

# Unit 4

THE PERIODIC TABLE																					
1 IA		2 IIA		VIIIB																	
<b>H</b>		<b>Li</b>		<b>Be</b>		<b>Hydrogen</b>															
1	1.008 Hydrogen	2	6.94 Lithium	3	9.01 Beryllium	4	10.00 Boron	5	11.98 Silicon	6	12.01 Phosphorus	7	14.01 Sulfur	8	15.99 Chlorine	9	16.00 Fluorine	10	17.98 Neon		
11	<b>Mg</b>	12	<b>Al</b>	13	<b>B</b>	14	<b>C</b>	15	<b>N</b>	16	<b>O</b>	17	<b>F</b>	18	<b>Ne</b>	19	<b>He</b>				
11	12.09 Magnesium	12	13.14 Aluminum	13	10.81 Boron	14	12.01 Carbon	15	14.01 Nitrogen	16	16.00 Oxygen	17	17.98 Fluorine	18	18.00 Neon	19	4.00 Helium				
20	<b>K</b>	21	<b>Ca</b>	22	<b>Ti</b>	23	<b>V</b>	24	<b>Cr</b>	25	<b>Mn</b>	26	<b>Fe</b>	27	<b>Co</b>	28	<b>Ni</b>	29	<b>Cu</b>	30	<b>Zn</b>
39.10	22.99 Potassium	40.08 Calcium	41.98 Scandium	47.88 Titanium	50.94 Vanadium	52.00 Chromium	54.94 Manganese	55.85 Iron	58.93 Cobalt	58.69 Nickel	63.55 Osmium	65.39 Copper	67.86 Zinc	69.72 Gallium	70.90 Germanium	72.61 Arsenic	74.92 Antimony	75.96 Bismuth	79.90 Boron		
40.47	<b>Rb</b>	41	<b>Sr</b>	42	<b>Y</b>	43	<b>Nb</b>	44	<b>Mo</b>	45	<b>Ru</b>	46	<b>Pd</b>	47	<b>Ag</b>	48	<b>Cd</b>	49	<b>In</b>	50	<b>Sn</b>
85.47	87.62 Rhenium	88.91	89.91 Strontium	91.22 Yttrium	92.91 Zirconium	95.94 Niobium	97.91 Molybdenum	99.07 Technetium	101.07 Ruthenium	102.91 Rhodium	106.42 Palladium	107.87 Silver	112.41 Cadmium	114.82 Indium	118.71 Tin	121.76 Antimony	126.90 Tellurium	127.60 Iodine	131.29 Xenon	131.29 Krypton	
55.00	<b>Cs</b>	56	<b>Ba</b>	57	<b>La</b>	58	<b>Hf</b>	59	<b>Ta</b>	60	<b>W</b>	61	<b>Re</b>	62	<b>Os</b>	63	<b>Ir</b>	64	<b>Pt</b>	65	<b>Au</b>
132.91	137.33 Cerium	138.91 Barium	138.91 Lanthanum	178.49 Hafnium	180.95 Tantalum	183.85 Tungsten	186.21 Rhenium	190.2 Osmium	192.22 Iridium	195.08 Platinum	196.97 Gold	200.59 Mercury	204.38 Thallium	207.2 Lead	208.98 Bismuth	210.2 Polonium	210.2 Astatine	210.2 Rhenium	210.2 Rhenium		
87.00	<b>Fr</b>	88	<b>Ra</b>	89	<b>Ac</b>	90	<b>Rf</b>	91	<b>Db</b>	92	<b>Sg</b>	93	<b>Bh</b>	94	<b>Hs</b>	95	<b>Mt</b>	96	<b>Tl</b>	97	<b>Pb</b>
223.02	229.03 Francium	229.03 Radium	227.03 Actinium	227.03 Rutherfordium	262.01 Dubnium	263.01 Seaborgium	262.01 Moscovium	265.01 Nihonium	265.01 Moscovium	265.01 Nhonium	266.01 Moscovium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	266.01 Nhonium	
140.12	<b>Ce</b>	140.91 Cerium	144.24 Praseodymium	144.24 Neodymium	145.01 Promethium	150.36 Samarium	152.97 Europium	157.25 Gadolinium	158.93 Dysprosium	162.50 Holmium	164.93 Dysprosium	167.26 Erbium	168.93 Thulium	169.93 Dysprosium	173.04 Terbium	174.97 Dysprosium	175.04 Dysprosium	175.04 Dysprosium	175.04 Dysprosium	175.04 Dysprosium	
232.04	<b>Th</b>	232.04 Thorium	231.04 Protactinium	238.03 Plutonium	238.03 Neptunium	237.05 (240)	243.06 Plutonium	243.06 (247)	243.06 Curium	243.06 (248)	243.06 Berkelium	243.06 (251)	252.08 Cf	257.10 Fermium	257.10 (257)	257.10 Mendelevium	259.10 Nobelium	262.11 Lawrencium	262.11 Lawrencium		
90	<b>Pa</b>	91	<b>U</b>	92	<b>Np</b>	93	<b>Pu</b>	94	<b>Am</b>	95	<b>Cm</b>	96	<b>Bk</b>	97	<b>Es</b>	98	<b>Fm</b>	99	<b>Md</b>	100	<b>No</b>
103	<b>Fr</b>	104	<b>Db</b>	105	<b>Sg</b>	106	<b>Bh</b>	107	<b>Hs</b>	108	<b>Mt</b>	109	<b>Tl</b>	110	<b>Pb</b>	111	<b>Bi</b>	112	<b>Po</b>	113	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
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116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
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116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	121	<b>Mt</b>	122	<b>Tl</b>	123	<b>Pb</b>	124	<b>Bi</b>	125	<b>Po</b>	126	<b>At</b>
116	<b>Fr</b>	117	<b>Db</b>	118	<b>Sg</b>	119	<b>Bh</b>	120	<b>Hs</b>	1											

## Newlands-Octaves (1865)

-  Newlands arranged the elements then known in the following manner.(seven groups of 7)

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca					

Every 8th element has repeating chemical and physical properties

## DIMITRI MENDELEEV

- ☞ was a Russian chemist and inventor.
- ☞ He is credited as being the creator of the first version of the periodic table of elements.
- ☞ Using the table, he predicted the properties of elements yet to be discovered.



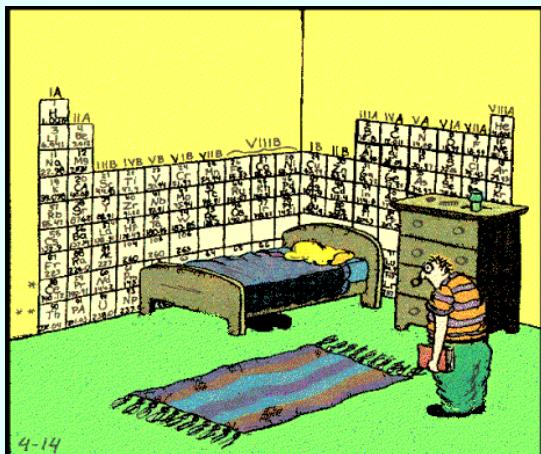
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## Unit 4 The Periodic Table

PERIODIC SYSTEM OF THE ELEMENTS IN GROUPS AND SERIES.										
Series	GROUPS OF ELEMENTS									
	O	I	II	III	IV	V	VI	VII	VIII	
1	Hydrogen H 1.008	—	—	—	—	—	—	—	—	—
2	He Lithium Li 7.03	Beryllium Be 9.1	Boron B 11.0	Carbon C 12.0	Nitrogen N 14.04	Oxygen O 16.00	Fluorine F 19.0			
3	Neon Ne 10.0	Sodium Na 22.05	Magnesium Mg 24.3	Aluminum Al 27.0	Silicon Si 28.4	Phosphorus P 31.0	Sulfur S 32.06	Chlorine Cl 35.45		
4	Argon Ar 39.9	Potassium K 39.1	Calcium Ca 40.1	Scandium Sc 44.9	Titanium Ti 48.1	Vanadium V 51.4	Chromium Cr 52.1	Manganese Mn 55.0	Iron Fe 55.9	Cobalt Co 59
5		Copper Cu 63.6	Zinc Zn 65.4	Gallium Ga 70.0	Germanium Ge 72.3	Arsenic As 75	Selenium Se 78	Bromine Br 79.95		Nickel Ni 59
6	Krypton Kr 87.6	Rubidium Rb 87.6	Strontium Sr 88.0	Yttrium Y 89.0	Zirconium Zr 90.6	Niobium Nb 94.0	Molybdenum Mo 96.0		Ruthenium Ru 101.7	Rhenium Re 103.0
7		Silver Ag 107.8	Cadmium Cd 112.4	Inodium In 114.0	Tin Sn 119.0	Antimony Sb 120.0	Tellurium Te 127	Iodine I 127	Palladium Pd 106.6	
8	Xenon Xe 132.9	Cesium Cs 137.4	Barium Ba 138.0	Lanthanum La 139	Cerium Ce 140					
9										
10										
11		Gold Au 197.2	Mercury Hg 200.0	Thallium Tl 204.1	Lead Pb 206.9	Bismuth Bi 208	Tungsten W 184			
12			Radium Ra 224	Thorium Th 232			Uranium U 239			

HIGHER SALINE OXIDES  
 | R | RO | RO<sub>2</sub> | RO<sub>3</sub> | RO<sub>4</sub> | RO<sub>5</sub> | RO<sub>6</sub> | RO<sub>7</sub> | RO<sub>8</sub> | RO<sub>9</sub> | RO<sub>10</sub> | RO<sub>11</sub> | RO<sub>12</sub> | RO<sub>13</sub> | RO<sub>14</sub> | RO<sub>15</sub> | RO<sub>16</sub> | RO<sub>17</sub> | RO<sub>18</sub> | RO<sub>19</sub> | RO<sub>20</sub> | RO<sub>21</sub> | RO<sub>22</sub> | RO<sub>23</sub> | RO<sub>24</sub> | RO<sub>25</sub> | RO<sub>26</sub> | RO<sub>27</sub> | RO<sub>28</sub> | RO<sub>29</sub> | RO<sub>30</sub> | RO<sub>31</sub> | RO<sub>32</sub> | RO<sub>33</sub> | RO<sub>34</sub> | RO<sub>35</sub> | RO<sub>36</sub> | RO<sub>37</sub> | RO<sub>38</sub> | RO<sub>39</sub> | RO<sub>40</sub> | RO<sub>41</sub> | RO<sub>42</sub> | RO<sub>43</sub> | RO<sub>44</sub> | RO<sub>45</sub> | RO<sub>46</sub> | RO<sub>47</sub> | RO<sub>48</sub> | RO<sub>49</sub> | RO<sub>50</sub> | RO<sub>51</sub> | RO<sub>52</sub> | RO<sub>53</sub> | RO<sub>54</sub> | RO<sub>55</sub> | RO<sub>56</sub> | RO<sub>57</sub> | RO<sub>58</sub> | RO<sub>59</sub> | RO<sub>60</sub> | RO<sub>61</sub> | RO<sub>62</sub> | RO<sub>63</sub> | RO<sub>64</sub> | RO<sub>65</sub> | RO<sub>66</sub> | RO<sub>67</sub> | RO<sub>68</sub> | RO<sub>69</sub> | RO<sub>70</sub> | RO<sub>71</sub> | RO<sub>72</sub> | RO<sub>73</sub> | RO<sub>74</sub> | RO<sub>75</sub> | RO<sub>76</sub> | RO<sub>77</sub> | RO<sub>78</sub> | RO<sub>79</sub> | RO<sub>80</sub> | RO<sub>81</sub> | RO<sub>82</sub> | RO<sub>83</sub> | RO<sub>84</sub> | RO<sub>85</sub> | RO<sub>86</sub> | RO<sub>87</sub> | RO<sub>88</sub> | RO<sub>89</sub> | RO<sub>90</sub> | RO<sub>91</sub> | RO<sub>92</sub> | RO<sub>93</sub> | RO<sub>94</sub> | RO<sub>95</sub> | RO<sub>96</sub> | RO<sub>97</sub> | RO<sub>98</sub> | RO<sub>99</sub> | RO<sub>100</sub> | RO<sub>101</sub> | RO<sub>102</sub> | RO<sub>103</sub> | RO<sub>104</sub> | RO<sub>105</sub> | RO<sub>106</sub> | RO<sub>107</sub> | RO<sub>108</sub> | RO<sub>109</sub> | RO<sub>110</sub> | RO<sub>111</sub> | RO<sub>112</sub> | RO<sub>113</sub> | RO<sub>114</sub> | RO<sub>115</sub> | RO<sub>116</sub> | RO<sub>117</sub> | RO<sub>118</sub> | RO<sub>119</sub> | RO<sub>120</sub> | RO<sub>121</sub> | RO<sub>122</sub> | RO<sub>123</sub> | RO<sub>124</sub> | RO<sub>125</sub> | RO<sub>126</sub> | RO<sub>127</sub> | RO<sub>128</sub> | RO<sub>129</sub> | RO<sub>130</sub> | RO<sub>131</sub> | RO<sub>132</sub> | RO<sub>133</sub> | RO<sub>134</sub> | RO<sub>135</sub> | RO<sub>136</sub> | RO<sub>137</sub> | RO<sub>138</sub> | RO<sub>139</sub> | RO<sub>140</sub> | RO<sub>141</sub> | RO<sub>142</sub> | RO<sub>143</sub> | RO<sub>144</sub> | RO<sub>145</sub> | RO<sub>146</sub> | RO<sub>147</sub> | RO<sub>148</sub> | RO<sub>149</sub> | RO<sub>150</sub> | RO<sub>151</sub> | RO<sub>152</sub> | RO<sub>153</sub> | RO<sub>154</sub> | RO<sub>155</sub> | RO<sub>156</sub> | RO<sub>157</sub> | RO<sub>158</sub> | RO<sub>159</sub> | RO<sub>160</sub> | RO<sub>161</sub> | RO<sub>162</sub> | RO<sub>163</sub> | RO<sub>164</sub> | RO<sub>165</sub> | RO<sub>166</sub> | RO<sub>167</sub> | RO<sub>168</sub> | RO<sub>169</sub> | RO<sub>170</sub> | RO<sub>171</sub> | RO<sub>172</sub> | RO<sub>173</sub> | RO<sub>174</sub> | RO<sub>175</sub> | RO<sub>176</sub> | RO<sub>177</sub> | RO<sub>178</sub> | RO<sub>179</sub> | RO<sub>180</sub> | RO<sub>181</sub> | RO<sub>182</sub> | RO<sub>183</sub> | RO<sub>184</sub> | RO<sub>185</sub> | RO<sub>186</sub> | RO<sub>187</sub> | RO<sub>188</sub> | RO<sub>189</sub> | RO<sub>190</sub> | RO<sub>191</sub> | RO<sub>192</sub> | RO<sub>193</sub> | RO<sub>194</sub> | RO<sub>195</sub> | RO<sub>196</sub> | RO<sub>197</sub> | RO<sub>198</sub> | RO<sub>199</sub> | RO<sub>200</sub> | RO<sub>201</sub> | RO<sub>202</sub> | RO<sub>203</sub> | RO<sub>204</sub> | RO<sub>205</sub> | RO<sub>206</sub> | RO<sub>207</sub> | RO<sub>208</sub> | RO<sub>209</sub> | RO<sub>210</sub> | RO<sub>211</sub> | RO<sub>212</sub> | RO<sub>213</sub> | RO<sub>214</sub> | RO<sub>215</sub> | RO<sub>216</sub> | RO<sub>217</sub> | RO<sub>218</sub> | RO<sub>219</sub> | RO<sub>220</sub> | RO<sub>221</sub> | RO<sub>222</sub> | RO<sub>223</sub> | RO<sub>224</sub> | RO<sub>225</sub> | RO<sub>226</sub> | RO<sub>227</sub> | RO<sub>228</sub> | RO<sub>229</sub> | RO<sub>230</sub> | RO<sub>231</sub> | RO<sub>232</sub> | RO<sub>233</sub> | RO<sub>234</sub> | RO<sub>235</sub> | RO<sub>236</sub> | RO<sub>237</sub> | RO<sub>238</sub> | RO<sub>239</sub> | RO<sub>240</sub> | RO<sub>241</sub> | RO<sub>242</sub> | RO<sub>243</sub> | RO<sub>244</sub> | RO<sub>245</sub> | RO<sub>246</sub> | RO<sub>247</sub> | RO<sub>248</sub> | RO<sub>249</sub> | RO<sub>250</sub> | RO<sub>251</sub> | RO<sub>252</sub> | RO<sub>253</sub> | RO<sub>254</sub> | RO<sub>255</sub> | RO<sub>256</sub> | RO<sub>257</sub> | RO<sub>258</sub> | RO<sub>259</sub> | RO<sub>260</sub> | RO<sub>261</sub> | RO<sub>262</sub> | RO<sub>263</sub> | RO<sub>264</sub> | RO<sub>265</sub> | RO<sub>266</sub> | RO<sub>267</sub> | RO<sub>268</sub> | RO<sub>269</sub> | RO<sub>270</sub> | RO<sub>271</sub> | RO<sub>272</sub> | RO<sub>273</sub> | RO<sub>274</sub> | RO<sub>275</sub> | RO<sub>276</sub> | RO<sub>277</sub> | RO<sub>278</sub> | RO<sub>279</sub> | RO<sub>280</sub> | RO<sub>281</sub> | RO<sub>282</sub> | RO<sub>283</sub> | RO<sub>284</sub> | RO<sub>285</sub> | RO<sub>286</sub> | RO<sub>287</sub> | RO<sub>288</sub> | RO<sub>289</sub> | RO<sub>290</sub> | RO<sub>291</sub> | RO<sub>292</sub> | RO<sub>293</sub> | RO<sub>294</sub> | RO<sub>295</sub> | RO<sub>296</sub> | RO<sub>297</sub> | RO<sub>298</sub> | RO<sub>299</sub> | RO<sub>300</sub> | RO<sub>301</sub> | RO<sub>302</sub> | RO<sub>303</sub> | RO<sub>304</sub> | RO<sub>305</sub> | RO<sub>306</sub> | RO<sub>307</sub> | RO<sub>308</sub> | RO<sub>309</sub> | RO<sub>310</sub> | RO<sub>311</sub> | RO<sub>312</sub> | RO<sub>313</sub> | RO<sub>314</sub> | RO<sub>315</sub> | RO<sub>316</sub> | RO<sub>317</sub> | RO<sub>318</sub> | RO<sub>319</sub> | RO<sub>320</sub> | RO<sub>321</sub> | RO<sub>322</sub> | RO<sub>323</sub> | RO<sub>324</sub> | RO<sub>325</sub> | RO<sub>326</sub> | RO<sub>327</sub> | RO<sub>328</sub> | RO<sub>329</sub> | RO<sub>330</sub> | RO<sub>331</sub> | RO<sub>332</sub> | RO<sub>333</sub> | RO<sub>334</sub> | RO<sub>335</sub> | RO<sub>336</sub> | RO<sub>337</sub> | RO<sub>338</sub> | RO<sub>339</sub> | RO<sub>340</sub> | RO<sub>341</sub> | RO<sub>342</sub> | RO<sub>343</sub> | RO<sub>344</sub> | RO<sub>345</sub> | RO<sub>346</sub> | RO<sub>347</sub> | RO<sub>348</sub> | RO<sub>349</sub> | RO<sub>350</sub> | RO<sub>351</sub> | RO<sub>352</sub> | RO<sub>353</sub> | RO<sub>354</sub> | RO<sub>355</sub> | RO<sub>356</sub> | RO<sub>357</sub> | RO<sub>358</sub> | RO<sub>359</sub> | RO<sub>360</sub> | RO<sub>361</sub> | RO<sub>362</sub> | RO<sub>363</sub> | RO<sub>364</sub> | RO<sub>365</sub> | RO<sub>366</sub> | RO<sub>367</sub> | RO<sub>368</sub> | RO<sub>369</sub> | RO<sub>370</sub> | RO<sub>371</sub> | RO<sub>372</sub> | RO<sub>373</sub> | RO<sub>374</sub> | RO<sub>375</sub> | RO<sub>376</sub> | RO<sub>377</sub> | RO<sub>378</sub> | RO<sub>379</sub> | RO<sub>380</sub> | RO<sub>381</sub> | RO<sub>382</sub> | RO<sub>383</sub> | RO<sub>384</sub> | RO<sub>385</sub> | RO<sub>386</sub> | RO<sub>387</sub> | RO<sub>388</sub> | RO<sub>389</sub> | RO<sub>390</sub> | RO<sub>391</sub> | RO<sub>392</sub> | RO<sub>393</sub> | RO<sub>394</sub> | RO<sub>395</sub> | RO<sub>396</sub> | RO<sub>397</sub> | RO<sub>398</sub> | RO<sub>399</sub> | RO<sub>400</sub> | RO<sub>401</sub> | RO<sub>402</sub> | RO<sub>403</sub> | RO<sub>404</sub> | RO<sub>405</sub> | RO<sub>406</sub> | RO<sub>407</sub> | RO<sub>408</sub> | RO<sub>409</sub> | RO<sub>410</sub> | RO<sub>411</sub> | RO<sub>412</sub> | RO<sub>413</sub> | RO<sub>414</sub> | RO<sub>415</sub> | RO<sub>416</sub> | RO<sub>417</sub> | RO<sub>418</sub> | RO<sub>419</sub> | RO<sub>420</sub> | RO<sub>421</sub> | RO<sub>422</sub> | RO<sub>423</sub> | RO<sub>424</sub> | RO<sub>425</sub> | RO<sub>426</sub> | RO<sub>427</sub> | RO<sub>428</sub> | RO<sub>429</sub> | RO<sub>430</sub> | RO<sub>431</sub> | RO<sub>432</sub> | RO<sub>433</sub> | RO<sub>434</sub> | RO<sub>435</sub> | RO<sub>436</sub> | RO<sub>437</sub> | RO<sub>438</sub> | RO<sub>439</sub> | RO<sub>440</sub> | RO<sub>441</sub> | RO<sub>442</sub> | RO<sub>443</sub> | RO<sub>444</sub> | RO<sub>445</sub> | RO<sub>446</sub> | RO<sub>447</sub> | RO<sub>448</sub> | RO<sub>449</sub> | RO<sub>450</sub> | RO<sub>451</sub> | RO<sub>452</sub> | RO<sub>453</sub> | RO<sub>454</sub> | RO<sub>455</sub> | RO<sub>456</sub> | RO<sub>457</sub> | RO<sub>458</sub> | RO<sub>459</sub> | RO<sub>460</sub> | RO<sub>461</sub> | RO<sub>462</sub> | RO<sub>463</sub> | RO<sub>464</sub> | RO<sub>465</sub> | RO<sub>466</sub> | RO<sub>467</sub> | RO<sub>468</sub> | RO<sub>469</sub> | RO<sub>470</sub> | RO<sub>471</sub> | RO<sub>472</sub> | RO<sub>473</sub> | RO<sub>474</sub> | RO<sub>475</sub> | RO<sub>476</sub> | RO<sub>477</sub> | RO<sub>478</sub> | RO<sub>479</sub> | RO<sub>480</sub> | RO<sub>481</sub> | RO<sub>482</sub> | RO<sub>483</sub> | RO<sub>484</sub> | RO<sub>485</sub> | RO<sub>486</sub> | RO<sub>487</sub> | RO<sub>488</sub> | RO<sub>489</sub> | RO<sub>490</sub> | RO<sub>491</sub> | RO<sub>492</sub> | RO<sub>493</sub> | RO<sub>494</sub> | RO<sub>495</sub> | RO<sub>496</sub> | RO<sub>497</sub> | RO<sub>498</sub> | RO<sub>499</sub> | RO<sub>500</sub> | RO<sub>501</sub> | RO<sub>502</sub> | RO<sub>503</sub> | RO<sub>504</sub> | RO<sub>505</sub> | RO<sub>506</sub> | RO<sub>507</sub> | RO<sub>508</sub> | RO<sub>509</sub> | RO<sub>510</sub> | RO<sub>511</sub> | RO<sub>512</sub> | RO<sub>513</sub> | RO<sub>514</sub> | RO<sub>515</sub> | RO<sub>516</sub> | RO<sub>517</sub> | RO<sub>518</sub> | RO<sub>519</sub> | RO<sub>520</sub> | RO<sub>521</sub> | RO<sub>522</sub> | RO<sub>523</sub> | RO<sub>524</sub> | RO<sub>525</sub> | RO<sub>526</sub> | RO<sub>527</sub> | RO<sub>528</sub> | RO<sub>529</sub> | RO<sub>530</sub> | RO<sub>531</sub> | RO<sub>532</sub> | RO<sub>533</sub> | RO<sub>534</sub> | RO<sub>535</sub> | RO<sub>536</sub> | RO<sub>537</sub> | RO<sub>538</sub> | RO<sub>539</sub> | RO<sub>540</sub> | RO<sub>541</sub> | RO<sub>542</sub> | RO<sub>543</sub> | RO<sub>544</sub> | RO<sub>545</sub> | RO<sub>546</sub> | RO<sub>547</sub> | RO<sub>548</sub> | RO<sub>549</sub> | RO<sub>550</sub> | RO<sub>551</sub> | RO<sub>552</sub> | RO<sub>553</sub> | RO<sub>554</sub> | RO<sub>555</sub> | RO<sub>556</sub> | RO<sub>557</sub> | RO<sub>558</sub> | RO<sub>559</sub> | RO<sub>560</sub> | RO<sub>561</sub> | RO<sub>562</sub> | RO<sub>563</sub> | RO<sub>564</sub> | RO<sub>565</sub> | RO<sub>566</sub> | RO<sub>567</sub> | RO<sub>568</sub> | RO<sub>569</sub> | RO<sub>570</sub> | RO<sub>571</sub> | RO<sub>572</sub> | RO<sub>573</sub> | RO<sub>574</sub> | RO<sub>575</sub> | RO<sub>576</sub> | RO<sub>577</sub> | RO<sub>578</sub> | RO<sub>579</sub> | RO<sub>580</sub> | RO<sub>581</sub> | RO<sub>582</sub> | RO<sub>583</sub> | RO<sub>584</sub> | RO<sub>585</sub> | RO<sub>586</sub> | RO<sub>587</sub> | RO<sub>588</sub> | RO<sub>589</sub> | RO<sub>590</sub> | RO<sub>591</sub> | RO<sub>592</sub> | RO<sub>593</sub> | RO<sub>594</sub> | RO<sub>595</sub> | RO<sub>596</sub> | RO<sub>597</sub> | RO<sub>598</sub> | RO<sub>599</sub> | RO<sub>600</sub> | RO<sub>601</sub> | RO<sub>602</sub> | RO<sub>603</sub> | RO<sub>604</sub> | RO<sub>605</sub> | RO<sub>606</sub> | RO<sub>607</sub> | RO<sub>608</sub> | RO<sub>609</sub> | RO<sub>610</sub> | RO<sub>611</sub> | RO<sub>612</sub> | RO<sub>613</sub> | RO<sub>614</sub> | RO<sub>615</sub> | RO<sub>616</sub> | RO<sub>617</sub> | RO<sub>618</sub> | RO<sub>619</sub> | RO<sub>620</sub> | RO<sub>621</sub> | RO<sub>622</sub> | RO<sub>623</sub> | RO<sub>624</sub> | RO<sub>625</sub> | RO<sub>626</sub> | RO<sub>627</sub> | RO<sub>628</sub> | RO<sub>629</sub> | RO<sub>630</sub> | RO<sub>631</sub> | RO<sub>632</sub> | RO<sub>633</sub> | RO<sub>634</sub> | RO<sub>635</sub> | RO<sub>636</sub> | RO<sub>637</sub> | RO<sub>638</sub> | RO<sub>639</sub> | RO<sub>640</sub> | RO<sub>641</sub> | RO<sub>642</sub> | RO<sub>643</sub> | RO<sub>644</sub> | RO<sub>645</sub> | RO<sub>646</sub> | RO<sub>647</sub> | RO<sub>648</sub> | RO<sub>649</sub> | RO<sub>650</sub> | RO<sub>651</sub> | RO<sub>652</sub> | RO<sub>653</sub> | RO<sub>654</sub> | RO<sub>655</sub> | RO<sub>656</sub> | RO<sub>657</sub> | RO<sub>658</sub> | RO<sub>659</sub> | RO<sub>660</sub> | RO<sub>661</sub> | RO<sub>662</sub> | RO<sub>663</sub> | RO<sub>664</sub> | RO<sub>665</sub> | RO<sub>666</sub> | RO<sub>667</sub> | RO<sub>668</sub> | RO<sub>669</sub> | RO<sub>670</sub> | RO<sub>671</sub> | RO<sub>672</sub> | RO<sub>673</sub> | RO<sub>674</sub> | RO<sub>675</sub> | RO<sub>676</sub> | RO<sub>677</sub> | RO<sub>678</sub> | RO<sub>679</sub> | RO<sub>680</sub> | RO<sub>681</sub> | RO<sub>682</sub> | RO<sub>683</sub> | RO<sub>684</sub> | RO<sub>685</sub> | RO<sub>686</sub> | RO<sub>687</sub> | RO<sub>688</sub> | RO<sub>689</sub> | RO<sub>690</sub> | RO<sub>691</sub> | RO<sub>692</sub> | RO<sub>693</sub> | RO<sub>694</sub> | RO<sub>695</sub> | RO<sub>696</sub> | RO<sub>697</sub> | RO<sub>698</sub> | RO<sub>699</sub> | RO<sub>700</sub> | RO<sub>701</sub> | RO<sub>702</sub> | RO<sub>703</sub> | RO<sub>704</sub> | RO<sub>705</sub> | RO<sub>706</sub> | RO<sub>707</sub> | RO<sub>708</sub> | RO<sub>709</sub> | RO<sub>710</sub> | RO<sub>711</sub> | RO<sub>712</sub> | RO<sub>713</sub> | RO<sub>714</sub> | RO<sub>715</sub> | RO<sub>716</sub> | RO<sub>717</sub> | RO<sub>718</sub> | RO<sub>719</sub> | RO<sub>720</sub> | RO<sub>721</sub> | RO<sub>722</sub> | RO<sub>723</sub> | RO<sub>724</sub> | RO<sub>725</sub> | RO<sub>726</sub> | RO<sub>727</sub> | RO<sub>728</sub> | RO<sub>729</sub> | RO<sub>730</sub> | RO<sub>731</sub> | RO<sub>732</sub> | RO<sub>733</sub> | RO<sub>734</sub> | RO<sub>735</sub> | RO<sub>736</sub> | RO<sub>737</sub> | RO<sub>738</sub> | RO<sub>739</sub> | RO<sub>740</sub> | RO<sub>741</sub> | RO<sub>742</sub> | RO<sub>743</sub> | RO<sub>744</sub> | RO<sub>745</sub> | RO<sub>746</sub> | RO<sub>747</sub> | RO<sub>748</sub> | RO<sub>749</sub> | RO<sub>750</sub> | RO<sub>751</sub> | RO<sub>752</sub> | RO<sub>753</sub> | RO<sub>754</sub> | RO<sub>755</sub> | RO<sub>756</sub> | RO<sub>757</sub> | RO<sub>758</sub> | RO<sub>759</sub> | RO<sub>760</sub> | RO<sub>761</sub> | RO<sub>762</sub> | RO<sub>763</sub> | RO<sub>764</sub> | RO<sub>765</sub> | RO<sub>766</sub> | RO<sub>767</sub> | RO<sub>768</sub> | RO<sub>769</sub> | RO<sub>770</sub> | RO<sub>771</sub> | RO<sub>772</sub> | RO<sub>773</sub> | RO<sub>774</sub> | RO<sub>775</sub> | RO<sub>776</sub> | RO<sub>777</sub> | RO<sub>778</sub> | RO<sub>779</sub> | RO<sub>780</sub> | RO<sub>781</sub> | RO<sub>782</sub> | RO<sub>783</sub> | RO<sub>784</sub> | RO<sub>785</sub> | RO<sub>786</sub> | RO<sub>787</sub> | RO<sub>788</sub> | RO<sub>789</sub> | RO<sub>790</sub> | RO<sub>791</sub> | RO<sub>792</sub> | RO<sub>793</sub> | RO<sub>794</sub> | RO<sub>795</sub> | RO<sub>796</sub> | RO<sub>797</sub> | RO<sub>798</sub> | RO<sub>799</sub> | RO<sub>800</sub> | RO<sub>801</sub> | RO<sub>802</sub> | RO<sub>803</sub> | RO<sub>804</sub> | RO<sub>805</sub> | RO<sub>806</sub> | RO<sub>807</sub> | RO<sub>808</sub> | RO<sub>809</sub> | RO<sub>810</sub> | RO<sub>811</sub> | RO<sub>812</sub> | RO<sub>813</sub> | RO<sub>814</sub> | RO<sub>815</sub> | RO<sub>816</sub> | RO<sub>817</sub> | RO<sub>818</sub> | RO<sub>819</sub> | RO<sub>820</sub> | RO<sub>821</sub> | RO<sub>822</sub> | RO<sub>823</sub> | RO<sub>824</sub> | RO<sub>825</sub> | RO<sub>826</sub> | RO<sub>827</sub> | RO<sub>828</sub> | RO<sub>829</sub> | RO<sub>830</sub> | RO<sub>831</sub> | RO<sub>832</sub> | RO<sub>833</sub> | RO<sub>834</sub> | RO

# OLD-Mendeleev (atomic mass)



# NEW-Moseley (atomic number)

(Tells you the valence shell)  
Period #'s-horizontally rows (read left to right)

\*A groups tell you the # of valence electrons

Groups / Families  
Read top to bottom

Non-metals

Metalloids

Metals

Lanthanide series

Actinide series

## Unit 4 The Periodic Table

### Representative elements

- \* Group A elements
- \* Represent a wide range of physical and chemical properties
- \* metals, nonmetals, metalloids

#### Metals

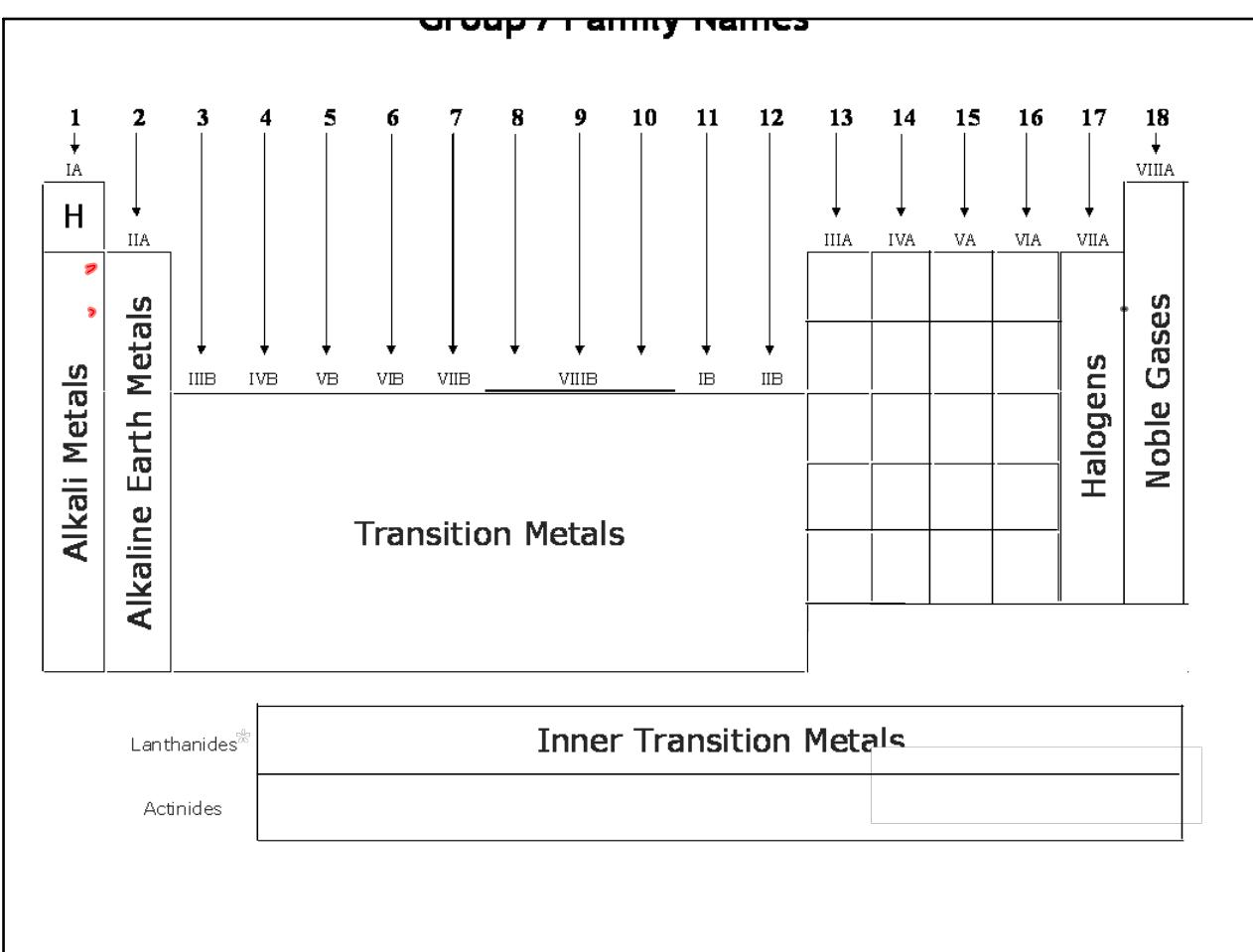
- \* left side of pd table
- \* ductile & malleable
- \* Usually shiny (not shiny!!)
- \* Good Conductors
- \* Mostly solids
- \* **LOSE** electrons to (not loose!) form bonds (**form CATIONS**)

#### Nonmetals

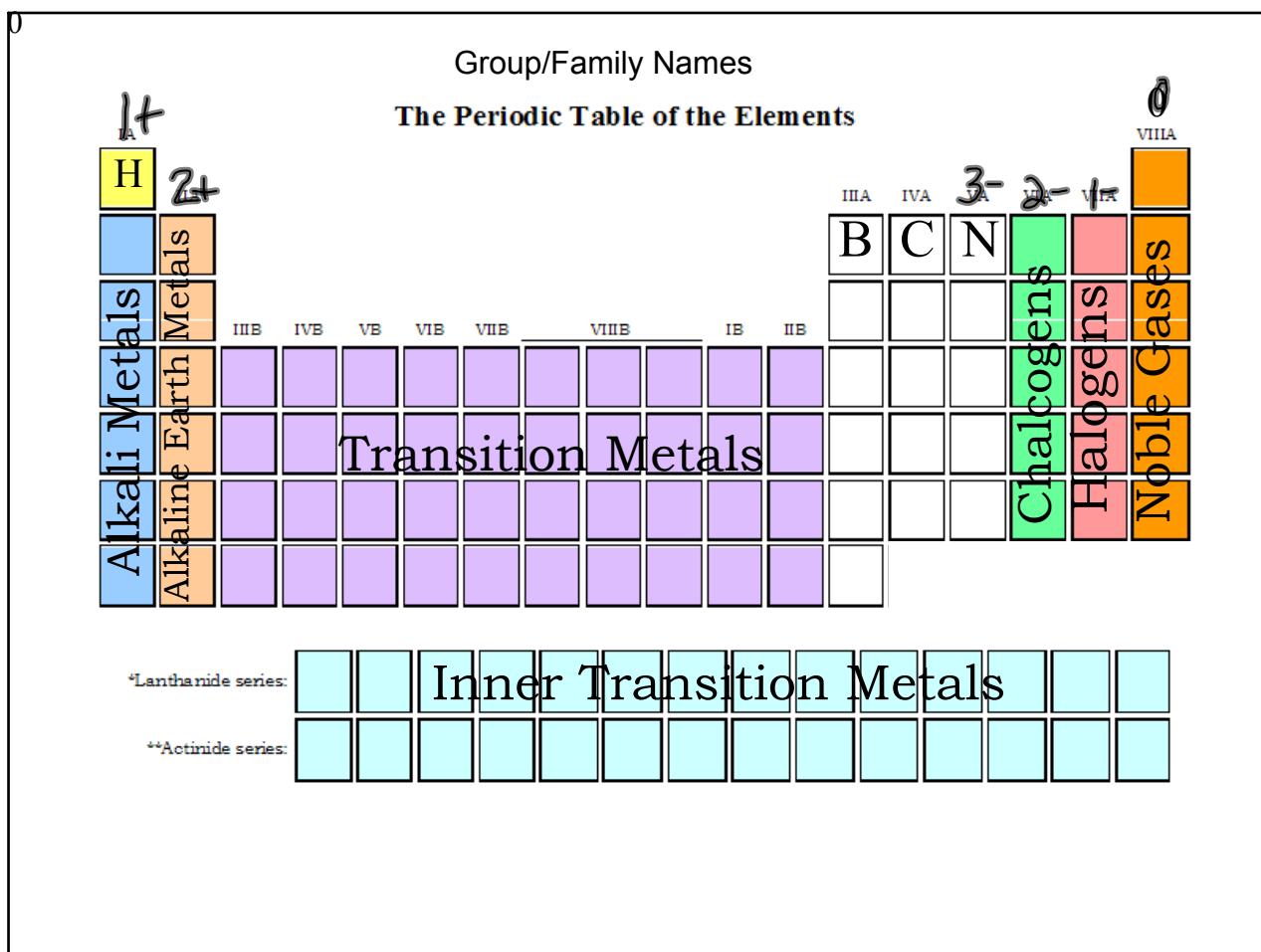
- \* right side of pd. table
- \* Brittle
- \* Dull
- \* Poor Conductors
- \* Mostly gases
- \* **GAIN** electrons to form bonds (**form ANIONS**)

#### Semi-Metals/Metalloids

- \* Share properties of both metal and non-metals
- \* Found on the line b/w metal and non-metals
- ★(except Aluminum, Al!!!)★



## Unit 4 The Periodic Table



A groups tell you the  
# of valence electrons

(Tells you the valence shell)

Periods-horizontal rows (read left to right) →

Read top to bottom ↓

1	2	3	4	5	6	7	8												
H 1.0	Be 9.0	Mg 24.3	Al 13.3	Si 14.0	P 15.0	S 16.0	Cl 17.0												
Li 6.9	Be 9.0	Mg 24.3	Al 13.3	Si 14.0	P 15.0	S 16.0	Ar 18.2												
Na 23.0	Mg 24.3	Al 13.3	Si 14.0	P 15.0	S 16.0	Cl 17.0	Ne 20.2												
K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.8	Co 58.9	Ni 58.7	Zn 63.5	Cu 65.4	Ga 69.7	Ge 72.6	In 74.9	Sn 79.0	Sb 83.8	Te 83.8	I 126.9	Xe 131.3
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (98)	Ru 101.1	Rh 102.9	Pd 106.4	Ag 107.9	Cd 112.4	In 114.8	Sn 118.7	Sb 121.8	Te 127.6	I 127.6	Xe 131.3		
Cs 132.9	Ba 137.3	La* 138.9	Hf 178.5	Ta 181.0	W 183.9	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 197.0	Hg 200.5	Tl 204.4	Pb 207.2	Bi 209.0	Po (209)	At (210)	Rn (222)		
Fr (223)	Ra 226.0	Ac** (227)	Rf (261)	Db (262)	Sg (263)	Bh (262)	Hs (265)	Mt (266)	Uuu (269)	Uun (272)	Uub (277)	Uut (282)							

\*Lanthanide series:

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
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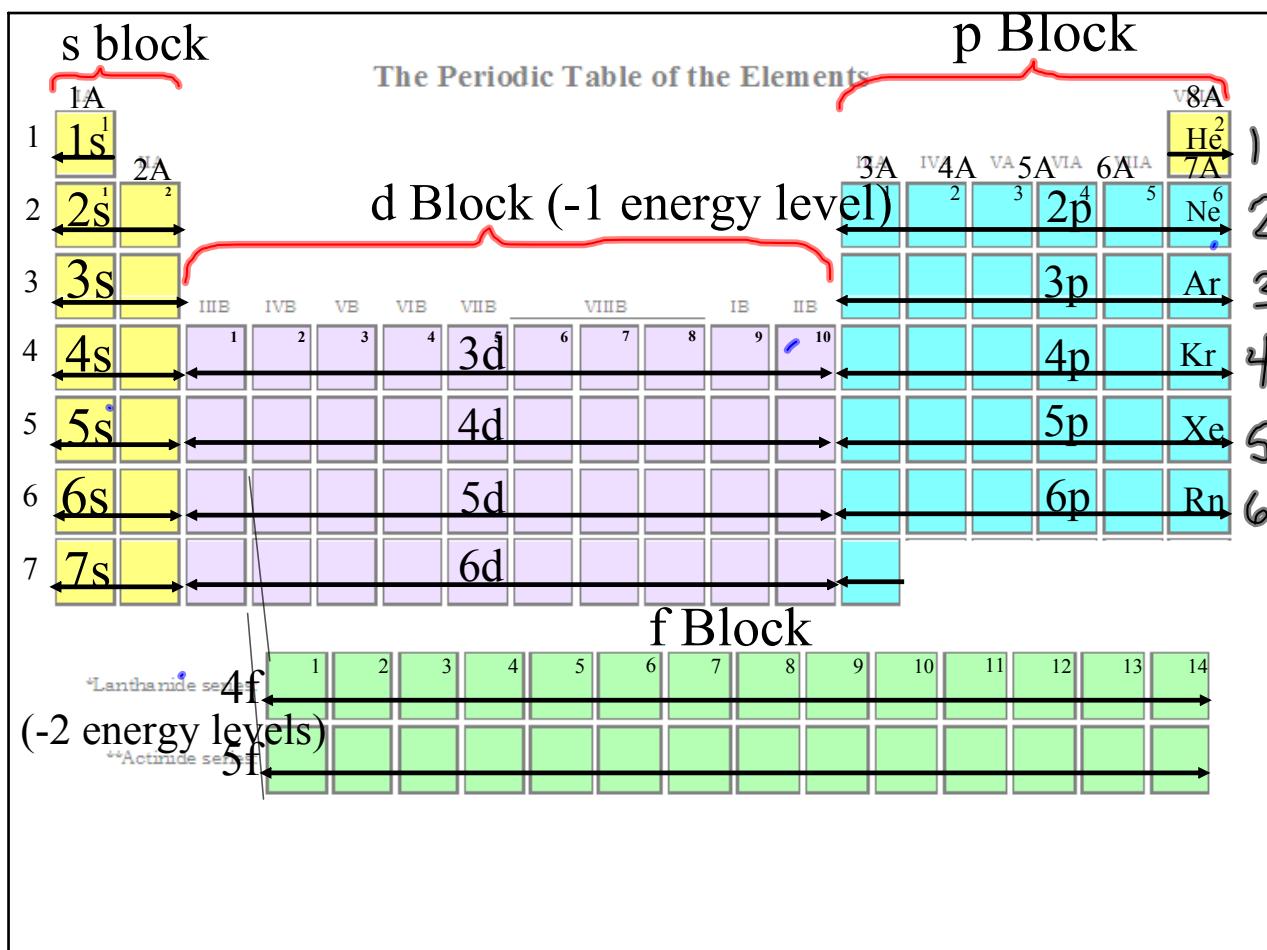
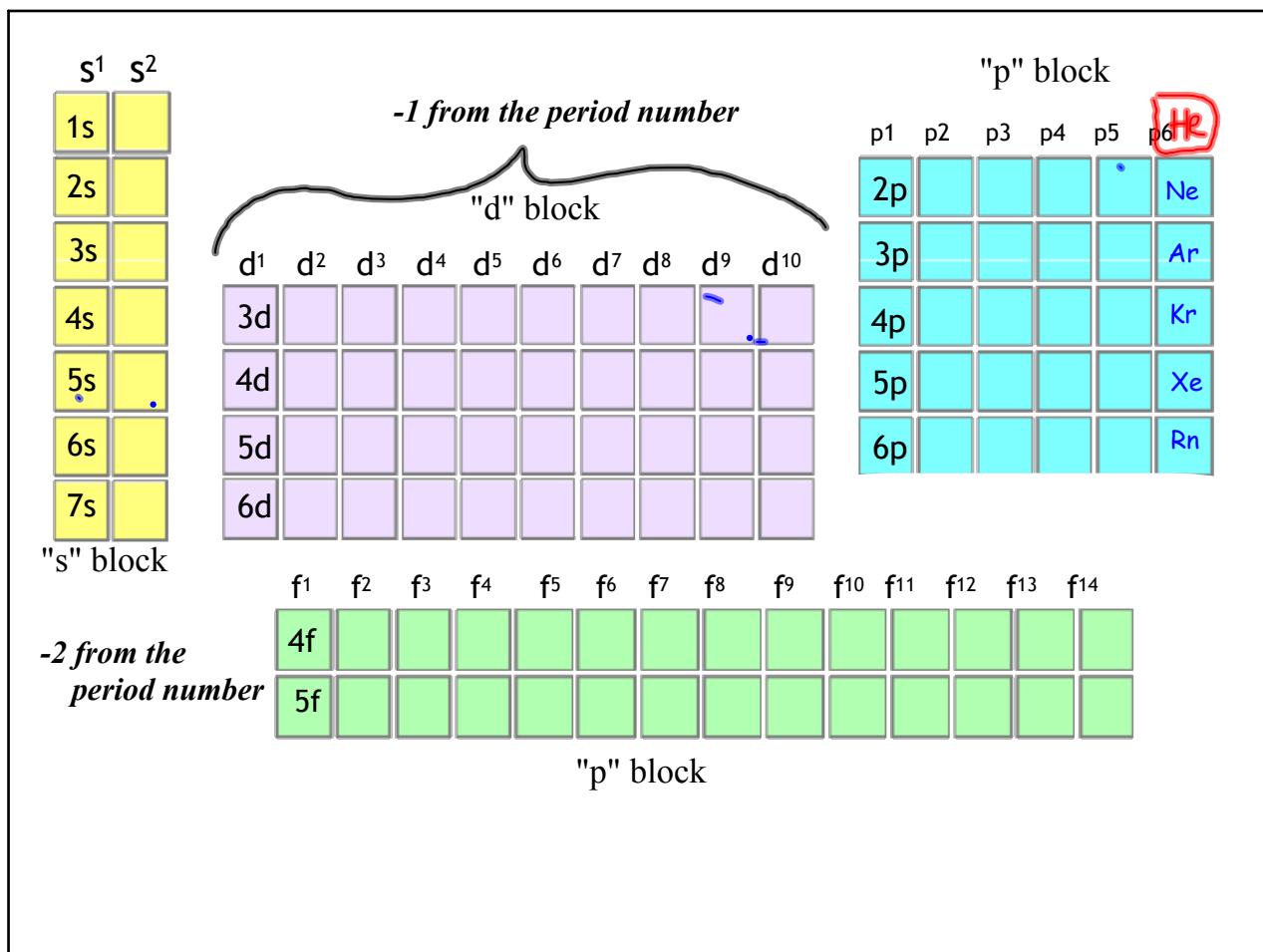
\*\*Actinide series:

90 Th 232.0	91 Pa 231.0	92 U 238.3	93 Np 237.1	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)
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## **Unit 4 The Periodic Table**

1. How do you read a period? Horizontal or vertical? (circle one)
  2. What halogen has a valence shell of 5? \_\_\_\_\_
  3. What group of elements lose 2 electrons? \_\_\_\_\_ What is the charge?
  4. Elements in the same**groups** have the same number of what? \_\_\_\_\_
  5. What Noble Gas is in Period 2? \_\_\_\_\_
  6. The current periodic table is arranged in order of increasing what? \_\_\_\_\_
  7. What Alkali Metal is in Period 5? \_\_\_\_\_
  8. The valence shell is the same as what? \_\_\_\_\_
  9. Fe is in what group? \_\_\_\_\_
  10. What element has a valence shell of 3 and 6 valence electrons? \_\_\_\_\_
  11. What group of elements LOSE 1 valence electron? \_\_\_\_\_ What is the charge?

## Unit 4 The Periodic Table



## **Unit 4 The Periodic Table**

Noble Gas Notation- shortened electron configuration that uses Noble gases as a reference point

Most of the time, this will save you writing

1   Example:  
IA 2+ IIA (old way) Sn-  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1 104s^2 5s^2 4d^1 105p^2$

Using NGN: Sn- [Kr] 5s<sup>2</sup>4d<sup>10</sup>5p<sup>2</sup>

#### **\*Lanthanide series:**

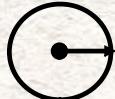
A 2x10 grid of 20 empty square boxes, arranged in two rows of ten. The boxes are outlined in black and have a white interior.

#### **\*\*Actinide series:**

\*Lanthanide series:

## Atomic Radius

the size of an atom or ion.



- + Cations- get smaller when they lose an electron (metals)
  - Anions- get bigger when they gain an electron (non-metals)

★(Radius of IONS only-whichever has the most electrons is larger)

## Electronegativity(EN)

the tendency for an atom to attract electrons to itself while bonded.

# Ionization Energy(IE)

is the energy needed to remove an electron from an atom while bonded.

## \*Electron Affinity(EA)

is the energy given off when a neutral atom GAINS an extra electron to form a negatively charged ion.

## Atomic radius decreases

### **Ionization Energy and Electronegativity increase**

## Most reactive non-metal

↓Smallest (lowest AR)

# Highest IE

## Highest EN /EA

Atomic radius increases  
Ionization Energy and Electronegativity decrease

## Periodic Trends

IA		Periodic Trends												VIIIA				
1	Li 6.9	IIA													Highest IE Highest EN /EA			
2	Be 9.0																	
3	Na 23.0																	
4	K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.8	Co 58.9	Ni 58.7	Cu 63.5	Zn 65.4	Ge 69.7	As 72.6	Se 74.9	Br 79.0	S 83.8	
5	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Tc 95.9	(98)	101.1	Ru 102.9	Pd 106.4	Rh 107.9	Cd 112.4	Ag 114.8	In 118.7	Sn 121.8	Te 127.6	I 126.9	At 131.6
6	Cs 132.9	Ba 137.3	L <sup>a+</sup> 138.9	Hf 178.5	Ta 181.0	W 183.9	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 197.0	Hg 200.6	Tl 204.4	Pb 207.2	Bi (209)	Po (210)	At (212)	Fr (223)
7	Fr 226.0	Ra 226.0	Ag** (227)	104 (261)	105 (262)	106 (263)	107 (262)	108 (265)	109 (266)	110 (269)	111 (272)	112 (277)	113 (282)					

## ↑ Biggest (highest AR)

## ↓ Lowest IE

↓ Lowest EN / EA

Most reactive metal

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
90 Th 232.0	91 Pa 231.0	92 U 238.3	93 Np 237.1	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (247)	99 Es (251)	100 Fm (252)	101 Md (257)	102 No (258)	103 Lr (259) (260)

## Unit 4 The Periodic Table

