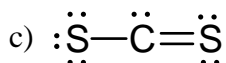
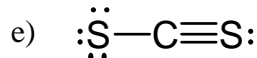
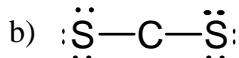
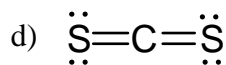
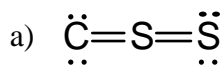


1441 Test Four Chapters 9 and 10 Silberberg
Website: <http://dipowell1.home.mindspring.com>

Chapter 9 and 10: Bonding, General Concepts

1. The correct statement is: (a) water is linear (b) the molecule ClO_2 cannot be accurately described by Lewis structure consistent with the octet rule (c) the bonds in LiF have more covalent character than those in F_2 (d) all of these are false
2. How many of the following molecules or ions are linear? NH_3 , NH_4^+ , HCN , CO_2 , NO_3^- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
3. Which of the following species has a trigonal bipyramidal structure? (a) NH_3 (b) IF_5 (c) I_3^- (d) PCl_5 (e) none of these
4. What is the molecular structure of XeF_4 ? (a) linear (b) tetrahedral (c) square planar (d) octahedral
5. Give an example of each: Polar Covalent Compound, 100% Covalent Compound, Ionic Compound. What one factor causes the bonding type to change
6. Which contains the most polar bond: HBr , HCl , or HF ?
7. As the bond order for a carbon-carbon bond increases, which one of the following decreases? (a) number of electrons between the carbon atoms (b) bond energy (c) bond length (d) number of pi bonds (e) none of these
8. Which of the following groups contain no ionic compounds? (a) HCN , NO_2 , $\text{Ca}(\text{NO}_3)_2$ (b) PCl_5 , LiBr , SF_4 (c) KOH , CCl_4 , SF_4 (d) NaH , CaF_2 , NaNH_2 (e) CHO_2 , H_2S , NH_3
9. Using the concept of formal charge, which electron dot formula most accurately describes the bonding of CS_2 ?



The correct dots did not show on the drawings. Please put the following numbers of dots around each atom starting with the atom to the far left. (a) 4,0,4 (b) 6,0,6 (c) 6,2,4 (d) 4,0,4 (e) 6,0,2

10. Which of the following molecules exhibit resonance? PF_5 , SO_2 , O_3 , SO_4^{2-} (a) SO_2 (b) PF_5 , SO_4^{2-} (c) SO_2 , O_3 (d) O_3 (e) SO_4^{2-}
11. Which of the following violates the octet rule: I. BF_3 II. CHBr_3 (C is central) III. Br_2 IV. XeCl_2 V. CO VI. SF_4 (a) I,II,IV (b) I,III,IV,VI (c) III,V,VI (d) I,IV,VI
12. What is ΔH for the reaction: $\text{Br}_2 + 3\text{F}_2 \rightarrow 2\text{BrF}_3$. Bond dissociation energies are as follows: $\text{Br-Br} = 192\text{kJ/mole}$, $\text{F-F} = 159\text{kJ/mole}$, $\text{Br-F} = 197\text{kJ/mole}$ (Bond energies given on page 372 in text.)

For each of the following molecules do the following: Lewis Dot Drawing, Geometric Drawing, Molecular Geometry(name of shape), Hybridization and Polarity (does it have a dipole moment)

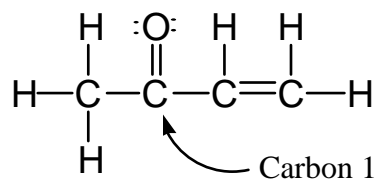
H_2O , CH_4 , NH_3 , CO_2 , XeF_4 , BCl_3 , NO , ClF_3 , SF_4

Chapter 11: Covalent Bonding: Orbitals (This will be on the final but not on test 4)

Molecular Orbital Order: $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p}^4 \sigma_{2p}^2 \pi_{2p}^{*4}$

13. Which of the following molecules or ions is not paramagnetic in its ground state? (a) O_2 (b) O_2^+ (c) B_2 (d) NO (e) F_2
Use Molecular Orbital to determine the bond order of B_2 and predict if the molecule could exist.
14. Which of the following statements is/are false? (1) the hybridization of N in NH_3 is sp^2 (2) the hybridization of P in PCl_5 is dsp^3 (3) the bond order of N_2 is three (4) the molecule HCN has two pi and two sigma bonds (a) all four statements are true (b) 2 (c) 1, 4 (d) 2, 3 (e) 2, 3, 4

15. Consider the Lewis structure for



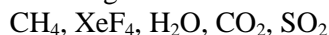
The dots around O did not print. Please put 4 dots around the O in the above diagram.

Which statement about the molecule is false? (a) C-1 is sp^2 hybridized (b) Oxygen is sp^2 hybridized (c) the molecule contains 28 valence electrons (d) the molecule contains 1 pi and 11 sigma bonds (e) all statements are true

Additional Advanced Questions

16. The angles between sp^2 orbitals are
- 45°
 - 90°
 - 109.5°
 - 120°
 - 180°
17. The hybrid orbitals used for bonding by Xe in the unstable XeF_2 molecule are ___ orbitals.
- sp^2
 - sp^3
 - sp^3d
 - sp^3d^2
 - sp
18. Draw the Lewis structures of NO^+ , NO_2^- , and NO_3^- . Based upon a consideration of the Lewis structures, which of these should have the longest N–O bond, and which should have the shortest N–O bond?
- | <u>Longest bond</u> | <u>Shortest bond</u> |
|---------------------|----------------------|
| a) NO^+ | NO_3^- |
| b) NO^+ | NO_2^- |
| c) NO_2^- | NO_3^- |
| d) NO_3^- | NO_2^- |
| e) NO_3^- | NO^+ |

19. Place the following molecules in order of increasing bond angle:



- a) $\text{XeF}_4 < \text{CH}_4 < \text{SO}_2 < \text{H}_2\text{O} < \text{CO}_2$
- b) $\text{CH}_4 < \text{XeF}_4 < \text{H}_2\text{O} < \text{CO}_2 = \text{SO}_2$
- c) $\text{H}_2\text{O} < \text{CH}_4 < \text{XeF}_4 < \text{SO}_2 < \text{CO}_2$
- d) $\text{SO}_2 < \text{CO}_2 < \text{CH}_4 < \text{XeF}_4 < \text{H}_2\text{O}$
- e) $\text{XeF}_4 < \text{H}_2\text{O} < \text{CH}_4 < \text{SO}_2 < \text{CO}_2$

Rules for Drawing Lewis Dot Diagrams

1. Count the total number of valence electrons. (Roman Numeral at top tells valence electrons)
 2. Hook all atoms to the central atom with single bonds and eight electrons around each atom except hydrogen which wants only two.
 3. (a) If the dots in the drawing match the valence electrons, the drawing is correct.
(b) If too few dots are used, add the extra dots to the central atom
(c) If too many dots are used, erase two dots from each of two adjacent atoms and replace them with a bond between the two atoms. Electrons in bonds between atoms count for both atoms involved.
- (I. Boron is an electron deficient atom and will have 6 dots instead of 8. (II) in oxygen-containing acids, the O's hook to the central atom and the H's hook to the O's.)

How to identify Sigma(σ) and Pi(Π) bonds

All single bonds between atoms are sigma bonds. The second bond in a double bond and the second and third bond in a triple bond are pi bonds. In other words, single bonds are sigma, double bond (one pi and one sigma), and triple bond(two pi and one sigma).

For a Molecule to be Polar:

1. Must contain at least two different elements.
2. The center of positive and negative must not coincide.

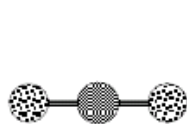
(If the Lewis Dot diagram has one lone pair or if it contains three different element, the molecule will be polar. It the Lewis Dot drawing contains no lone pairs and the same element at each position, it will be nonpolar.)

Hybridization:

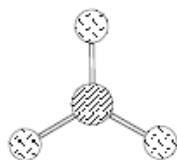
Count the things around the central atom. (Everything counts as one: single bond, double bond, triple bond, atoms, or loan pairs.) You must use one atomic orbital for each thing around the central atom. Your choice of atomic orbitals will always be one s orbital first, three p orbitals secondly, and five d orbitals last. Example: 4 things would need one s and three p = sp^3 . Five things would need one s, three p, and one d = sp^3d .

VSEPR Geometries

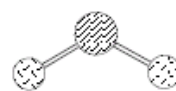
"A" is the central atom; "X" is a bonded atom; "E" is a nonbonding pair of electrons



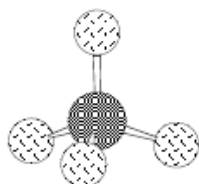
AX₂ Linear



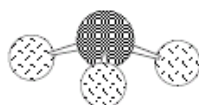
AX₃ Trigonal Planar



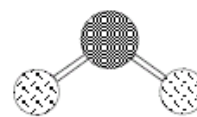
AX₂E Bent



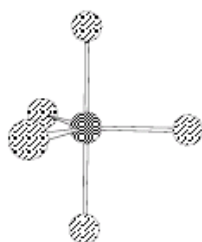
AX₄ Tetrahedral



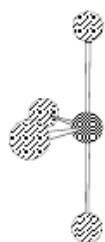
AX₃E Pyramidal



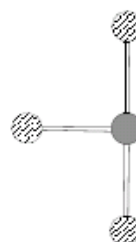
AX₂E₂ Bent



AX₅ Trigonal Bipyramidal



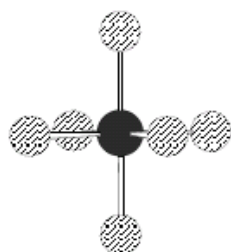
AX₄E Seesaw



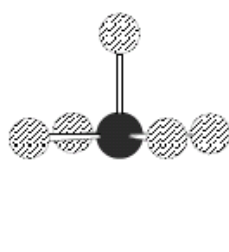
AX₃E₂ T-shaped



AX₂E₃ Linear



AX₆ Octahedral



AX₅E Square Pyramidal



AX₄E₂ Square Planar