Electron configuration refers to a method that is used to locate electrons in an atom. Electron configurations are important to identify the number of electrons in the outermost energy level of an atom. Electrons in the outermost energy level are called *valence electrons.*

Valence electrons play an important part in determining the physical and chemical properties of an element. There is a unique relationship between the groups of elements on the periodic table and electron configurations of elements. Groups 1 and 2 (IA and IIA) are the first to fill; these groups fill the "s" sublevel, which can hold a total of two electrons. Groups 13 through 18 (IIIA – VIIIA) fill next; these groups fill the "p" sublevel, which can hold a total of six electrons. Refer to your periodic table to locate these groups. When writing electron configurations, the order is read from left to right from the periodic table. The transition elements fill the "d" sublevel, which can hold a total of ten electrons; these elements are the B groups in the middle of the periodic table. The rare-earth elements (the two periods that appear to be separated from the periodic table) fill the "f" sublevel, which can hold a total of 14 electrons. Figure A shows the location of each of these sublevels.

Group

IA	*IIA*											*IIIA*	*IVA*	*VA*	*VIA*	*VIIA*	*VIIIA*
1s																	**1s**
1																	2
2s												**2p**					
3	4											5	6	7	8	9	10
3s												**3p**					
11	12											13	14	15	16	17	18
4s		**3d**										**4p**					
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
5s		**4d**										**5p**					
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
6s		**5d**										**6p**					
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
7s		**6d**															
87	88	89	104	105	106	107	108	109	110								

4f													
58	59	60	61	62	63	64	65	66	67	68	69	70	71

5f													
90	91	92	93	94	95	96	97	98	99	100	101	102	103

FIGURE A

When electrons begin to fill an atom, the 1st main energy level with one sublevel (s) is filled first. It can only hold two electrons. The second main energy level with s and p sublevels fills next. The second level can hold a total of 8 electrons; two in the s and 6 in the p. The third main energy level with s, p and d sublevels is the next to fill; this level is filled with a total of 18 e^-.

To write electron configurations, follow the rules below:

1. Write the symbol of the element and make note of its atomic number (the atomic number is equal to the number of protons and the number of electrons since atoms are electrically neutral).
2. Begin with the 1s level, then move on to 2s, 2p and then to the third level, etc.
3. Arabic number coefficients represent the main energy levels and letters (s, p, d, f) represent the sublevels.
4. Superscripts are used to show the number of electrons in a particular level.
5. The sum total of the superscripts will equal the atomic number. Study the examples:

Element	Atomic #	Configurations
H	1	$1s^1$
He	2	$1s^2$
Li	3	$1s^2 2s^1$
Be	4	$1s^2 2s^2$
B	5	$1s^2 2s^2 2p^1$
C	6	$1s^2 2s^2 2p^2$

Notice that the above configurations follow the organization of periods on the periodic table. Study the configuration of potassium, K $1s^2 2s^2 2p^2 3s^2 3p^6 4s^1$. Note that the last main energy level is $4s^1$. Since K belongs to period 4, the last main energy level to fill is the 4th one. Because K belongs to group 1 (IA), the s sublevel with one electron is filled. All other main energy levels below $4s^1$ have already been filled.

When filling elements located in a "d" sublevel, take the period number minus one to get the correct main energy level. For example: Zn: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$. Notice that Zn belongs to the 4th period but the d sublevel that is filled is 3d (or 4 – 1 = 3). Also in this example, the last main energy level to fill is 4s. Only s or s and p levels make up the outer main energy levels of electrons. The d and f sublevels are inner orbits in an atom.

In this lab exercise, you will write electron configurations and relate them to the organization of the period table.

Name ___________________________________ Date__________________ Period______

Electron Configuration Part 1 **Chemistry**

DATA AND CALCULATIONS

Using the periodic table, write the configuration for the elements of ***Period 2*** in the data table below.

DATA TABLE for ***Period 2***

Element	Atomic #	Electron Configuration

QUESTIONS

1. What happens to the valence electrons across a period of elements?

2. What is the relationship between valence electrons and the group number?

3. What is the difference between the last main energy level and the period number?

4. In the above data table, which main level is being filled?

Name ________________________________ **Date** ____________________ **Period**______

Electron Configuration Part 2 **Chemistry**

Using the periodic table, write the configuration for the elements of ***Period 3.*** Fill in the information in the data table.

DATA TABLE – Period 3

Element	Atomic #	Electron Configuration

DATA TABLE – Group IIA (2)

Element	Atomic #	Electron Configuration

DATA TABLE – Iron and Cobalt

Element	Atomic #	Electron Configuration

DATA TABLE – Neon and Argon

Element	Atomic #	Electron Configuration

INFERENCES AND RELATED QUESTIONS

1. What happens to the last main energy level as you go across a period of elements?

2. What happens to the last main energy level as you go down a group of elements?

3. Identify the last main energy level for iron and cobalt.

4. Do iron and cobalt have a complete “d” level?

5. How many valence electrons do Ne and Ar have?

6. What groups of elements fill the “s” sublevel?

7. What two sublevels make up the last main energy level in Ne and Ar?

8. Why do you suppose iron and cobalt have variable oxidation numbers?

9. Which family of elements is stable with eight electrons?

10. List the 4 sublevels and number of electrons each can hold.