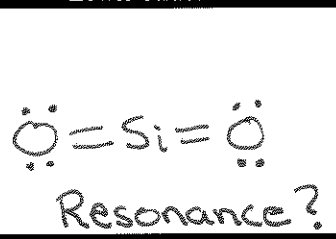
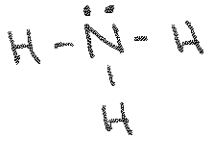
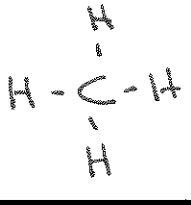
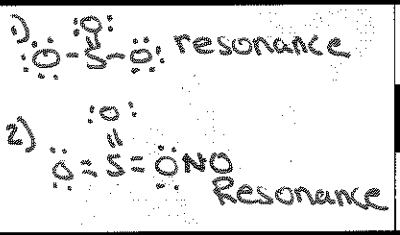
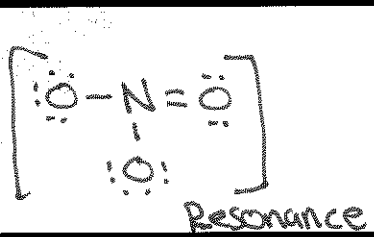
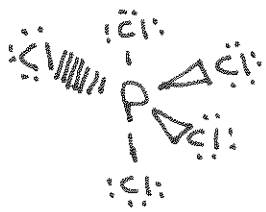
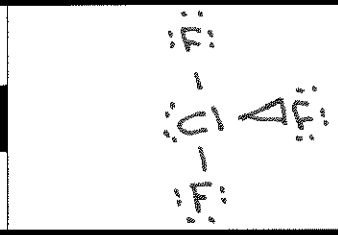
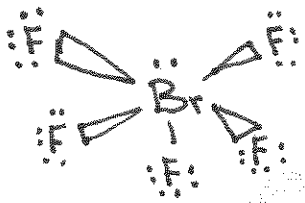
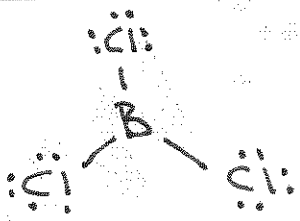
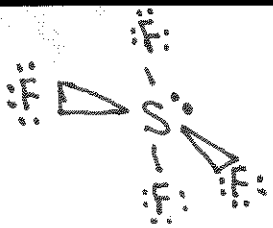
Name _____ **Honors Chemistry** ___/___/___

Covalent Compounds Practice Test

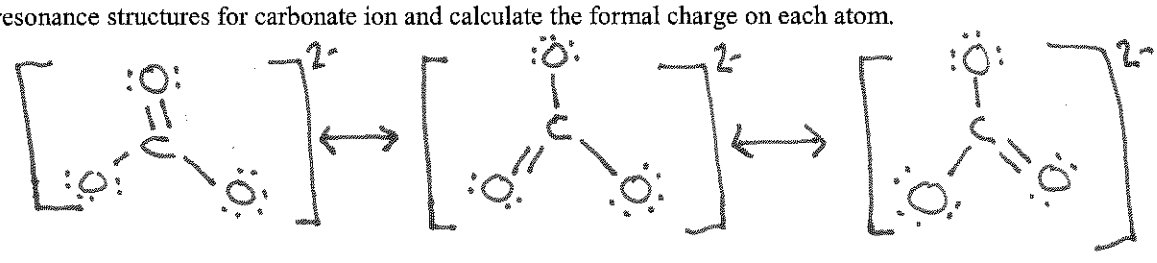
Part I: For each of the following, fill in the missing information. **All molecules should be drawn so that the central atom has a formal charge of zero.** If a resonance structure can be drawn, write "resonance" in the Lewis Structure box.

Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
silicon dioxide		**linear**	**Si +→ O polar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
SiO_2		**sp**	**2**	**2**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Ammonia		**trigonal pyramidal**	**N ←+H polar**	**polar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
NH_3		**sp^3**	**3**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Methane		**tetrahedral**	**C--H nonpolar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
CH_4		**sp^3**	**4**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Sulfur trioxide		**trigonal planar**	**S+→O polar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
SO_3		**sp^2**	**3 or 3**	**1 or 3**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Nitrate ion		**trigonal planar**	**N--O nonpolar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
NO_3^{1-}		**sp^2**	**3**	**1**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Phosphorus pentachloride		**trigonal bipyramidal**	**P+→Cl polar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
PCl_5		**dsp^3**	**5**	**0**

Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Chlorine trifluoride		**T-shaped**	**Cl+→F polar**	**polar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
ClF_3		**dsp^3**	**3**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Dihydrogen monoxide		**bent**	**O←+H polar**	**polar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
H_2O		**sp^3**	**2**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Beryllium dichloride		**linear**	**Be+→Cl polar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
$BeCl_2$		**sp**	**2**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Bromine pentafluoride		**square pyramidal**	**Br+→F polar**	**polar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
BrF_5		**d^2sp^3**	**5**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Boron trichloride		**trigonal planar**	**B+→Cl polar**	**nonpolar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
BCl_3		**sp^2**	**3**	**0**
Name	Lewis Structure	Shape	Bond Polarity	Molecular Polarity
Sulfur tetrafluoride		**seesaw**	**S+→F polar**	**polar**
Formula		Hybridization of Central Atom	# sigma bonds	# pi bonds
SF_4		**dsp^3**	**4**	**0**

Part II - Draw all resonance structures for carbonate ion and calculate the formal charge on each atom.

C: 4-4 = 0
O_1: 6-7 = -1
O_2: 6-6 = 0



Part III - For each of the following, indicate if it is a property of **ionic compounds** or **covalent compounds**.

1. **IONIC** They have high melting and boiling points.

2. **COVALENT** They are composed of two non-metals.

3. **COVALENT** They can sometimes have resonance structures.

4. **COVALENT** Their atoms are arranged into distinct molecules.

5. **IONIC** They are generally solid at room temperature.

6. **IONIC** They conduct electricity when dissolved in water.

Part IV - Multiple Choice: For each of the following, pick the best answer. Circle and write it on the line.

1. E Which of the following bonds is the weakest?
   a. single covalent bond b. double covalent bond c. triple covalent bond
   d. hydrogen bond **e. London dispersion force**

2. C Which of the following types of attractions is the strongest?
   a. dispersion forces b. dipole interactions **c. covalent bonds**
   d. hydrogen bonds e. all are equal in strength

3. C Which of the following molecules has polar bonds but is a non-polar molecule?
   a. silicon tetrahydride b. ammonia c. silicon dioxide
   d. dihydrogen monoxide e. diatomic nitrogen

4. E Which of the following is the most non-polar covalent bond?
   a. C - N b. N - H c. C - O d. N – O **e. F - F**

5. D Which of the following is an ionic bond?
   a. H-O b. P-F c. C-O **d. O-K** e. Cu-Cu

6. A Which of the following intermolecular forces explains why fluorine is a gas, but iodine is a solid?
   a. dispersion forces b. dipole interactions c. hydrogen bonds
   d. covalent bonds e. ionic bonding

7. A Which of the following molecules would have the most hydrogen bonding?
   a. H_2O b. H_2 c. CH_4 d. HCN e. HCl

8. B Which of the following molecules has the strongest dispersion forces?
   a. H_2 **b. I_2** c. Br_2 d. F_2 e. Cl_2

9. A Which of the following compounds does not have a resonance structure?
   a. SCl_2 b. NO_3^{1-} c. SO_2 d. CO_3^{2-} e. NO_2^{1-}

10. C Which of the following elements never follows the octet rule?
    a. C b. N **c. H** d. I e. F

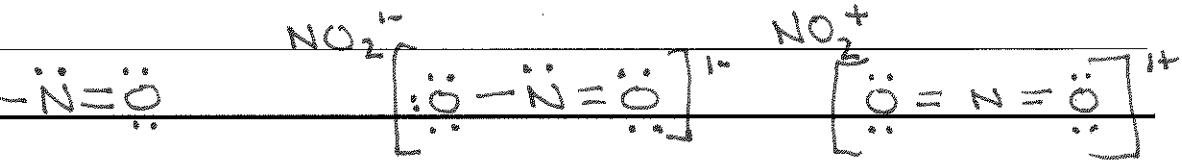
11. A Which of the following bonds is the longest?
    a. single bond b. double bond c. triple bond d. all bonds are the same length

12. D Which of the following molecules has the strongest bonds between atoms?
    a. H_2 b. F_2 c. O_2 **d. N_2** e. I_2

Part V – Free Response NO_2 NO_2^- NO_2^+

(a) Draw the Lewis electron-dot structure for each of the three species.
(b) List the species in order of increasing bond angle.
(c) List the species in order of increasing bond length.
(d) Give the hybridization of the nitrogen atom in each molecule.
(e) Identify the only one of the species that dimerizes and explain what causes it to do so.

a. NO_2 NO_2^- NO_2^+



b. NO_2^- or NO_2 (small ~120°) ; NO_2^+ (large 180°)

c. NO_2^+ (short) ; NO_2^- or NO_2 (longer)
double bonds 1½ bonds

d. NO_2: sp^2 NO_2^-: sp^2 NO_2^+: sp

e. NO_2 dimerizes because it has an odd # of electrons.

H 2.20																He
Li 0.98	Be 1.57											B 2.04	C 2.55			Ne
Na 0.93	Mg 1.31											Al 1.61	Si 1.90	P 2.19	S 2.58	Ar
K 0.82	Ca 1.00	Sc 1.36	Ti 1.54	V 1.63	Cr 1.66	Mn 1.55	Fe 1.83	Co 1.88	Ni 1.91	Cu 1.90	Zr 1.65	Ga 1.81	Ge 2.01	As 2.18	Se 2.55	Br 2.96
Rb 0.82	Sr 0.95	Y 1.22	Zr 1.33	Nb 1.6	Mo 2.16	Tc 1.9	Ru 2.2	Rh 2.28	Pd 2.20	Ag 1.93	Cd 1.69	In 1.78	Sn 1.96	Sb 2.05	Te 2.1	2.66