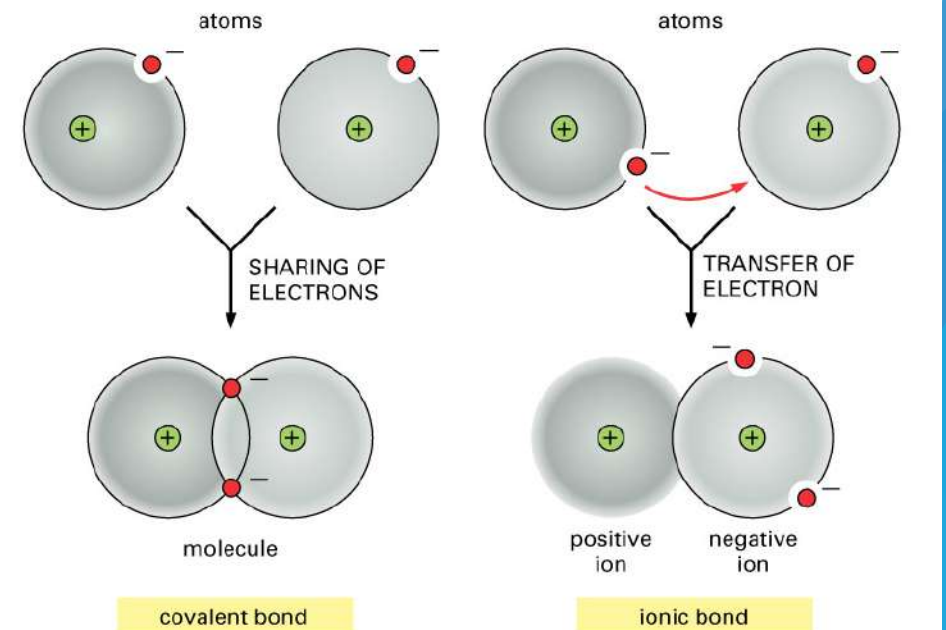


Chapter 6 - Chemical Bonding

- ▶ When an ionic bond is formed, electrons are transferred until each atom has a full outer energy level.
- ▶ Ionic compounds tend to have high melting points (above 300°C).
- ▶ Ionic compounds are poor conductors in the solid state, but they can conduct heat or electricity when they are melted.
- ▶ Ionic compounds are brittle, so they shatter when struck by a hammer.
- ▶ The properties of ionic compounds can be explained by the strong attractions among ions within a crystal lattice.

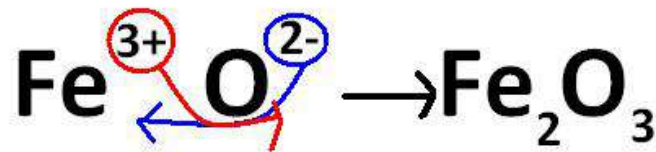
Chapter 6 - Chemical Bonding

- ▶ A covalent bond is a chemical bond in which two atoms share a pair of valence electrons.
- ▶ Many nonmetal elements exist as diatomic molecules. Diatomic means two atoms. They are H_2 , N_2 , O_2 , F_2 , Cl_2 , Br_2 , and I_2 .



Chapter 6 - Chemical Bonding

- ▶ When naming an ionic compound the name of the metal (cation) does not change and the name of the nonmetal (anion) has the suffix -ide.
- ▶ Ex. MgBr_2 = magnesium bromide
- ▶ To balance the charges in an ionic compound, you can cross the charges if they are not the same.



Chapter 6 - Chemical Bonding

- ▶ Molecular compounds only contain nonmetals.
- ▶ The name of the first element is the same. The name of the second element ends in the suffix -ide.
- ▶ Prefixes tell the number of atoms of each element. A prefix is not used when the first element only has 1 atom.
- ▶ Ex. CO_2 = carbon dioxide

1 = mono	6 = hexa
2 = di	7 = hepta
3 = tri	8 = octa
4 = tetra	9 = nona
5 = penta	10 = deca

Chapter 6 - Chemical Bonding

- ▶ Write the symbols for the elements in the order the elements appear in the name. The prefixes indicate the number of atoms of each element in this molecule.
- ▶ Ex: diphosphorus pentoxide = P_2O_5

Chapter 6 - Chemical Bonding

- ▶ In a metal, valence electrons are free to move among the atoms, so the cations are surrounded by a sea of electrons.
- ▶ The more valence electrons an atom can contribute to the shared pool, the stronger the metallic bond will be.
- ▶ The mobility of electrons within a metal lattice explains the fact that metals are good conductors and malleable.
- ▶ An alloy is a mixture of two or more elements that have metallic properties.

