Periodic Properties Practice Items

1. Upon what basis did Mendeleev construct his periodic table?

    A.   the electron configuration of atoms as determined by emission spectra

    B.   the atomic radii of the elements as determined by α particle collision data

    C.   the variation of chemical properties with atomic weight

    D.   the periodic nature of electronegativity

2. Why do non-metals have high ionization energies?

    A.   They are very large atoms and thus have a stronger hold on their electrons.

    B.   They are on the right side of the periodic table.

    C.   High effective nuclear charge provides a stronger hold on outer shell electrons.

    D.   Their outer shell electrons are shielded from the nuclear charge.

3. Which has higher first ionization energy?

    A.   lithium
    B.   aluminum
    C.   boron
    D.   carbon

4. Which of the following statements is **true**?

    A.   Fluorine is less electronegative than chlorine.

    B.   Potassium has greater ionization energy than sodium.

    C.   Nitrogen has a greater electron affinity than carbon.

    D.   Carbon has a greater atomic radius than oxygen.

5. Which of the following statements is consistent with the table below?

    A.   The more electropositive the central atom of an oxide the more basic the oxide.

    B.   The larger the central atom of the oxide the more acidic the oxide.

    C.   The oxides of non-metals are acidic.

    D.   Nonmetal oxides react with acids to produce salts

Acidity or basicity of oxides of s- and p- block elements when dissolved in water						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	Ga	Ge	As	Se	Br
Rb	Sr	In	Sn	Sb	Te	I
Cs	Ba	Tl	Pb	Bi	Po	At
Basic Oxides		Amphoteric Oxides			Acidic Oxides	

**6.** Which of the following elements has an electronegativity value of 1.0 on the Pauling scale?

    A.   calcium
    B.   carbon
    C.   hydrogen
    D.   oxygen

7. All of the following can be measured **except**

    A. the ionization energy of krypton.
    B. the atomic radius of hydrogen.
    C. the Pauling electronegativity of helium.
    D. the electron affinity of lithium.

8. The graph below shows the variation across the 2nd period of the periodic table of this property

    A. ionization energy
    B. electron affinity
    C. atomic radius
    D. electronegativity
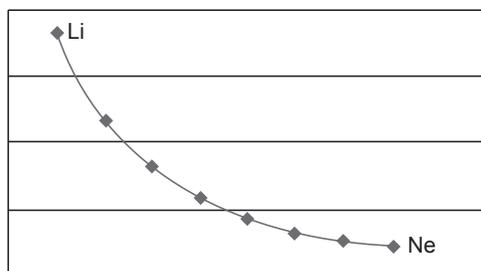
9. Which ion has the smallest radius?

    A. Be^+
    B. Li^+
    C. F^-
    D. O^{2-}

10. For which group is the difference between the first and second ionization energy the greatest?

    A. alkali metals
    B. alkaline earth metals
    C. halogens
    D. noble gases

11. The following elements appear prominently in organic chemistry – carbon, hydrogen, oxygen, nitrogen, and sulfur. Which two are closest to each other in Pauling electronegativity?

    A. carbon and sulfur
    B. oxygen and nitrogen
    C. carbon and hydrogen
    D. sulfur and nitrogen

12. Which of the following elements possesses an electron affinity that is actually endothermic?

    A. carbon
    B. nitrogen
    C. oxygen
    D. fluorine

13. For which of these salts does the bond between the anion and cation possess the greatest covalent character?

    A. $CaBr_2$
    B. $AgCl$
    C. KI
    D. $NaOH$

14. In comparing the standard state forms of various elements, which of the following properties is more positive the greater the Pauling electronegativity of the element?

    A. standard reduction potential
    B. electron affinity
    C. brittleness
    D. electric conductivity

The following passage pertains to questions 15 - 17.

Linus Pauling first proposed the concept of electronegativity in 1932. The concept explained the additional stabilization of a heteronuclear bond in terms of the contribution of ionic forms to an underlying covalent bond. The difference in electronegativity between atoms A and B is given by:

$$\chi_A - \chi_B = (eV)^{-1/2}\sqrt{E_d(AB) - [E_d(AA) + E_d(BB)]/2}$$

where the dissociation energies, E_d, of the A–B, A–A and B–B bonds are expressed in electron volts. Hence, for hydrogen and bromine, the dissociation energies H–Br, 3.79 eV; H–H, 4.52 eV; Br–Br 2.00 eV entail a difference in Pauling electronegativity of 0.73 between hydrogen and bromine.

One consequence of the Pauling electronegativity scale is that it provides a semi-empirical formula to determine dissociation energies. This energy estimate can be only used for single, not multiple bonds.

$$E_d(AB) = [E_d(AA) + E_d(BB)]/2 + (\chi_A - \chi_B)^2 eV$$

As only differences in electronegativity are defined, it is necessary to choose an arbitrary reference point in order to construct a scale. Because it forms covalent bonds with a large variety of elements, hydrogen was chosen as the reference, fixed at 2.1 (later revised to 2.2).

15. A heteronuclear covalent bond in which there is a strong contribution of ionic forms to the underlying covalent bond is a

   A. π bond
   B. σ bond
   C. polar covalent bond
   D. coordinate covalent bond

16. Which statement below follows from the method of determining bond dissociation energies described in the passage?

   A. Polar bonds tend to be stronger than nonpolar bonds.
   B. Bond formation between two atoms with high electronegativity tends to be very exothermic.
   C. The electronegativity difference between bonded atoms determines whether the bond is a single or double bond.
   D. Bond dissociation energy increases with ionization energy.

17. According to the theory underlying the electronegativity scale, which of the following is closest to the contribution made by the polar character of the bond to the bond dissociation energy of H–Br?

   A. 0.53 eV
   B. 0.63 eV
   C. 0.73 eV
   D. 2.52 eV