Group Name _____ Period _____ Date _____

Patterns in Electron Configuration

One of the many patterns contained in the periodic table is that of electron configuration. In this activity, you will identify these patterns. Later, you will use these patterns to determine the order in which electrons fill the orbitals of an atom. As you complete the activity, keep the following in mind:

- Period = row, Group = column
- Use the table on your book cover, which shows only valence electrons.
- There are two number systems for the Groups. We will focus on the A/B system.

1. Which Groups have an s-orbital as the *last* orbital? _____
2. Which Groups have a p-orbital as the *last* orbital? _____
3. Which Groups have a d-orbital as the *last* orbital? _____
4. Which section of the table is left? This section corresponds to the f-orbitals.
5. Look at Group 1A. What is the relationship between the Period number and the energy level of the valence electrons?
6. Look at Group 3A. What is the relationship between the Period number and the energy level of the valence electrons?
7. Look at Group 3B. What is the relationship between the Period number and the energy level of the d-orbitals?
8. Look at the Inner Transition Metals (bottom section). The Lanthanide series (58-71) is part of Period 6. The Actinide series (90-103) is part of Period 7. What is the relationship between the Period number and the energy level of the f-orbitals?
9. Look at all of the A Groups. What is the relationship between the Group number (1A, 2A, etc.) and the total number of valence electrons for each element? (Add up the exponents to find the total number of valence electrons.)

Periodic Table of the Elements

(based on $^{12}_{6}C = 12.0000$)

1* 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 **H** Hydrogen 1.008 $1s^1$																	2 **He** Helium 4.003 $1s^2$
3 **Li** Lithium 6.941 $2s^1$	4 **Be** Beryllium 9.012 $2s^2$											5 **B** Boron 10.811 $2s^22p^1$	6 **C** Carbon 12.011 $2s^22p^2$	7 **N** Nitrogen 14.007 $2s^22p^3$	8 **O** Oxygen 15.999 $2s^22p^4$	9 **F** Fluorine 18.998 $2s^22p^5$	10 **Ne** Neon 20.180 $2s^22p^6$
11 **Na** Sodium 22.990 $3s^1$	12 **Mg** Magnesium 24.305 $3s^2$											13 **Al** Aluminum 26.982 $3s^23p^1$	14 **Si** Silicon 28.086 $3s^23p^2$	15 **P** Phosphorus 30.974 $3s^23p^3$	16 **S** Sulfur 32.066 $3s^23p^4$	17 **Cl** Chlorine 35.453 $3s^23p^5$	18 **Ar** Argon 39.948 $3s^23p^6$
19 **K** Potassium 39.098 $4s^1$	20 **Ca** Calcium 40.078 $4s^2$	21 **Sc** Scandium 44.956 $4s^23d^1$	22 **Ti** Titanium 47.88 $4s^23d^2$	23 **V** Vanadium 50.942 $4s^23d^3$	24 **Cr** Chromium 51.996 $4s^13d^5$	25 **Mn** Manganese 54.938 $4s^23d^5$	26 **Fe** Iron 55.847 $4s^23d^6$	27 **Co** Cobalt 58.933 $4s^23d^7$	28 **Ni** Nickel 58.693 $4s^23d^8$	29 **Cu** Copper 63.546 $4s^13d^{10}$	30 **Zn** Zinc 65.39 $4s^23d^{10}$	31 **Ga** Gallium 69.723 $4s^24p^1$	32 **Ge** Germanium 72.61 $4s^24p^2$	33 **As** Arsenic 74.922 $4s^24p^3$	34 **Se** Selenium 78.96 $4s^24p^4$	35 **Br** Bromine 79.904 $4s^24p^5$	36 **Kr** Krypton 83.80 $4s^24p^6$
37 **Rb** Rubidium 85.468 $5s^1$	38 **Sr** Strontium 87.62 $5s^2$	39 **Y** Yttrium 88.906 $5s^24d^1$	40 **Zr** Zirconium 91.224 $5s^24d^2$	41 **Nb** Niobium 92.906 $5s^14d^4$	42 **Mo** Molybdenum 95.94 $5s^14d^5$	43 **Tc** Technetium (98) $5s^24d^5$	44 **Ru** Ruthenium 101.07 $5s^14d^7$	45 **Rh** Rhodium 102.906 $5s^14d^8$	46 **Pd** Palladium 106.42 $4d^{10}$	47 **Ag** Silver 107.868 $5s^14d^{10}$	48 **Cd** Cadmium 112.411 $5s^24d^{10}$	49 **In** Indium 114.82 $5s^25p^1$	50 **Sn** Tin 118.710 $5s^25p^2$	51 **Sb** Antimony 121.757 $5s^25p^3$	52 **Te** Tellurium 127.60 $5s^25p^4$	53 **I** Iodine 126.904 $5s^25p^5$	54 **Xe** Xenon 131.29 $5s^25p^6$
55 **Cs** Cesium 132.905 $6s^1$	56 **Ba** Barium 137.327 $6s^2$	57 **La** Lanthanum 138.906 $6s^25d^1$	72 **Hf** Hafnium 178.49 $6s^25d^2$	73 **Ta** Tantalum 180.948 $6s^25d^3$	74 **W** Tungsten 183.85 $6s^25d^4$	75 **Re** Rhenium 186.207 $6s^25d^5$	76 **Os** Osmium 190.2 $6s^25d^6$	77 **Ir** Iridium 192.22 $6s^25d^7$	78 **Pt** Platinum 195.08 $6s^15d^9$	79 **Au** Gold 196.967 $6s^15d^{10}$	80 **Hg** Mercury 200.59 $6s^25d^{10}$	81 **Tl** Thallium 204.383 $6s^26p^1$	82 **Pb** Lead 207.2 $6s^26p^2$	83 **Bi** Bismuth 208.980 $6s^26p^3$	84 **Po** Polonium (209) $6s^26p^4$	85 **At** Astatine (210) $6s^26p^5$	86 **Rn** Radon (222) $6s^26p^6$
87 **Fr** Francium (223) $7s^1$	88 **Ra** Radium (226.025) $7s^2$	89 **Ac** Actinium 227.028 $7s^26d^1$	104 **Unq** (261) $7s^26d^2$	105 **Unp** (262) $7s^26d^3$	106 **Unh** (263) $7s^26d^4$	107 **Uns** (262) $7s^26d^5$	108 **Uno** (265) $7s^26d^6$	109 **Une** (266) $7s^26d^7$									

14 — Atomic number
Si — Symbol
Silicon — Name
28.086 — Atomic mass
$3s^23p^2$ — Valence electron configuration

TRANSITION METALS

An atomic mass given in parentheses is the mass number of the isotope of longest half-life for that element.

**The 1–18 group designation has been recommended by the International Union of Pure and Applied Chemistry (IUPAC) but is not widely used. In this book, we refer to the standard U.S. notation for group numbers (1A–8A and 1B–8B).*

INNER TRANSITION METALS

Lanthanide series	58 **Ce** Cerium 140.115 $6s^24f^15d^1$	59 **Pr** Praseodymium 140.908 $6s^24f^3$	60 **Nd** Neodymium 144.24 $6s^24f^4$	61 **Pm** Promethium (145) $6s^24f^5$	62 **Sm** Samarium 150.36 $6s^24f^6$	63 **Eu** Europium 151.965 $6s^24f^7$	64 **Gd** Gadolinium 157.25 $6s^24f^75d^1$	65 **Tb** Terbium 158.925 $6s^24f^9$	66 **Dy** Dysprosium 162.50 $6s^24f^{10}$	67 **Ho** Holmium 164.930 $6s^24f^{11}$	68 **Er** Erbium 167.26 $6s^24f^{12}$	69 **Tm** Thulium 168.934 $6s^24f^{13}$	70 **Yb** Ytterbium 173.04 $6s^24f^{14}$	71 **Lu** Lutetium 174.967 $6s^24f^{14}5d^1$
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Actinide series	90 **Th** Thorium 232.038 $7s^26d^2$	91 **Pa** Protactinium 231.036 $7s^25f^26d^1$	92 **U** Uranium 238.029 $7s^25f^36d^1$	93 **Np** Neptunium 237.048 $7s^25f^46d^1$	94 **Pu** Plutonium (244) $7s^25f^6$	95 **Am** Americium (243) $7s^25f^7$	96 **Cm** Curium (247) $7s^26d^15f^7$	97 **Bk** Berkelium (247) $7s^25f^9$	98 **Cf** Californium (251) $7s^25f^{10}$	99 **Es** Einsteinium (252) $7s^25f^{11}$	100 **Fm** Fermium (257) $7s^25f^{12}$	101 **Md** Mendelevium (258) $7s^25f^{13}$	102 **No** Nobelium (259) $7s^25f^{14}$	103 **Lr** Lawrencium (260) $7s^25f^{14}6d^1$