Name _____ Block ____

Test Review for Unit 4 Periodic Trends

Part A: Multiple Choice

1. As one moves from down (↓) a group on the periodic table, the electronegativity of the elements encountered tends to:

   A. decrease
   B. stay the same
   C. increase

   - Because extra orbitals make it more difficult to gain an electron

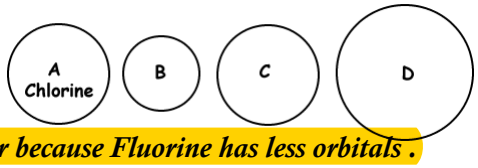
2. **Multiple Response**: A vertical column (↓) of elements on the periodic table may also be referred to as a:

   A. period
   B. family
   C. group
   D. series

   - Examples are Oxygen Family, Nitrogen Family, Carbon Family
   - Examples are Alkali Metals Group, Halogen Group, Noble Gas Group

3. Given the size of a chlorine atom, which circle might represent an atom of fluorine?

   A. Circle D
   B. Circle B
   C. None of these
   D. Circle C



Fluorine must be smaller because Fluorine has less orbitals .

4. The least electronegative elements are the:

   A. Noble gases
   B. Metalloids
   C. Halogens
   D. Alkali metals

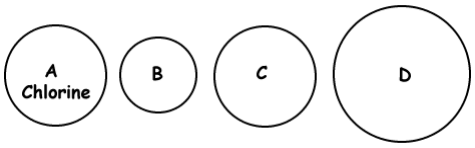
Electronegativity is the desire to gain valence electrons. Alkali metals have low EN #'s because they are trying to lose 1 electron to become stable... but Nobel Gases the lowest EN. Nobel Gases' valence orbitals are already full, so they cannot gain any more. Therefore the EN value is zero for Nobel Gases.

5. The energy required to remove an electron from an atom is known as:

   A. electron affinity
   B. ionization energy
   C. radioactivity
   D. Electronegativity

6. Given the size of a chlorine atom, which circle might a chloride ion, Cl^-?

   A. Circle C
   B. Circle B
   C. Circle D
   D. None of these



The chloride ion will be larger because it is a nonmetal that gains an electron.

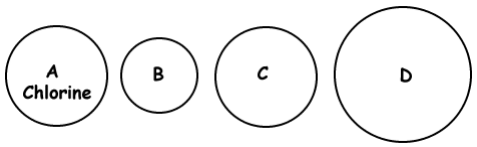
7. As one moves from left to right (→) within a period across the periodic table, the electronegativity of the elements encountered tends to:

   A. decrease
   B. stay the same
   C. Increase

Electronegativity increases because nonmetals want to gain electrons to become more stable. (Except the Noble Gases, which are already stable.

8. Given the representation of a chlorine atom, which circle might represent an atom of argon?

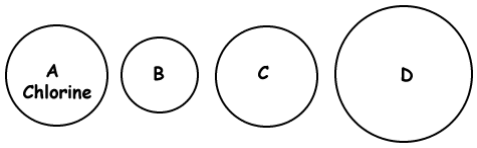
A. Circle B
B. Circle C
C. Circle D
D. None of these



Chlorine is #17 and Argon is #18. When two atoms are side by side, the one with more protons is always smaller due to the nuclear force.

9. Given the representation of a chlorine atom, which circle might represent an atom of bromine?

A. None of these
B. Circle D
C. Circle C
D. Circle B



Chlorine is #17 and Bromine is # 35. When two atoms are on top of each other, the one on the bottom is larger due to more orbitals.

10. Of the following elements, which one would have the smallest radius?

A. Bromine (Br, atomic #35)
B. Chlorine (Cl, atomic #17)
C. Fluorine (F, atomic #9)
D. Iodine (I, atomic #53)

Same rule as last time. These elements are all Halogens from Group 17. So the one on top is smallest because it has the least amount of orbitals.

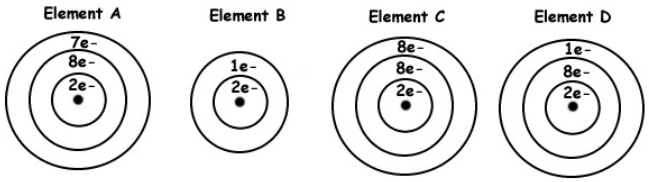
11. As one moves from down (↓) a group on the periodic table, the atomic radius of the elements encountered tends to:

A. decrease
B. increase
C. stay the same

Atomic radius increases because more orbitals are added as you go down.

12. Which of these elements would have the lowest first ionization energy?

A. Element D
B. Element A
C. Element B
D. Element C



Both B and D have 1 valence electron which requires only a little energy to remove, but D has more orbitals so it requires less energy to remove the electron from D.

13. **Multiple Response**: A horizontal row (→) of elements on the periodic table may also be referred to as a:

A. period
B. family
C. group
D. series

14. The elements with the smallest atomic radii are found in the:

A. lower right-hand corner of the periodic table
B. upper left-hand corner of the periodic table
C. lower left-hand corner of the periodic table
D. upper right-hand corner of the periodic table

Helium is the smallest atom because it has the most protons for its row, largest nuclear force, and fewest orbitals.

15. Of the following elements, which one would have the largest electronegativity energy?

A. Iodine (I, atomic #53)
B. Chlorine (Cl, atomic #17)
C. Fluorine (F, atomic #9)
D. Bromine (Br, atomic #35)

Fluorine is the most electronegative atom because it only needs one more valence electron to be stable and it has the least amount of orbitals, making it easier for the protons to attract a new electron.

Name _____ Date _____

Part B: Short Answer

1. Rank the following elements by increasing atomic radius: carbon, aluminum, oxygen, potassium.

   oxygen < carbon < aluminum < potassium

2. Rank the following elements by increasing electronegativity: sulfur, oxygen, neon, aluminum.

   neon, aluminum, sulfur, oxygen

3. Why does fluorine have a higher ionization energy than iodine?

   Ionization energy is the energy to remove an electron. The closer the valence orbital is to the nucleus, the harder it will be to remove the electron. Fluorine has 2 orbitals, while Iodine has 5 orbitals.

4. Why do elements in the same family generally have similar properties?

   Because they have the same number of valence electrons.

5. Indicate whether the following properties increase or decrease from left to right across the periodic table.
   a. atomic radius (excluding noble gases)
   b. first ionization energy
   c. electronegativity

   Due to more protons and stronger nuclear force, the atomic radius gets smaller, but the IE and EN get larger.

6. What trend in atomic radius occurs down a group on the periodic table? What causes this trend?

   The atomic radius gets larger going down because more orbitals (increased sheilding).

7. What trend in ionization energy occurs across a period on the periodic table? What causes this trend?

   The ionization energy increases nonmetals have almost full orbitals. They are trying to gain electrons, not lose them. So it will require more energy to make them lose an electron.

8. Circle the atom in each pair that has the largest atomic radius.
   a. Al or B
   b. Na or Al
   c. S or O
   d. O or F
   e. Br or Cl
   f. Mg or Ca

   - Al has more orbitals
   - Na has less protons , weaker nuclear force, cannot pull inward
   - S has more obitals
   - O has less protons, weaker nuclear force, cannot pull inward
   - Br has more obitals
   - Ca has mor obitals

Name _____ Date _____

9. Circle the atom in each pair that has the greater ionization energy.
   a. Li or Be
   b. Ca or Ba
   c. Na or K
   d. P or Ar
   e. Cl or Si
   f. Li or K

Ionization Energy increases up and to the right. Noble gases are the highest!

10. Circle the atom in each pair that has the greater electronegativity.
    a. Ca or Ga
    b. Br or As
    c. Li or O
    d. Ba or Sr
    e. Cl or S
    f. O or S

Electronegativity increases up and to the right. Noble gases are zero!

Part C: Fill-in-the-blank and Critical Thinking

1. Sulfur has ___6___ valence electrons when it is in the ground state.

2. Calcium and strontium have similar chemical properties because they both have the same number of ___valence electrons___.

3. The strength of an atom's attraction for the electrons in a chemical bond is called ___electronegativity___.

4. The element in Group 1 that is most likely to lose an electron is ___Francium (Fr)___.

5. The element in Group 17 that has the least attraction for gaining electrons is ___Astatine (At)___.

   Note: If this question had asked for which Halogen, the answer would have been Iodine. However, Astatine is the lowest element in Group 17 for the 2011 SOL version of the periodic table. The 2016 periodic table now shows Tennessine (Ts) as the lowest in Group 17.

6. The element with the highest ionization energy is ___Helium (He)___, and the element with the lowest ionization energy is ___Francium (Fr)___.

Part D: Critical Thinking

1. Name an element from Period 5 on the periodic table that is a transition element.

   Student may list any element from #39 - #48 on the periodic table.

2. List the elements from Group 2 in order of increasing atomic radius.

   Be < Mg < Ca < Sr < Ba < Ra

3. List the elements from Group 1 in order of increasing ionization energy.

   Fr < Cs < Rb < K < Na < Li < H

4. Explain the difference between ionization energy and electronegativity.

   Ionization is trying to remove an electron - making the atom less negatively charged. ELECTRONegativity (has the word ELECTRON) so it is trying to gain an electron making the atom more negative.

5. If ionization energy and electronegativity are different, then why do their trends increase in the same direction?

   IE is energy required to remove an electron, which will be harder to do when the valence orbital get more full. Electronegativity is the desire to gain an electron, which is stronger as the valence gets more full because it is almost completely stable.

6. Name the elements that belong to the Halogen group.

   Flourine, Chlorine, Bromine, Iodine

7. Which group on the periodic table has no electronegativity value? Why?

   Noble gases because they have full valence orbitals and have no desire to gain more electrons.

8. What happens to the atomic radius as shielding increases? Why?

   As shielding increases, the number of orbitals increases, which makes radius larger.

9. What happens to the electronegativity as shielding decreases? Why?

   As shielding decreases, the atoms has less orbitals, making the valence electrons get closer to the nucleus. This will increase EN because nucleus greater desire to gain electrons, when its easy for protons to attract them.

10. What happens to ionization energy as you move from left to right across the table?

    Ionization energy increase to the right because nonmetals have almost full valence orbitals. They want to gain electrons to be more stable, not lose electrons.

11. What happens to ionization energy as shielding increases? Why?

    As shielding increases the number of orbitals increase, pushing the valence electrons futher from the nucleus. The further way the electrons are, the easier it is to remove them so the IE decreases as shielding increases.