

### + Special Names

#### Group Names

- Group 1 - Alkali Metals
- Group 2 - Alkali Earth Metals
- Groups 3 - 12 - Transition Metals
- Group 17 - Halogens
- Group 18 - Noble Gases

#### Period Names

- 4f - Lanthanide series
- 5f - Actinide series
- both technically in group 3 (inner transition metals)

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### + Atomic Radius Trends

Atomic Radii of Representative Elements (nm)

1A	2A	3A	4A	5A	6A	7A
Li 0.152	Be 0.111	B 0.098	C 0.077	N 0.070	O 0.066	F 0.064
Na 0.186	Mg 0.160	Al 0.143	Si 0.117	P 0.110	S 0.104	Cl 0.099
K 0.231	Ca 0.197	Ga 0.162	Ge 0.162	As 0.121	Se 0.110	Br 0.115
Rb 0.244	Sr 0.215	In 0.162	Sn 0.14	Sb 0.141	Te 0.137	I 0.133
Cs 0.262	Ba 0.217	Tl 0.171	Pb 0.175	Bi 0.146	Po 0.14	At 0.140

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### + Periodic Trends

Atomic radius - the distance from the center of the atom to the outer edge.

Trends:

- 1) Atomic radius increases down a group.
  - 2) Atoms get smaller as you move across the period.
- Explanation of (2) - As you move left to right across the period, there are more protons which give a stronger pull on the outermost electrons.

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## Groups

### Alkali Metals:

- highly reactive due to single  $s$ -orbital electron.
- Forms a +1 charge
- Reacts with oxygen & water rapidly, must be stored in oil.
- Soft metal, very abundant

### Alkali Earth Metals:

- Very reactive, but not as much as alkali metals.
- Soft metal, very abundant
- Forms +2 charge

3 <b>Li</b> Lithium 6.941 [He]2s <sup>1</sup>	4 <b>Be</b> Beryllium 9.012182 [He]2s <sup>2</sup>
11 <b>Na</b> Sodium 22.98976928 [Ne]3s <sup>1</sup>	12 <b>Mg</b> Magnesium 24.3050 [Ne]3s <sup>2</sup>
19 <b>K</b> Potassium 39.0983 [Ar]4s <sup>1</sup>	20 <b>Ca</b> Calcium 40.078 [Ar]4s <sup>2</sup>
37 <b>Rb</b> Rubidium 85.4678 [Kr]5s <sup>1</sup>	38 <b>Sr</b> Strontium 87.62 [Kr]5s <sup>2</sup>
55 <b>Cs</b> Cesium 132.90545196 [Xe]6s <sup>1</sup>	56 <b>Ba</b> Barium 137.327 [Xe]6s <sup>2</sup>
87 <b>Fr</b> Francium [223]101 [Rn]7s <sup>1</sup>	88 <b>Ra</b> Radium 226.0754 [Rn]7s <sup>2</sup>

## Groups

### Halogens:

- Nonmetals with high reactivity.
- Very common in compound form
- Gas or liquid at room temp.
- Forms a -1 charge.

### Noble Gases:

- Gases with a full  $p$ -orbital.
- Very few compounds of noble gases made because of stable  $p$ -orbital.
- Commonly used in gas tubes for neon-type signs.

9 <b>F</b> Fluorine 18.998403223 [He]2s <sup>2</sup> 2p <sup>5</sup>	10 <b>Ne</b> Neon 20.1797 [He]2s <sup>2</sup> 2p <sup>6</sup>
17 <b>Cl</b> Chlorine 35.4527 [Ne]3s <sup>2</sup> 3p <sup>5</sup>	18 <b>Ar</b> Argon 39.948 [Ne]3s <sup>2</sup> 3p <sup>6</sup>
35 <b>Br</b> Bromine 79.904 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup>	36 <b>Kr</b> Krypton 83.8 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>6</sup>
53 <b>I</b> Iodine 126.90447 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>5</sup>	54 <b>Xe</b> Xenon 131.29 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>6</sup>
85 <b>At</b> Astatine [210]101 [Xe]4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>5</sup>	86 <b>Rn</b> Radon [222]101 [Xe]4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>6</sup>

## Groups

21 <b>Sc</b> Scandium 44.955912 [Ar]3d <sup>1</sup> 4s <sup>2</sup>	22 <b>Ti</b> Titanium 47.88 [Ar]3d <sup>2</sup> 4s <sup>2</sup>	23 <b>V</b> Vanadium 50.9415 [Ar]3d <sup>3</sup> 4s <sup>2</sup>	24 <b>Cr</b> Chromium 51.9961 [Ar]3d <sup>5</sup> 4s <sup>1</sup>	25 <b>Mn</b> Manganese 54.938044 [Ar]3d <sup>5</sup> 4s <sup>2</sup>	26 <b>Fe</b> Iron 55.845 [Ar]3d <sup>6</sup> 4s <sup>2</sup>	27 <b>Co</b> Cobalt 58.933194 [Ar]3d <sup>7</sup> 4s <sup>2</sup>	28 <b>Ni</b> Nickel 58.6934 [Ar]3d <sup>8</sup> 4s <sup>2</sup>	29 <b>Cu</b> Copper 63.546 [Ar]3d <sup>10</sup> 4s <sup>1</sup>	30 <b>Zn</b> Zinc 65.38 [Ar]3d <sup>10</sup> 4s <sup>2</sup>
39 <b>Y</b> Yttrium 88.905848 [Kr]4d <sup>1</sup> 5s <sup>2</sup>	40 <b>Zr</b> Zirconium 91.224 [Kr]4d <sup>2</sup> 5s <sup>2</sup>	41 <b>Nb</b> Niobium 92.90638 [Kr]4d <sup>4</sup> 5s <sup>1</sup>	42 <b>Mo</b> Molybdenum 95.94 [Kr]4d <sup>5</sup> 5s <sup>1</sup>	43 <b>Tc</b> Technetium 98.0062 [Kr]4d <sup>5</sup> 5s <sup>2</sup>	44 <b>Ru</b> Ruthenium 101.07 [Kr]4d <sup>7</sup> 5s <sup>1</sup>	45 <b>Rh</b> Rhodium 102.9055 [Kr]4d <sup>8</sup> 5s <sup>1</sup>	46 <b>Pd</b> Palladium 106.42 [Kr]4d <sup>10</sup>	47 <b>Ag</b> Silver 107.8682 [Kr]4d <sup>10</sup> 5s <sup>1</sup>	48 <b>Cd</b> Cadmium 112.411 [Kr]4d <sup>10</sup> 5s <sup>2</sup>
57 <b>La</b> Lanthanum 138.90547 [Xe]5d <sup>1</sup> 6s <sup>2</sup>	58 <b>Hf</b> Hafnium 178.49 [Xe]4f <sup>14</sup> 5d <sup>2</sup> 6s <sup>2</sup>	59 <b>Ta</b> Tantalum 180.94788 [Xe]4f <sup>14</sup> 5d <sup>3</sup> 6s <sup>2</sup>	60 <b>W</b> Tungsten 183.84 [Xe]4f <sup>14</sup> 5d <sup>4</sup> 6s <sup>2</sup>	61 <b>Re</b> Rhenium 186.207 [Xe]4f <sup>14</sup> 5d <sup>5</sup> 6s <sup>2</sup>	62 <b>Os</b> Osmium 190.23 [Xe]4f <sup>14</sup> 5d <sup>6</sup> 6s <sup>2</sup>	63 <b>Ir</b> Iridium 192.222 [Xe]4f <sup>14</sup> 5d <sup>7</sup> 6s <sup>2</sup>	64 <b>Pt</b> Platinum 195.084 [Xe]4f <sup>14</sup> 5d <sup>9</sup> 6s <sup>1</sup>	65 <b>Au</b> Gold 196.966569 [Xe]4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>1</sup>	66 <b>Hg</b> Mercury 200.59 [Xe]4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup>
89 <b>Ac</b> Actinium 227.028 [Rn]5f <sup>1</sup> 6s <sup>2</sup>	90 <b>Unq</b> Unquadium [261]101 [Rn]5f <sup>14</sup> 6d <sup>1</sup> 7s <sup>2</sup>	91 <b>Unp</b> Unpentium [261]101 [Rn]5f <sup>14</sup> 6d <sup>2</sup> 7s <sup>2</sup>	92 <b>Unh</b> Unhexium [261]101 [Rn]5f <sup>14</sup> 6d <sup>3</sup> 7s <sup>2</sup>	93 <b>Uno</b> Unoctium [261]101 [Rn]5f <sup>14</sup> 6d <sup>4</sup> 7s <sup>2</sup>	94 <b>Unf</b> Unnonium [261]101 [Rn]5f <sup>14</sup> 6d <sup>5</sup> 7s <sup>2</sup>	95 <b>Uue</b> Unundecium [261]101 [Rn]5f <sup>14</sup> 6d <sup>6</sup> 7s <sup>2</sup>	96 <b>Unh</b> Unhectium [261]101 [Rn]5f <sup>14</sup> 6d <sup>7</sup> 7s <sup>2</sup>	97 <b>Unp</b> Unpentium [261]101 [Rn]5f <sup>14</sup> 6d <sup>8</sup> 7s <sup>2</sup>	98 <b>Unh</b> Unhexium [261]101 [Rn]5f <sup>14</sup> 6d <sup>9</sup> 7s <sup>2</sup>

### Transition Metals: (d-orbital)

- Metals found throughout the Earth, sometimes in elemental form.
- Varying charges, most commonly form +2 charge.
- Most applications of industry from these elements

## Groups

### Inner Transition Metals: (f-orbital)

- Group of highly unstable elements used in nuclear reactions, and lighting.
- Instability due to size of atoms.

<sup>58</sup> Ce Cerium 137.255	<sup>59</sup> Pr Praseodymium 137.627	<sup>60</sup> Nd Neodymium 144.242	<sup>61</sup> Pm Promethium 144.9126	<sup>62</sup> Sm Samarium 150.36	<sup>63</sup> Eu Europium 151.964	<sup>64</sup> Gd Gadolinium 157.25	<sup>65</sup> Tb Terbium 158.925	<sup>66</sup> Dy Dysprosium 162.500	<sup>67</sup> Ho Holmium 164.930	<sup>68</sup> Er Erbium 167.259	<sup>69</sup> Tm Thulium 168.930	<sup>70</sup> Yb Ytterbium 173.054	<sup>71</sup> Lu Lutetium 174.967
<sup>89</sup> Tb Terbium 158.925	<sup>90</sup> Pm Promethium 144.9126	<sup>91</sup> U Uranium 238.02891	<sup>92</sup> Np Neptunium 237.04817	<sup>93</sup> Pu Plutonium 244.0642	<sup>94</sup> Am Americium 243.06138	<sup>95</sup> Cm Curium 247.0703	<sup>96</sup> Bk Berkelium 247.0703	<sup>97</sup> Cf Californium 251.07958	<sup>98</sup> Rf Rutherfordium 261.10888	<sup>99</sup> Mt Meitnerium 268.1094	<sup>100</sup> Ds Darmstadtium 271.10369	<sup>101</sup> Lr Lawrencium 260.1053	<sup>102</sup> Lr Lawrencium 260.1053

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