

## Periodic Trends Worksheet #8

1. Describe the contributions made by the following scientists: Mendeleev and Moseley
2. Write the noble gas electron configuration for the following elements:
- a. Be [He]2s<sup>2</sup>      b. Al [Ne]3s<sup>2</sup>3p<sup>1</sup>      c. Mn [Ar]4s<sup>2</sup>3d<sup>5</sup>  
 d. Y [Kr]5s<sup>2</sup>4d<sup>1</sup>      e. Po [Xe]6s<sup>2</sup>4f<sup>14</sup>5d<sup>10</sup>6p<sup>4</sup>      f. Hs [Rn]7s<sup>2</sup>5f<sup>14</sup>6d<sup>6</sup>  
 g. What is the relationship between the electron configuration of an element and the period in which that element appears in the periodic table? → Period tell the # of shells or energy levels of electrons
3. Write the noble gas electron configuration for the following elements:
- a. Be [He]2s<sup>2</sup>      b. Mg [Ne]3s<sup>2</sup>      c. Ca [Ar]4s<sup>2</sup>  
 d. Sr [Kr]5s<sup>2</sup>      e. Ba [Xe]6s<sup>2</sup>      f. Ra [Rn]7s<sup>2</sup>

- Same Valance 3. How do the electron configurations within the same group of elements compare?  
sublevels filled 4. What information is provided by the specific block location of an element?  
Grp. 1 5. Which group of elements are the alkali metals? List four characteristic properties:  
Metals, highly reactive, low I.E., Low Electronegativity  
Grp. 2 6. Which group of elements are the alkaline earth metals? List four characteristic properties:  
Metals, very reactive, low I.E., Low Electronegativity  
transition 7. What name is used to refer to the entire d-block elements?  
Grp. 17 8. Which group of elements are the halogens? List three characteristic properties:  
nonmetals, low reactive, high I.E. + Electronegativity  
In 13, 14, 15, 16 9. Which elements are the metalloids? List their characteristic properties:  
along the staircase → semiconductors (some prop of metals + nonmetals)  
1, 2, 13-18 10. Which groups of elements are the main group elements?  
Group 18 11. Which group of elements are the noble gases? List three characteristic properties:  
nonmetals, gas at RoomTemp., inert

12. Without looking at a periodic table, identify the period, block, and group in which the elements with the following electron configurations are located.

- |                 |                |                 |  |
|-----------------|----------------|-----------------|--|
| Period <u>3</u> | Block <u>p</u> | Group <u>16</u> | a. [Ne]3s <sup>2</sup> 3p <sup>4</sup>                                   |
| Period <u>5</u> | Block <u>d</u> | Group <u>14</u> | b. [Kr]5s <sup>2</sup> 4d <sup>10</sup> 5p <sup>2</sup>                  |
| Period <u>6</u> | Block <u>f</u> | Group <u>17</u> | c. [Xe]6s <sup>2</sup> 4f <sup>14</sup> 5d <sup>10</sup> 6p <sup>5</sup> |

13. Without looking at a periodic table, write the expected outer electron configuration for each of the following elements.

- 4s<sup>2</sup>3d<sup>5</sup> a. Group 7, Period 4  
5s<sup>2</sup>4d<sup>1</sup> b. Group 3, Period 5  
6s<sup>2</sup>4f<sup>14</sup>5d<sup>10</sup> c. Group 12, Period 6

outer shell electron 14. What are valence electrons? in the highest occupied energy level

- 1 15. Which main group elements have 1 valence electron?  
16 16. Which main group elements have 6 valence electrons?

- 44  
20 Ca<sup>+2</sup> 17. Write the nuclear symbol for an ion with a charge of +2, 20 protons, and 24 neutrons.  
18 a. How many electrons are in this ion? cation      b. Is it an anion or cation?

- 34  
16 S<sup>-2</sup> 18. Write the nuclear symbol for an ion with a charge of -2, 18 electrons, and 18 neutrons.  
16 a. How many protons are in this ion? anion      b. Is it an anion or cation?

- 28  
13 Al<sup>+3</sup> 19. Write the nuclear symbol for an ion with a charge of +3, 13 protons, and 15 neutrons.  
10 a. How many electrons are in this ion? cation      b. Is it an anion or cation?

## Periodic Trends Worksheet Part 2

### Trends-Atomic size, Shielding, Ionization Energy, Electron Affinity

#### 1. Circle the one from each pair that would be the larger in size:

- (A) F atom or O atom  
(B) Ba atom or Ra atom # 88  
(C) Hf atom #72 or Ti atom #22  
(D) Cs ion or Ba ion  
(E) Al ion or Al atom  
(F) Po ion #84 or At ion #85  
(G) I ion or I atom  
(H) Dy atom #66 or Cf atom #98  
(I) As #33 atom or Cl atom  
(J) Ca atom or Ca ion  
(K) W atom #74 or Gd atom #64  
(L) Mg ion or Na ion

#### 2. Circle the element that has more shielding:

- (A) B#5 or In #49  
(B) Mg or S or neither  
(C) Tl #81 or Y#39  
(D) Cl#17 or I#53  
(E) Ar#18 or Xe#54  
(F) Ca#20 or Ga#31 or neither

#### 3. Circle the element with the greater first ionization energy (IE):

- (A) Pb or Sn  
(B) B or C  
(C) Ba or At #85  
(D) Lr #103 or Ra #88  
(E) Cs #55 or V #23  
(F) Si # 14 or Ag  
(G) F atom or O atom  
(H) Ba atom or Ra atom  
(I) S#16 and Te#52

#### 4. Circle the element with the greater electron affinity (EA):

- (A) F or Cl  
(B) Sr #38 or Rb #37  
(C) Os #76 or Co #27  
(D) Am #95 or Eu #63  
(E) Pb or Sn  
(F) Ba or At #85

#### 5. Circle the element with the lower electronegativity (EN):

- (A) C or N  
(B) Na or K  
(C) Ta #73 or Cu  
(D) Pd #46 or Mo #42  
(E) Lr #103 or Ra #88  
(F) Cs #55 or V #23  
(G) F atom or O atom  
(H) Ba atom or Ra atom

#### 6. Write the complete electron configuration for the following ions and state if it is an anion or cation:

- a. Mg<sup>2+</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>  
b. H<sup>1+</sup> None  
c. S<sup>2-</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>  
d. Na<sup>1+</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>  
e. Cl<sup>1-</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>  
f. Ca<sup>2+</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>  
g. H<sup>1-</sup> 1s<sup>2</sup>  
h. O<sup>2-</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>  
i. F<sup>1-</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>  
j. K<sup>1+</sup> 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>

## Periodic Trends Test Review

Read over notes, all homework problems, and the periodic table we drew in class. Be able to define the following: valence electrons, ion, atomic radius, ionization energy. Make sure you are able to label the group numbers, period numbers, alkali metals, alkaline earth metals, transition metals, inner transition metals, halogens, noble gases, s-block, p-block, d-block, f-block, metalloids, nonmetals, main group elements, atomic radii trends, ionization energy trends, electron affinity trends, ionic radii trends, electronegativity trends, and number of valence electrons found in each group. Be able to list the different characteristics of the various families found on the periodic table (ex. Alkali metals are the most reactive metals; they are all soft, silvery metals...)

Mendeleev 1. Who and how was the first periodic table constructed and how has our present day periodic table changed from the original? By increasing at. mass originally → now at #

2. As you move across the periodic table, from left to right,
- (A) do the atoms get smaller or larger? smaller
  - (B) are the ionization energies increasing or decreasing? increase
  - (C) are the metals becoming more or less reactive? less
  - (D) are the metals getting harder or softer? harder

3. Explain the trends involving ionization energy, atomic radii, electronegativity, electron affinity, and ionic radii that are evident in the various groups and periods of the periodic table. Notes pt 3 + Lab "In the Cando"

4. Which main group elements have 1 valence electron? Gr 1 6 valence electrons? Gr 16

5. Without looking at the periodic table determine the group, period, and block for the following elements:
- a. [Ne]3s<sup>1</sup> block S group 1 period 3
  - b. [Ar]4s<sup>2</sup>3d<sup>10</sup> block d group 12 period 4
  - c. [Ar]4s<sup>2</sup>3d<sup>10</sup>4p<sup>2</sup> block p group 14 period 4
  - d. [Kr]5s<sup>2</sup>4d<sup>2</sup> block d group 4 period 5
  - e. [Kr]5s<sup>2</sup>4d<sup>10</sup> block d group 12 period 5

6. Use their placement on the periodic table to arrange the following elements based on their size (atomic radii) from largest to smallest.

- a. Ca, Ge, Br, K, Kr      b. Sr, Mg, Be, Ba, Ra      c. F, Cl, Fr, Cs
- K, Ca, Ge, Br, Kr      Ra, Ba, Sr, Mg, Be      F, Cl, Fr, Cs

7. Use their placement on the periodic table to arrange the following elements from highest ionization energy to lowest ionization energy.

- a. Ca, Ge, Br, K, Kr      b. Sr, Mg, Be, Ba, Ra      c. F, Cl, Fr, Cs
- K, Br, Ge, Ca, K      Be, Mg, Sr, Ba, Ra

8. Use their placement on the periodic table to determine which of the following has a higher electron affinity.

- a. F or Sn      b. Si or Y      c. Fe or K      d. Bi or N      e. Ho or Br      f. Rb or Cl

9. Use their placement on the periodic table to determine which of the following has a lower electronegativity.

- a. F or Sn      b. Si or Y      c. Fe or K      d. Bi or N      e. Ho or Br      f. Rb or Cl

10. Use their placement on the periodic table to determine which of the following is smaller.

- a. Ca atom or Ca ion      b. Cl atom or Cl ion      c. N ion or O ion      Mg ion or Sr ion

11. Which of the following has the most shielding?

- a. Br or F      b. Al or Cl or neither      c. Ca or Ra

12. When sodium becomes an ion will it lose or gain electrons? lose How many electrons? 1 Write the nuclear symbol for an ion of sodium (assume it has 11 neutrons).  $^{23}_{11}\text{Na}^+$

13. When aluminum ionizes will it lose or gain electrons? lose How many electrons? 3 Write the nuclear symbol for an ion of aluminum (assume it has 14 neutrons).  $^{27}_{13}\text{Al}^{3+}$

14. When nitrogen becomes an ion will it lose or gain electrons? gain How many electrons? 3 Write the nuclear symbol for an ion of nitrogen (assume it has 7 neutrons).  $^{14}_7\text{N}^{3-}$

15. Write the nuclear symbol for an ion with a charge of +2, 20 protons, and 24 neutrons.

- a. How many electrons are in this ion? \_\_\_\_\_ b. Is it an anion or cation? \_\_\_\_\_

16. Write the nuclear symbol for an ion with a charge of -2, 18 electrons, and 18 neutrons.

- a. How many protons are in this ion? \_\_\_\_\_ b. Is it an anion or cation? \_\_\_\_\_

17. Write the nuclear symbol for an ion with a charge of +3, 13 protons, and 15 neutrons.

- a. How many electrons are in this ion? \_\_\_\_\_ b. Is it an anion or cation? \_\_\_\_\_

★ 18. Describe the characteristics of metals, nonmetals, and metalloids. → semiconductors, dull or shiny, gain or lose e<sup>s</sup>

Metals: solids, good conductors, luster, malleable, ductile, lose e<sup>s</sup>  
Nonmetals: dull appearance, brittle solids poor conductors, gain e<sup>s</sup>

see page 8 #17, 18, 19