

MULTIPLE CHOICE. Circle the one alternative that best completes the statement or answers the question.

1. "Electrons will spread out in orbitals with the same energy before they begin to pair" is called _____ . (2 pts.)
***A) Hund's Rule**
B) the Pauli Exclusion Principle
C) the ground state
D) the excited state
E) the Aufbau Principle
2. Of the following, which atom has the largest atomic radius? (2 pts.)
***A) Ge** B) As C) Si D) P
3. Of the following, which element has the highest first ionization energy? (2pts.)
A) Ge B) As C) Si ***D) P**
4. Which of the following has the highest second ionization energy? (2 pts.)
***A) K** B) Ca C) Rb D) Sr
5. Which of the following has the largest Electron Affinity (the largest negative number)? (2 pts.)
***A) S** B) Se C) P D) As
6. Which of the following has the smallest electronegativity? (2 pts.)
***A) Ge** B) As C) Si D) P
7. Which of the following ionic compounds would be expected to have the highest lattice energy? (2 pts.)
A) NaBr ***B) MgBr₂** C) CaBr₂ D) BaBr₂
8. Which of the following has the smallest diameter? (2 pts.)
***a. Mg⁺²** b. Mg c. Mg⁻¹

9. Which has the longest bond length? (2 pts.)

*A. a single-bond

B. a double-bond

C. a triple-bond

D. they're all about the same

10. Which of the following bonds is the most polar? (2 pts)

*a) B—F

b) O—F

c) C—F

d) they have the same polarity

e) these are nonpolar bonds

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

11. How many valence electrons do each of the following elements have? (1 pt. each)

A) Br 7

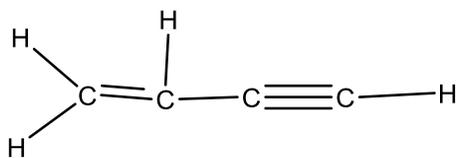
B) P 5

C) C 4

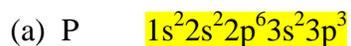
12. What is the electron domain geometry in a molecule in which the central atom of a molecule

has sp^3 hybridization? tetrahedral (2 pts.)

13. How many π bonds and σ bonds are in the following molecule? 3 π bonds, 7 σ bonds (2 pts.)



14. Write the complete electron configuration for the following: (3 pts. each)



15. Write the condensed electron configuration for each of the following: (3 pts. each)



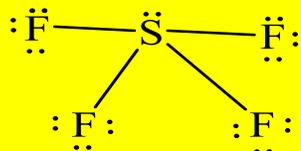
CALCULATIONS and STRUCTURES. Show answers with units and correct significant figures. MUST SHOW WORK.

16. Assign formal charges to each atom in the following structure. SHOW ALL WORK. Please identify which atom each calculation is for. (6 pts.)

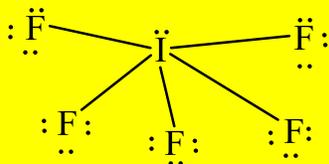


$1^{\text{st}} \text{ N from left: } 5 - 4 - 2 = -1$ $2^{\text{nd}} \text{ N: } 5 - 0 - 4 = +1$ $\text{O: } 6 - 4 - 2 = 0$

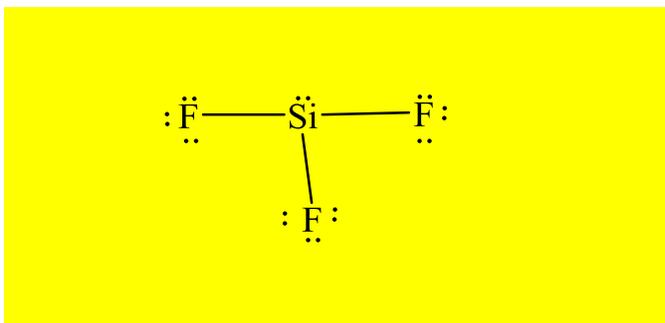
17. (a) Draw the electron dot structure for SF₄. (8 pts.)
(b) What is the Electron Domain Geometry? **trigonal bipyramidal**
(c) What is the Molecular Geometry? **see-saw**
(d) What is the hybridization of the central atom? **dsp³**
(e) What are the bond angles? **<90°, <120°, and >180°**
(f) Is this molecule **polar** or nonpolar? Circle one.



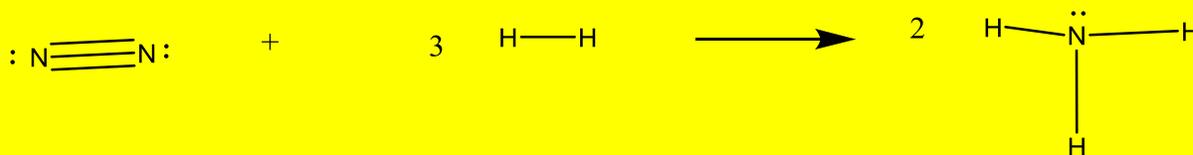
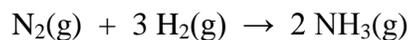
18. (a) Draw the electron dot structure for IF₅. (8 pts.)
(b) What is the Electron Domain Geometry? **octahedral**
(c) What is the Molecular Geometry? **square pyramidal**
(d) What is the hybridization of the central atom? **d²sp³**
(e) What are the bond angles? **<90°, and >180°**
(f) Is this molecule **polar** or nonpolar? Circle one.



19. (a) Draw the electron dot structure for SiF_3^{-1} . (8 pts.)
 (b) What is the Electron Domain Geometry? **tetrahedral**
 (c) What is the Molecular Geometry? **trigonal pyramidal**
 (d) What is the hybridization of the central atom? **sp^3**
 (e) What are the bond angles? **$<109.5^\circ$**
 (f) Is this molecule **polar** or nonpolar? Circle one.



20. Use the average bond dissociation energies (bond enthalpies) to calculate approximate ΔH_{rxn} in kJ for the following reaction. (8 pts.)



$$\Delta H_{\text{rxn}} = [1(\text{N}\equiv\text{N}) + 3(\text{H}-\text{H})] - [6(\text{N}-\text{H})]$$

$$= [(1\text{mole})(941 \text{ kJ/mole}) + (3 \text{ mole})(436 \text{ kJ/mole})] - [(6 \text{ mole})(391 \text{ kJ/mole})]$$

$$= [2249 \text{ kJ}] - [2346 \text{ kJ}] = -97 \text{ kJ}$$

21. (a) Draw the Molecular Orbital Diagram for the peroxide ion, O_2^{-2} , labeling each orbital. (10 pts)
- (b) What is the bond order for this ion? Show calculation. What does this predict? (2 pts)
- (c) Using this MO diagram, predict whether this ion is diamagnetic or paramagnetic. Explain. (2 pts.)

(a) See textbook p. 466, look at the Molecular Orbital Diagram for O_2 , and then add 2 electrons because this is O_2^{-2} . (I don't know how to draw this on the computer yet.)

(b) bond order = $1/2 (10-8) = 1$

(this predicts a single bond)

(c) diamagnetic, because all electrons are paired in the Molecular Orbital Diagram.

TABLE 8.4 ■ Average Bond Enthalpies (kJ/mol)**Single Bonds**

C—H	413	N—H	391	O—H	463	F—F	155
C—C	348	N—N	163	O—O	146		
C—N	293	N—O	201	O—F	190	Cl—F	253
C—O	358	N—F	272	O—Cl	203	Cl—Cl	242
C—F	485	N—Cl	200	O—I	234		
C—Cl	328	N—Br	243			Br—F	237
C—Br	276			S—H	339	Br—Cl	218
C—I	240	H—H	436	S—F	327	Br—Br	193
C—S	259	H—F	567	S—Cl	253		
		H—Cl	431	S—Br	218	I—Cl	208
Si—H	323	H—Br	366	S—S	266	I—Br	175
Si—Si	226	H—I	299			I—I	151
Si—C	301						
Si—O	368						
Si—Cl	464						

Multiple Bonds

C=C	614	N=N	418	O ₂	495
C≡C	839	N≡N	941		
C=N	615	N=O	607	S=O	523
C≡N	891			S=S	418
C=O	799				
C≡O	1072				