Name_____Date _____

☞ Due Test Day!

Pretest: Unit 4
Covalent Bonding

The following is an overview of the concepts, ideas, and problems we have covered in this unit. You are, however, responsible for all material covered, regardless if found here or not! Therefore, be sure to review all your notes, worksheets, assignments, handouts, readings, labs, problems, etc.. On the day of the test you will want to be well-acquainted with the material and organized, you will not want to waste time trying to understand an idea or searching for some needed information. Arrive prepared!

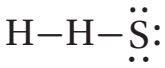
Text References:

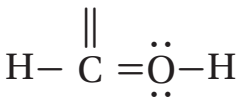
- Introduction to Chemical Bonding (6.1)
- Covalent Bonding (6.2)
- Molecular Geometry (6.5)
- Naming Molecular Compounds (7.1, pages 215-219)

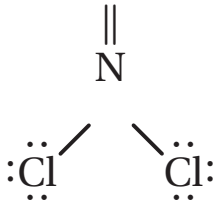
Know the following vocabulary terms listed below:

• acids	• Formal charge	• multiple bond
• binary compound	• hybridization	• nonpolar covalent bond
• bond energy	• Lewis structure	• polar covalent bond
• chemical bond	• molecular compound	• resonance
• covalent bonding	• molecular formula	• single bond
• dipole	• molecule	• structural formula
		• VSEPR theory

1. Explain what is wrong with the following Lewis structures, then rewrite each one correctly!

a. 

b. 

c. 

Practice Problems

1.) Draw Lewis dot structures for:

a	H_2O	
b	CO_2	
c	PF_3	
d	H_2S	
e	CN^-	
f	CF_4	
g	$C_2H_3O_2^-$ (CH_3COO^-) (you've had this one before!)	

2.) Name each of the following compounds:

a.) N_2O_3 _____

b.) FeP _____

c.) H_3PO_4 _____

d.) PBr_3 _____

e.) HCl _____

f.) $MgCl_2$ _____

g.) OF_2 _____

3.) Write formulas for the following compounds:

a.) aluminum hydroxide _____

b.) chromium(II) chloride _____

c.) phosphorus pentoxide _____

d.) hydrobromic acid _____

e.) tetraphosphorus decoxide _____

f.) sulfurous acid _____

4.) With words and a diagram, describe the bond that occurs between chlorine and hydrogen in HCl. (Note a similar example was done in class... Check your notes!)

5.) Using the electronegativity values found on the last page of this packet, label each bond below as nonpolar covalent, polar covalent, or ionic. For polar covalent bonds, correctly add δ+ and δ-to indicate the bond's polarity.

a.) H ----- F _____ d.) Mg ---- O _____

b.) N ----- N _____ e.) Cl ---- P _____

c.) N ----- O _____ f.) S ---- Cl _____

6.) In terms of bonding, why does the element oxygen always appear as a diatomic element (O_2 not just O)? Explain thoroughly, using labeled orbital diagrams in your discussion.

7.) Use an orbital diagram to show how carbon creates four identical hybrid orbitals. (What are these orbitals called? Why are they called this?)

8.) i. Draw a proper Lewis structure for each of the following ions, then circle the one that has the shortest and strongest N-O bonding.

NO_2^- NO_3^- NO^+

ii. Which compound(s) from part i has a N-O bond that is composed of 1 pi bond and 1 sigma bond?

9.)

Valence e^- Total	Lewis Dot Structure	Molecular Shape & Bond Angle	Name of Shape	Molecular Polarity
NO_3^-				
BrCN				
SO_3				
C_2HF				
HNO_2 (oxyacid)			(with respect to N) (with respect to O)	
BF_3				
HCOOH			(with respect to C) (with respect to the O with 2 bonds)	

10.) Which compound(s) in problem #9 (above) contain polar bonds, but is/are nonpolar due to symmetry?

11.) Draw the three resonance structures for the nitrate ion, NO_3^-.

12.) Use Lewis structures and arrows to show the coordinate covalent bonding that forms between BF_3 and NH_3.

13.) Use the table below to calculate the energy need to break all the bonds in the following compounds:

a. CCl_4

b. HCOOH

Bond	Average bond energy (kJ/mol)	Bond	Average bond energy (kJ/mol)	Bond	Average bond energy (kJ/mol)	Bond	Average bond energy (kJ/mo
H—H	436	C—C	346	C—C	346	C—O	358
F—F	159	C—N	305	C=C	612	C=O	732
Cl—Cl	243	C—O	358	C≡C	835	C≡O	1072
Br—Br	193	C—H	418	C—N	305	N—N	163
I—I	151	C—Cl	327	C=N	615	N=N	418
H—F	569	C—Br	285	C≡N	887	N≡N	945
H—Cl	432	N—N	163				
H—Br	366	N—H	386				
H—I	299	O—H	459				

14.) Circle the correct answers.

Use the questions and the test-taking tip to prepare for your standardized test.

1. The common name of SiI_4 is tetraiodosilane. What is its molecular compound name?

a. silane tetraiodide
b. silane tetraiodine
c. silicon iodide
d. silicon tetraiodide

2. Which of the following compounds contains at least one pi bond?

a. CO_2 **c.** AsI_3
b. $CHCl_3$ **d.** BeF_2

3. The Lewis structure for silicon disulfide is _____.

a. Si=S

b. S=Si=S

c. S :Si: S

d. :S=Si=S:

4. The central selenium atom in selenium hexafluoride forms an expanded octet. How many electron pairs surround the central Se atom?

a. 4 **c.** 6
b. 5 **d.** 7

5. Chloroform ($CHCl_3$) was one of the first anesthetics used in medicine. The chloroform molecule contains 26 valence electrons in total. How many of these valence electrons take part in covalent bonds?

a. 26 **c.** 8
b. 13 **d.** 4

6. Which is the strongest type of intermolecular bond?

a. ionic bond
b. dipole-dipole force
c. dispersion force
d. hydrogen bond

7. All of the following compounds have bent molecular shapes EXCEPT _____.

a. BeH_2 **c.** H_2O
b. H_2S **d.** SeH_2

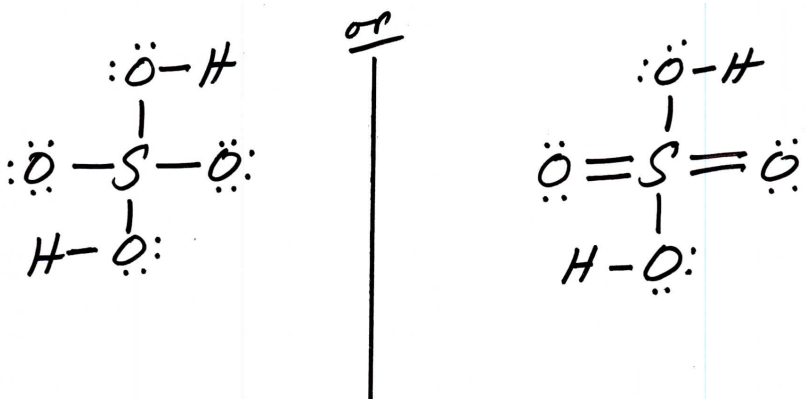
8. Which of the following compounds is NOT polar?

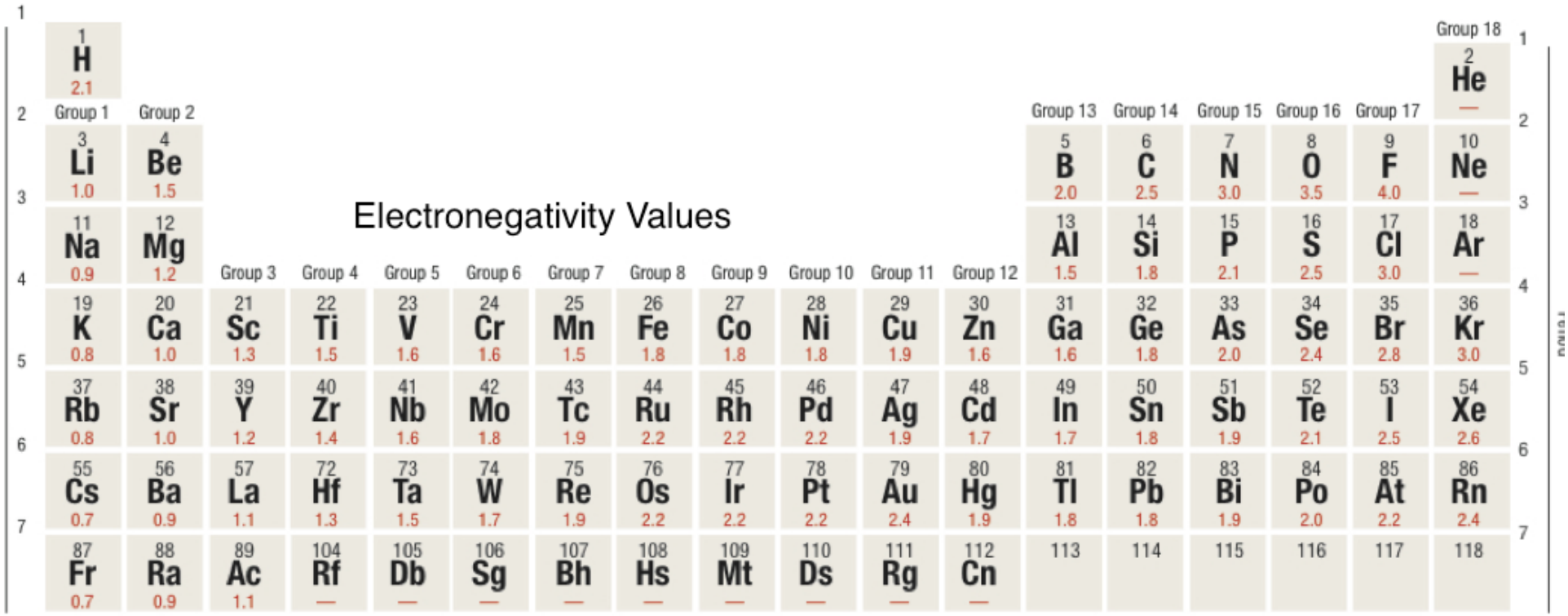
a. H_2S **c.** SiH_3Cl
b. CCl_4 **d.** AsH_3

9. Which of the following diatomic gases has the shortest bond between its two atoms?

a. HI **c.** Cl_2
b. O_2 **d.** N_2

15.) Use the concept of Formal Charge to determine which of the following is the most likely structure for sulfuric acid, H_2SO_4.




Electronegativity Values
Group 1
Group 2
Group 3
Group 4
Group 5
Group 6
Group 7
Group 8
Group 9
Group 10
Group 11
Group 12
Group 13
Group 14
Group 15
Group 16
Group 17
Group 18
1 H 2.1
2 He —
3 Li 1.0
4 Be 1.5
5 B 2.0
6 C 2.5
7 N 3.0
8 O 3.5
9 F 4.0
10 Ne —
11 Na 0.9
12 Mg 1.2
13 Al 1.5
14 Si 1.8
15 P 2.1
16 S 2.5
17 Cl 3.0
18 Ar —
19 K 0.8
20 Ca 1.0
21 Sc 1.3
22 Ti 1.5
23 V 1.6
24 Cr 1.6
25 Mn 1.5
26 Fe 1.8
27 Co 1.8
28 Ni 1.8
29 Cu 1.9
30 Zn 1.6
31 Ga 1.6
32 Ge 1.8
33 As 2.0
34 Se 2.4
35 Br 2.8
36 Kr 3.0
37 Rb 0.8
38 Sr 1.0
39 Y 1.2
40 Zr 1.4
41 Nb 1.6
42 Mo 1.8
43 Tc 1.9
44 Ru 2.2
45 Rh 2.2
46 Pd 2.2
47 Ag 1.9
48 Cd 1.7
49 In 1.7
50 Sn 1.8
51 Sb 1.9
52 Te 2.1
53 I 2.5
54 Xe 2.6
55 Cs 0.7
56 Ba 0.9
57 La 1.1
72 Hf 1.3
73 Ta 1.5
74 W 1.7
75 Re 1.9
76 Os 2.2
77 Ir 2.2
78 Pt 2.2
79 Au 2.4
80 Hg 1.9
81 Tl 1.8
82 Pb 1.8
83 Bi 1.9
84 Po 2.0
85 At 2.2
86 Rn 2.4
87 Fr 0.7
88 Ra 0.9
89 Ac 1.1
104 Rf —
105 Db —
106 Sg —
107 Bh —
108 Hs —
109 Mt —
110 Ds —
111 Rg —
112 Cn —
113
114
115
116
117
118