

## Periodic Trends Review

Using a periodic table to decide, answer each of the following.

1. Which of the following has the **largest** 1<sup>st</sup> ionization energy?

- a. Strontium, silver, tin, or iodine
- b. Bismuth, arsenic, or nitrogen

iodine  
nitrogen

2. Which of the following has the **largest** electron affinity?

- a. Lead, tin, carbon, or silicon
- b. Cesium, tungsten, or bismuth

carbon  
bismuth

3. Which of the following has the **lowest** electronegativity?

- a. Beryllium, barium, calcium, or magnesium
- b. Sulfur, magnesium, or silicon

barium  
magnesium

4. Which of the following has the **largest** atomic radius?

- a. Fluorine, oxygen, lithium, or beryllium
- b. Aluminum, gallium, or boron

lithium  
gallium

5. Which of the following has the **lowest** 1<sup>st</sup> ionization energy?

- a. Magnesium or sodium
- b. Bromine or chlorine

sodium  
bromine

6. Which of the following has the **lowest** ionic radius?

- a. <sup>2-</sup>Sulfur or <sup>1-</sup>chlorine
- b. <sup>1+</sup>Potassium or <sup>1+</sup>rubidium  
<sup>4<sup>th</sup> period</sup>      <sup>5<sup>th</sup> period</sup>
- c. <sup>3-</sup>Nitrogen or <sup>3-</sup>phosphorus  
<sup>2<sup>nd</sup> period</sup>      <sup>3<sup>rd</sup> period</sup>

chlorine  
potassium  
nitrogen

7. Which of the following has the **highest** shielding effect?

- a. Xenon, neon, or argon
- b. Silicon, sulfur, phosphorus, or aluminum  
all in the same period

xenon  
same

8. Which of the following has the **lowest** atomic radii?

- a. Neon, radon, or argon
- b. Chlorine, sodium, or silicon

neon  
chlorine

9. Which of the following has the **lowest** electron affinity?

a. Rubidium or sodium

b. Sulfur or oxygen

rubidium

Sulfur

10. Circle the **more reactive** of the pair.

a. K, Ga

c. Mg, Ba

d. F, Br

b. Ne, Br

noble  
gases  
are  
inert

e. S, Ar

noble  
gases  
are  
inert

f. N, F

11. Circle the **larger** atom.

a. K, Ga

b. Rb, Si

c. Mg, Ba

d. P, Ra

12. Circle the **larger** of the pair.

a. Li, Li<sup>+</sup>  
cations  
are  
smaller

b. B, B<sup>+3</sup>  
cations  
are  
smaller

c. F, F<sup>-</sup>  
anions  
are  
larger

d. P, P<sup>-3</sup>  
anions  
are  
larger

13. Circle the **more** electronegative element of the pair.

a. K, Se

b. N, As

c. F, Ne  
noble gases  
don't have EN  
since they don't  
form compounds

d. Se, Ne  
noble gases  
don't have EN  
since they don't  
form compounds

14. Circle the element with the **greater** ionization energy.

a. Rb, **I**

b. **N**, Sb

c. N, **O**

15. Circle the element with a **more negative** electron affinity.

a. C, **F**

b. **C**, Ne  
noble gases  
don't want to  
gain e<sup>-</sup> since  
they are already  
stable

16. What is the trend in atomic radii when one moves down a group? Explain why this is so.

The atomic radius **increases** down a group because with each step down, an energy level is being added to hold the additional electrons further from the nucleus.

Therefore, the size of the electron cloud and the atom increases.

17. What is the trend in atomic radii when one moves left in a period? Explain why this is so.

The atomic radius **decreases** across a period because with each step to the right a proton is being added making the nucleus more positive and an electron is added making the electron cloud more negative. The increased attraction between the two pulls the electron cloud in towards the nucleus therefore decreasing the size of the atom. More protons = more nuclear pull.

18. Are anions larger or smaller than their respective atoms? Explain why this is so.

Anions are **larger** than the neutral atoms from which they were formed. Atoms gain electrons in order to form anions so the  $\#p^+$  in the nucleus becomes less than the  $\#e^-$  in the electron cloud; so, the pull from the nucleus is lessened (gets weaker) and the electron cloud spreads out. Furthermore, there is increased repulsion between the electrons due to like charges which also results in the electron cloud spreading out and the anion getting larger.

19. Are cations larger or smaller than their respective atoms? Explain why this is so.

Cations are **smaller** than the neutral atoms from which they were formed. Atoms lose electrons in order to form cations so the  $\#p^+$  in the nucleus becomes more than the  $\#e^-$  in the electron cloud; so, the pull from the nucleus gets stronger (increases) and the electron cloud is pulled inward towards the nucleus. Furthermore, in some cases, an entire energy level can be removed from the atom during ionization which results in the electron cloud decreasing in size and the cation getting smaller.

20. What are the four factors affecting the Ionization Energy?

1. Nuclear charge
2. Shielding effect
3. Atomic radius
4. Sublevels

Identify the group #, period #, block, and element with the following valence electron/group configuration:

| Configuration     | Group # | Period # | Block | Element |
|-------------------|---------|----------|-------|---------|
| 1. $1s^2$         | 18      | 1        | S     | He      |
| 2. $2s^2 2p^4$    | 16      | 2        | P     | O       |
| 3. $4s^2 3d^2$    | 4       | 4        | d     | Ti      |
| 4. $6s^1$         | 1       | 6        | S     | Cs      |
| 5. $5s^2 5p^6$    | 18      | 5        | P     | Xe      |
| 6. $4s^2 4p^2$    | 14      | 4        | P     | Ge      |
| 7. $3s^2$         | 2       | 3        | S     | Mg      |
| 8. $5s^2 4d^8$    | 10      | 5        | d     | Pd      |
| 9. $6s^1 5d^{10}$ | 11      | 6        | d     | Au      |
| 10. $4s^1 3d^5$   | 6       | 4        | d     | Cr      |

$\uparrow$   
 s-block:  $s^{e^-}$   
 p-block:  $s^{e^-} p^{e^- + 10}$   
 d-block:  $s^{e^-} d^{e^-}$

Write the valence electron/group configuration for the following elements:

| Element        | Configuration  |
|----------------|----------------|
| 1. Beryllium   | $2s^2$         |
| 2. Silicon     | $3s^2 3p^2$    |
| 3. Molybdenum  | $5s^1 4d^5$    |
| 4. Platinum    | $6s^2 5d^8$    |
| 5. Antimony    | $5s^2 5p^3$    |
| 6. Potassium   | $4s^1$         |
| 7. Copper      | $4s^1 3d^{10}$ |
| 8. Yttrium (Y) | $5s^2 4d^1$    |
| 9. Radium      | $7s^2$         |
| 10. Nitrogen   | $2s^2 2p^3$    |

**I only include d if the element is a transition metal!**

Exam Date: \_\_\_\_\_

• **The Periodic Law (Chapter 5)**

- ✓ Periodic table (Canizzaro/Berzelius/Prout/Dobereiner/Newlands/Mendelev / Moseley)
- ✓ Periodic law / groups / periods / blocks
- ✓ Valence electron / group configuration
- ✓ Metals / Nonmetals / Metalloids
- ✓ Periodicity for atomic radii / ionic radii / ionization energy / electron affinity / electronegativity / shielding effect / metallic character / overall reactivity