

Name: _____

KEY

Date: _____

Hr _____

Covalent Bonds and Molecular Structure

1) How are ionic bonds and covalent bonds different?

ionic bonds have a transfer of electrons.
 covalent bonds share electrons

2) Describe the relationship between the length of a bond and the strength of that bond.

longer the bond the weaker

3) Identify the type(s) of bond(s) found in the following molecules:

- a. CCl_4 covalent 2 non-metals
 b. Li_2O ionic metal + nonmetal
 c. NF_3 covalent
 d. CaSO_4 ionic
 e. SO_2 covalent
 f. Mg(OH)_2 ionic

4) Define electronegativity.

An atom's ability to pull an electron toward itself
 in a chemical bond.

5) Use electronegativity values to place the following elements in **increasing** order: ^{4.0 3.0 2.2 2.1 1.9 2.5 3.4} F, N, H, P, Si, C, O

Si, H, P, C, N, O, F

6) Determine if the bond between atoms in each example below is nonpolar covalent, polar covalent, or ionic.

- | | | | |
|-----------------|-----------------|--------|------------------|
| a. H_2 | <u>nonpolar</u> | e. NF | <u>polar</u> |
| b. PCl | <u>polar</u> | f. MgO | <u>ionic</u> |
| c. F_2 | <u>nonpolar</u> | g. CH | <u>non-polar</u> |
| d. NaBr | <u>ionic</u> | h. HCl | <u>ionic</u> |

7) Draw Lewis Structures for the following molecules:

a. $\overset{4 \uparrow}{\text{CO}_2}$



b. BeCl_2



c. H_2O



d. BF_3



e. CCl_4

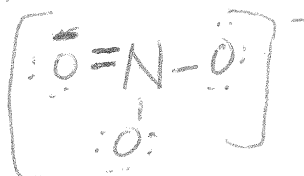


f. NH_3



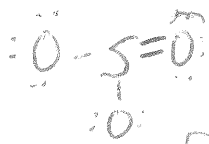
g. $\overset{5 \uparrow +14}{\text{NO}_3^-}$

24e⁻



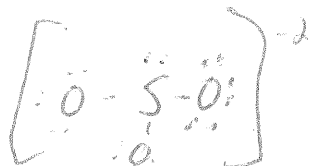
h. $\overset{6 \uparrow +18}{\text{SO}_3}$

24e⁻



i. $\overset{22}{\text{SO}_3^{2-}}$

26e⁻



j. NF_3



k. CO

10e⁻



l. O_3

18e⁻



m. CO_3^{2-}

24e⁻



n. SO_2

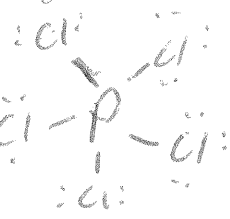
18e⁻



o. PF_5



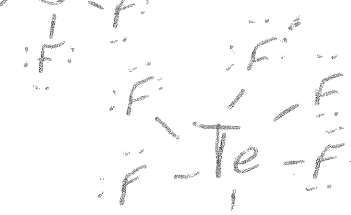
p. PCl_5



q. SF_6



r. TeF_6



8) Which of the above compounds (in number 7) require resonance structures to describe the structure properly? Draw them.



9) Which of the above compounds (in number 7) are exceptions to the octet rule?



10) Fill in the table below to determine the molecular geometry for the following molecules:

Formula	Number of e ⁻ domains on central atom	Bonding pairs	Lone pairs	Electron-Domain Geometry (name)	Molecular Geometry (name)	Bond angle(s) on central atom
CO ₂	2	2	0	linear	linear	180°
BeCl ₂	2	2	0	linear	linear	180°
H ₂ O	4	2	2	tetrahedral linear	bent	less than 109.5°
BF ₃	3	3	0	trigonal planar	trigonal planar	120°
CCl ₄	4	4	0	tetrahedral	tetrahedral	109.5°
NH ₃	4	3	1	tetrahedral	trigonal pyramidal	less than 109.5°
NO ₃ ⁻	3	3	0	trigonal planar	trigonal planar	120°
SO ₃	3	3	0	trigonal planar	trigonal planar	120°
SO ₃ ²⁻	4	3	1	tetrahedral	trigonal pyramidal	less than 109.5°
NF ₃	4	3	1	tetrahedral	trigonal pyramidal	less than 109.5°

Formula	Number of e ⁻ domains on central atom	Bonding pairs	Lone pairs	Electron-Domain Geometry (name)	Molecular Geometry (name)	Bond angle(s) on central atom
CO	2	2	0	linear	linear	180°
O ₃	3	2	1	trigonal planar	bent	less than 120°
CO ₃ ²⁻	3	3	0	trigonal planar	trigonal planar	120°
SO ₂	3	2	1	trigonal planar	bent	less than 120°
PF ₅	5	5	0	trigonal bipyramidal	trigonal bipyramidal	90° 120°
PCl ₅	5	5	0	trigonal bipyramidal	trigonal bipyramidal	90° 120°
SF ₆	6	6	0	octahedral	octahedral	90°
TeF ₆	6	6	0	octahedral	octahedral	90°

11) a. Identify the molecules in the table above that are polar.

H₂O, NH₃, SO₃²⁻, NF₃, SO₂

b. How many nonbonding pairs of electrons did the polar molecules have? 1 or 2

c. How many nonbonding pairs of electrons did the nonpolar molecules have? 0

12) Give one example of a polar molecule that has nonpolar bonds. None

Give one example of a nonpolar molecule that has polar bonds. SF₆