Name BETH "KEY" Period _____ BONDING REVIEW WS

1. Explain what is meant by the term "chemical bond".

A FORCE THAT HOLDS TWO ATOMS TOGETHER.

2. Complete the following table:

Bond Type	Ionic	Polar Covalent	Nonpolar Covalent
Describe what is happening with the electrons to create this bond.	Electrons are transferred.	Electrons are shared UNEQUALLY!	Electrons are shared EQUALLY!
What type of elements create this bond?	METAL & NONMETAL	NONMETALS	NONMETALS
Describe the difference in electronegativity between the atoms that form this bond.	LARGE	Difference is >0.4	Difference is ≤ 0.4

3. Examine the electron configuration for each of the following elements. Indicate if the atoms would gain or lose electrons and how many electrons in order to take on a noble gas electron configuration.

a. Ga LOSE 3 b. Ba LOSE 2 c. Te GAIN 2

d. Fr LOSE 1 e. I GAIN 1 f. As GAIN 3

4. Write the symbol for each of the ions formed in question 1.

a. Ga^{3+} b. Ba^{2+} c. Te^{2-}

d. Fr^{1+} e. I^{1-} f. As^{3-}

4. For each of the ions formed in question 1, write the symbol for the noble gas that has the same electron configuration.

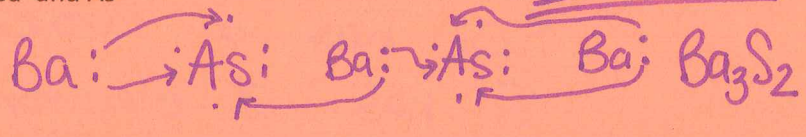
a. Ar b. Xe c. Xe

d. Rn e. Xe f. Kr

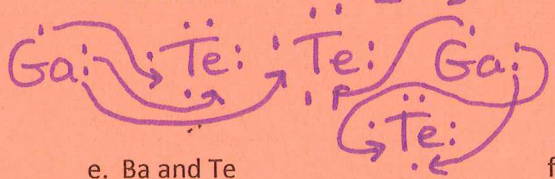
5. Use electron dot structures to show how ionic bonds would form for the following. USE ARROWS!

a. Fr and I

b. Ba and As

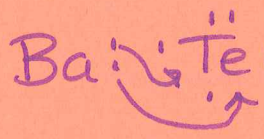


c. Ga and Te Ga_2Te_3

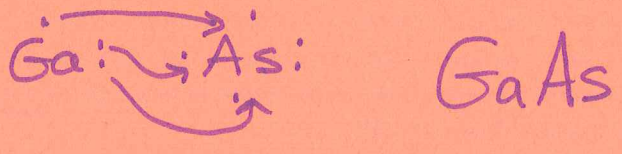


d. Fr and Te

e. Ba and Te



f. Ga and As



"EN"

6. Explain the term "electronegativity" in your own words.

Electronegativity is the ability of an atom in a bond to "Hog" the shared electrons.

Where on the periodic table do you find the atoms with the highest electronegativity?

EN is highest in the upper right corner.
F is the biggest hog on the table.

Where on the periodic table do you find the atoms with the lowest electronegativity?

EN is lowest in the bottom left corner.

7. Using the values for electronegativity, determine if the following bonds are ionic, polar covalent or nonpolar covalent.

If metal/nonmetal = Ionic → Large difference
If both nonmetals, ≤ 0.4 = nonpolar >0.4 = polar

a. Hydrogen and Chlorine
2.20 3.16
Polar Covalent

b. Strontium and Bromine
0.95 2.96
Ionic

c. Francium and Fluorine
0.7 3.98
IONIC!

d. Oxygen and Nitrogen
3.44 - 3.04 = 0.4
NONPOLAR
Charges too small, ignore.

8. Explain how you can use the position of elements on the periodic table to predict relative polarity of bonds. For example, how do you know by looking at the periodic table that a C-O bond is more polar than a N-O bond? The greater the distance between two elements on the table, the greater the difference in electronegativity.

How do you know that a bond between strontium and bromine is ionic?

Large difference in electronegativity and it is a metal & nonmetal.

9. What determines the molecular geometry (shape) of a molecule?

The repulsions of electron pairs around the central atom of a molecule.

10.

Both of these molecules can be described as bent/angular. However, one molecule has larger bond angles than the other. Which one? Explain.

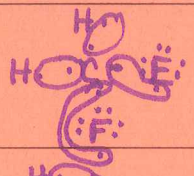
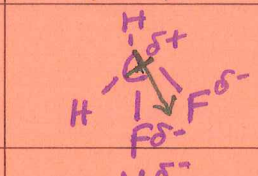
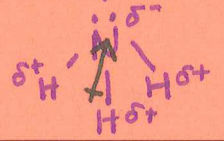
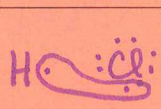
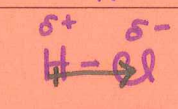
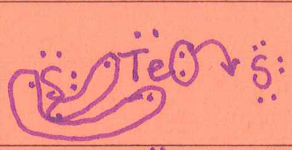
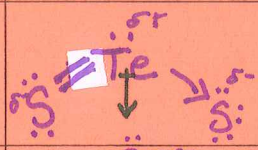
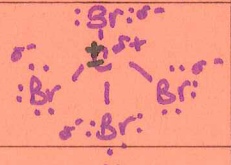
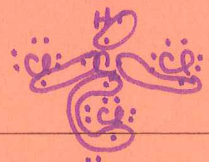
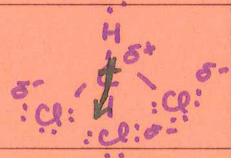
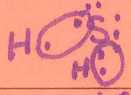
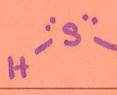
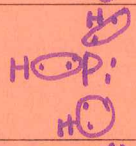
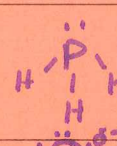
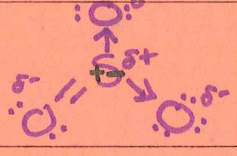
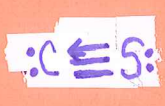
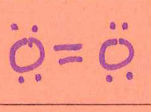
SO_2 has a larger bond angle.
S has 3 electron groups repelling where as in H_2O, the O has 4 electron groups repelling.

10. According to VSEPR Theory, the arrangements of electron pairs around NH_3 and CH_4 are:

a. different because there is a different number of atoms around the central atom.
b. different because there is a different number of electron pairs around the central atom.
c. the same because both nitrogen and carbon are in the second period.
d. the same because there is the same number of electron pairs around the central atom
e. both a and b are correct

6 a. Using electron dot structures, illustrate how the following molecules are <u>covalently</u> bonded. Circle the shared pairs of electrons.
b. Determine the shape of the molecule formed using VSEPR Theory
c. After completing the dot structure, draw the structural formula (Lewis structure) making sure it is drawn with the correct shape identified in step b.
d. Indicate any partial charges due to polar bonds on the structural formula.
e. Find the center of positive and negative charge and determine if the molecule is polar. If it is polar, please indicate the dipole moment with an arrow on the structural formula.

Cooridinate Covalent Bond (CCB) = One atom contributes both e⁻ to shared pair.

Formula	Electron Dot Structure	Structural Formula (Lewis)	Shape of Molecule	Polar or Nonpolar Molecule
CH_2F_2			Tetrahedral	Polar
NH_3			Trigonal pyramidal	Polar
HCl			Linear	Polar
TeS_2 CCB			Angular 120°	slightly Polar
CBr_4			Tetrahedral	Nonpolar
$CHCl_3$			Tetrahedral	Polar
H_2S			Angular 109.5°	Nonpolar
PH_3			Trigonal Pyramidal	Nonpolar
SO_3 CCB			Trigonal Planar	Nonpolar
CS CCB			Linear	Nonpolar
O_2			Linear	Nonpolar

C-H NONPOLAR
C-F POLAR
C = 2.55
H = 2.20
F = 3.98

N = 3.04
H = 2.20

H = 2.20
Cl = 3.16

Te = 2.1
S = 2.58
Barely Polar

C = 2.55
Br = 2.96
Barely Polar

H = 2.20
C = 2.55
Cl = 3.16

H = 2.20
S = 2.58
0.38

P = 2.19
H = 2.20
.01

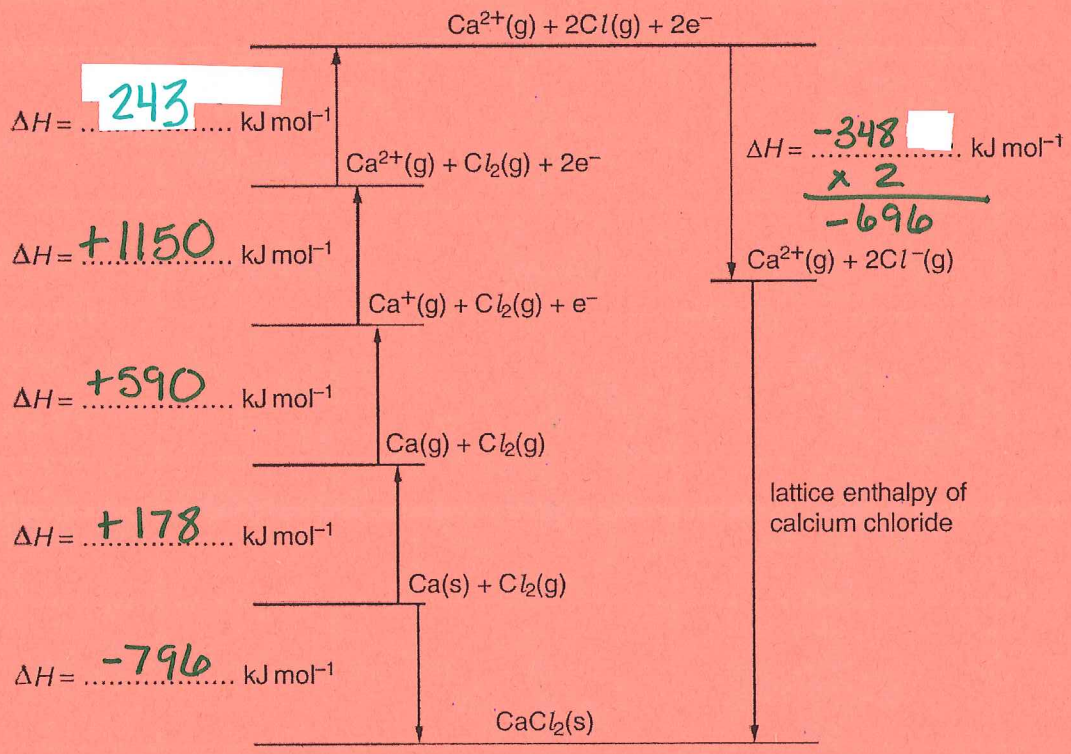
O = 3.44
S = 2.58

C = 2.55
S = 2.58

12. The table below shows the enthalpy (energy) changes needed to calculate the lattice energy of calcium chloride, $CaCl_2$.

Process	Enthalpy (Energy) Change: kJ mol^{-1}
1st Ionization Energy of Ca	+590
2nd Ionization Energy of Ca	+1150
Electron Affinity of Cl	-348
Sublimation of Ca	+178
Bond Breaking for Cl_2	+243
ΔH_f (Heat of Formation) $CaCl_2$	-796

(a) The Born-Haber cycle below can be used to calculate the lattice enthalpy for calcium chloride.



(i) Use the table of enthalpy changes to complete the Born-Haber cycle by putting in the correct numerical values on the appropriate dotted line. [3]

(ii) Use the Born-Haber cycle to calculate the lattice enthalpy of calcium chloride.

$178\ kJ + 590\ kJ + 1150\ kJ + 243\ kJ + (-696\ kJ) + X = -796\ kJ$ / mol $CaCl_2$

$1465\ kJ + X = -796\ kJ/mol\ CaCl_2$

$-1465 \qquad -1465$

Lattice Energy $= X = -2261\ kJ$

EXOTHERMIC!