

Periodic Table of the Elements

	I A	II A	III B	IV B	V B	VI B	VII B		VIII B		I B	II B	III A	IV A	V A	VI A	VII A	VIII A				
1	1 H 1.008																1 H 1.008	2 He 4.0026				
2	3 Li 6.939	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 20.183				
3	11 Na 22.99	12 Mg 24.312											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948				
4	19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.89	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.932	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.922	34 Se 78.96	35 Br 79.909	36 Kr 83.8				
5	37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc * 98	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.9	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.61	53 I 126.9	54 Xe 131.29				
6	55 Cs 132.91	56 Ba 137.33	57 **La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.29	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po * 209	85 At * 210	86 Rn * 222				
7	87 Fr * 223	88 Ra 226.03	89 ***Ac 227.03	104 Rf * 261	105 Ha * 262	106 Sg * 263	107 Ns * 262	108 Hs * 265	109 Mt * 268	110 Uun * 269	111 Uuu * 272	112 Unb * 277		114 Uuq *285		116 Uuh *289		118 Uuo *293				
													Based on symbols used by ACS S.M.Condren 2001									
					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 162.51	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97				
	* Designates that all isotopes are radioactive	**Lanthanum Series			90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	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				
		*** Actinium Series																				

Valance, Charge on Ions

- compounds have electrical neutrality
- metals form positive monatomic ions
- non-metals form negative monatomic ions

Valence of Metal Ions

Monatomic Ions

Group IA $\rightarrow +1$

Group IIA $\rightarrow +2$

Maximum positive valence
equals

Group A #

Valence of Non-Metal Ions

Monatomic Ions

Group VIA $\rightarrow -2$

Group VIIA $\rightarrow -1$

Maximum negative valence
equals

$(8 - \text{Group A \#})$

Types of Elements

metals

nonmetals

metalloids – semimetals

Charges on Some Common Monatomic Cations and Anions

Hydrogen appears twice because it can gain or lose an electron.

H^+																	H^-
												7A	8A				
												(17)	(18)				
1A	2A											3A	4A	5A	6A		
(1)	(2)											(13)	(14)	(15)	(16)		
Li^+		3B	4B	5B	6B	7B	8B	8B	8B	1B	2B						
Na^+	Mg^{2+}	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)						
K^+	Ca^{2+}		Ti^{2+}		Cr^{2+} Cr^{3+}	Mn^{2+}	Fe^{2+} Fe^{3+}	Co^{2+} Co^{3+}	Ni^{2+}	Cu^+ Cu^{2+}	Zn^{2+}			Se^{2-}	Br^-		
Rb^+	Sr^{2+}									Ag^+	Cd^{2+}			Te^{2-}	I^-		
Cs^+	Ba^{2+}										Hg_2^{2+} Hg^{2+}			Pb^{2+}	Bi^{3+}		

Transition metals can lose varying numbers of electrons, forming cations with different charges.

Family Names

Group IA alkali metals

Group IIA alkaline earth metals

Group VIIA halogens

Group VIIIA noble gases

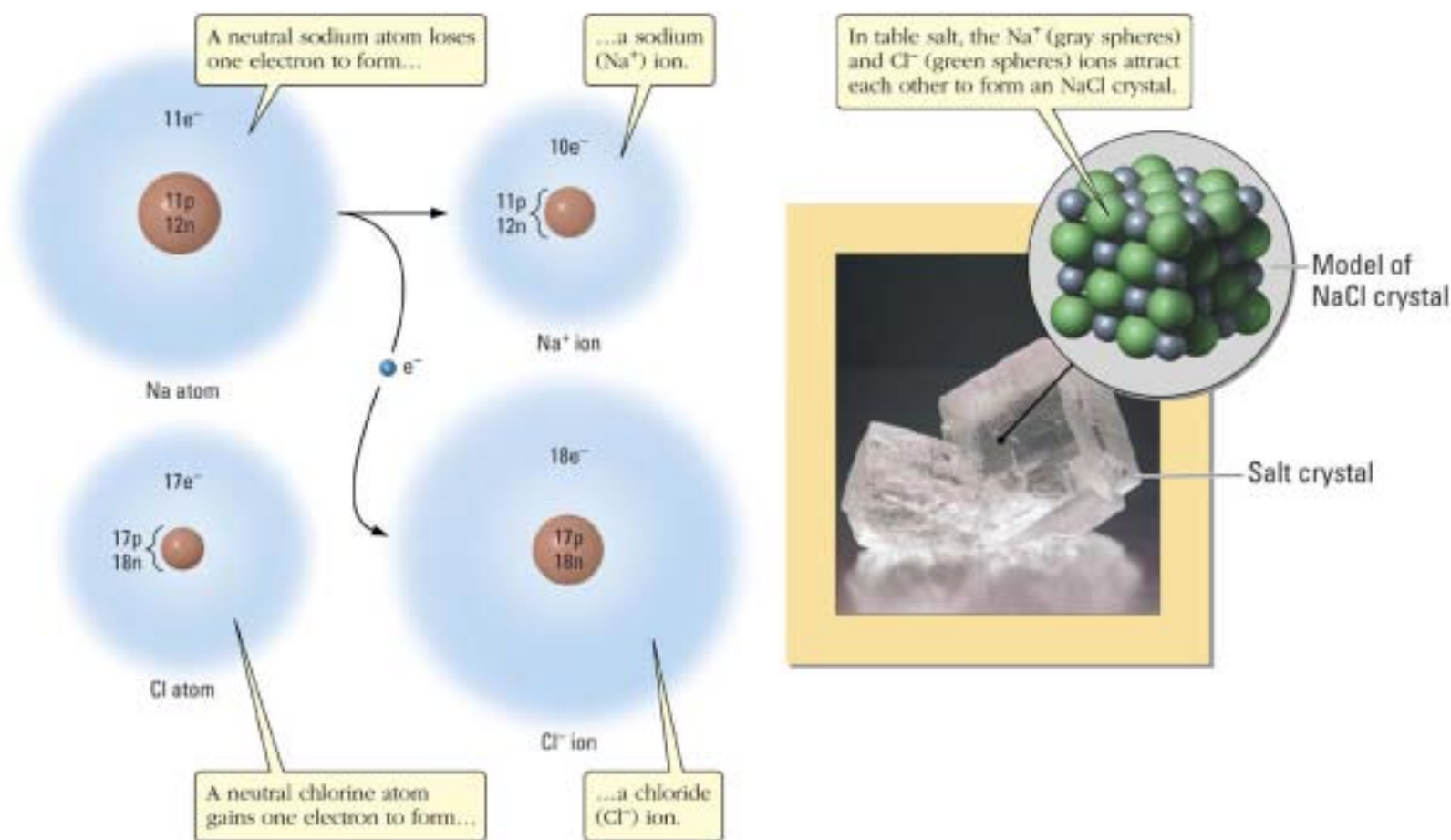
transition metals

inner transition metals




- lanthanum series rare earths

- actinium series trans-uranium series

Formation of Ionic Compound, NaCl



Alkanes and their Alcohols

Alkane			Alcohol			Molecular Model
Alkane		Alkane Boiling Point	Alcohol		Alcohol Boiling Point	
Methane	CH ₄	-161.6 °C	Methanol	CH ₃ OH	65 °C	
Ethane	CH ₃ CH ₃	-88.6 °C	Ethanol	CH ₃ CH ₂ OH	78 °C	
Propane	CH ₃ CH ₂ CH ₃	-42.1 °C	Propanol	CH ₃ CH ₂ CH ₂ OH	97 °C	

Hydrocarbons and Alcohols

- alkanes – C_nH_{2n+2}
- alkenes – C_nH_{2n}
- alkynes – C_nH_{2n-2}
- alcohols – ROH
 - where R refers to the hydrocarbon radical backbone
 - created by substituting an -OH functional group for a H atom in the hydrocarbon

Alkanes – C_nH_{2n+2}


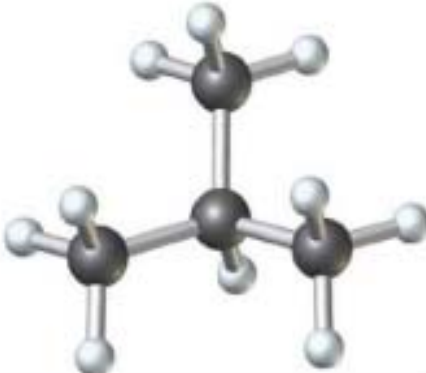
- methane – CH_4
- ethane – C_2H_6
- propane – C_3H_8
- butanes – C_4H_{10}
- pentanes – C_5H_{12}
- hexanes – C_6H_{14}
- heptanes – C_7H_{16}
- octanes – C_8H_{18}
- nonanes – C_9H_{20}
- decanes – $C_{10}H_{22}$

Butane

- Butane molecules are present in the liquid and gaseous states in the lighter



Straight & Branch-Chain Alkanes

Molecular Formula	Condensed Formula	Structural Formula	Molecular Model
Butane C_4H_{10}	$CH_3CH_2CH_2CH_3$ Melting point $-138\text{ }^{\circ}C$ Boiling point $-0.5\text{ }^{\circ}C$	<pre> H H H H H-C - C - C - C-H H H H H</pre>	
Methylpropane	CH_3CHCH_3 CH_3 Boiling point $-11.6\text{ }^{\circ}C$	<pre> H H-C-H H H H-C - C - C-H H H H</pre>	

Alkane Isomers

TABLE 3.6 Alkane Isomers

Molecular Formula	Number of Isomers	Molecular Formula	Number of Isomers
CH ₄	1	C ₉ H ₂₀	35
C ₂ H ₆	1	C ₁₀ H ₂₂	75
C ₃ H ₈	1	C ₁₂ H ₂₆	355
C ₄ H ₁₀	2	C ₁₅ H ₃₂	4,347
C ₅ H ₁₂	3	C ₂₀ H ₄₂	366,319
C ₆ H ₁₄	5	C ₃₀ H ₆₂	4,111,846,763
C ₇ H ₁₆	9	C ₄₀ H ₈₂	62,491,178,805,831
C ₈ H ₁₈	18		