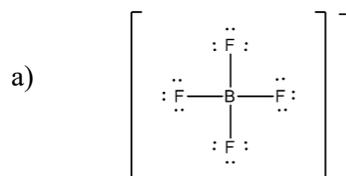
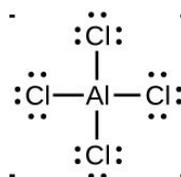


Chapters 10 – 12: This review goes over important concepts needed for your exam but is not exhaustive of everything you need to know and should be used as a supplement (not the sole resource) to your own studying.

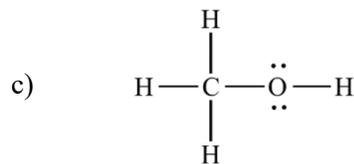
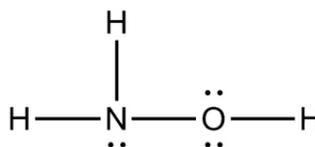
1. Which of the following Lewis structures is incorrect?



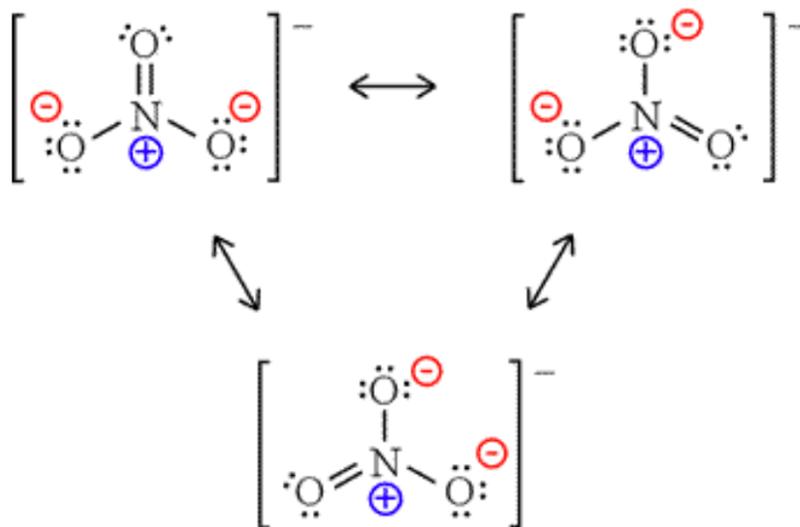
d)



e)



2. Draw NO_3^- and its resonance structures. Calculate its formal charges.



3. Which of the following are exceptions to the octet rule?

I. PCl_5 II. BeCl_2 III. CH_4 IV. SF_6 V. H_2O

a) I, III, V

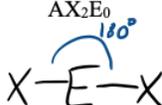
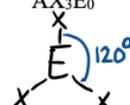
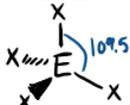
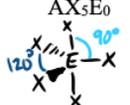
b) I, II, IV

c) II, IV

d) I, II, V

e) II, III, IV

4. VSEPR Theory. Fill in the following chart including the structure, bond angles, shape name, and AX_yE_z format.

VSEPR Geometries					
Electron Pairs ↓	0 Lone Pair	1 Lone Pair	2 Lone Pairs	3 Lone Pairs	4 Lone Pairs
2	Linear 180° AX_2E_0 				
3	Trigonal Planar 120° AX_3E_0 	Bent <120° AX_2E_1 			
4	Tetrahedral 109.5° AX_4E_0 	Trigonal Pyramidal <109.5° AX_3E_1 	Bent <<109.5° AX_2E_2 		
5	Trigonal Bipyramidal 90° & 120° AX_5E_0 	Seesaw <90° & <120° AX_4E_1 	T-Shaped <90° AX_3E_2 	Linear 180° AX_2E_3 	
6	Octahedral 90° AX_6E_0 	Square Pyramidal <90° AX_5E_1 	Square Planar 90° AX_4E_2 	T-Shaped <90° AX_3E_3 	Linear 180° AX_2E_4 

5. Name to electron geometry, molecular geometry, and bond angles for the following compounds:

a) H₂O

tetrahedral, bent, $<<109.5$

b) ICl₂

trigonal bipyramidal, linear, 180

c) SF₄

trigonal bipyramidal, seesaw, <90 & <120

d) BeCl₂

linear, linear, 180

e) CO₃²⁻

trig planar, trig planar, 120

6. Which of the following molecules are polar?

I. NH_3 II. BF_3 III. COS IV. XeF_4 V. IF_5

a) I, III, V

b) I, II, III

c) II, III, V

d) All

e) None

7. Which of the following is a nonpolar molecule with polar covalent bonds?

a) Cl_2

b) SOCl_2

c) BeBr_2

d) NH_3

e) H_2O

8. How many σ bonds are in this molecule?

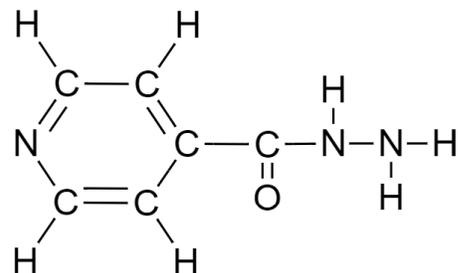
a) 20

b) 36

c) 17

d) 19

e) 16



9. For the previous structure, what are the hybridizations of the C, N, and O atoms?

a) C: sp^2 ; N (ring): sp^2 ; N: sp^3 ; O: sp^2

b) C (ring): sp^3 ; C (other): sp^2 ; N (all): sp^2 ; O: sp^2

c) C: sp^2 ; N: sp^2 ; O: sp^2

d) C: sp^3 ; N (ring): sp^2 ; N: sp^3 ; O: sp^2

10. Which of the following statements is/are likely true:

a) NH_3 should have a higher boiling point than CH_4

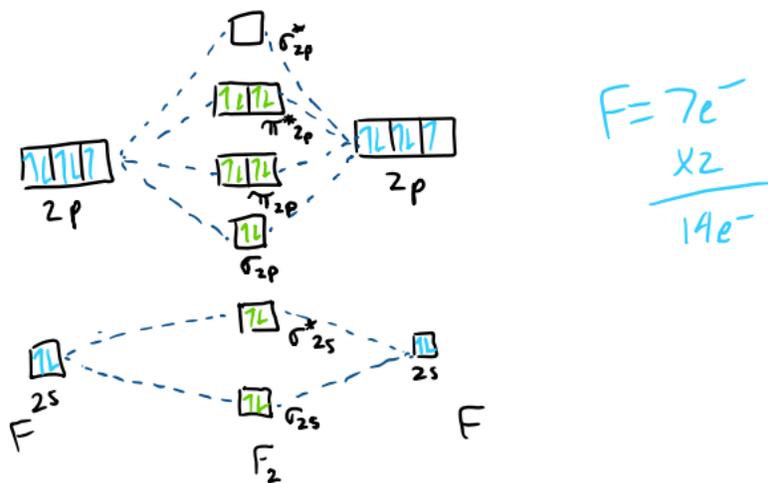
b) PH_3 should have a higher boiling point than NH_3

c) SO_2 should have a higher boiling point than CO_2

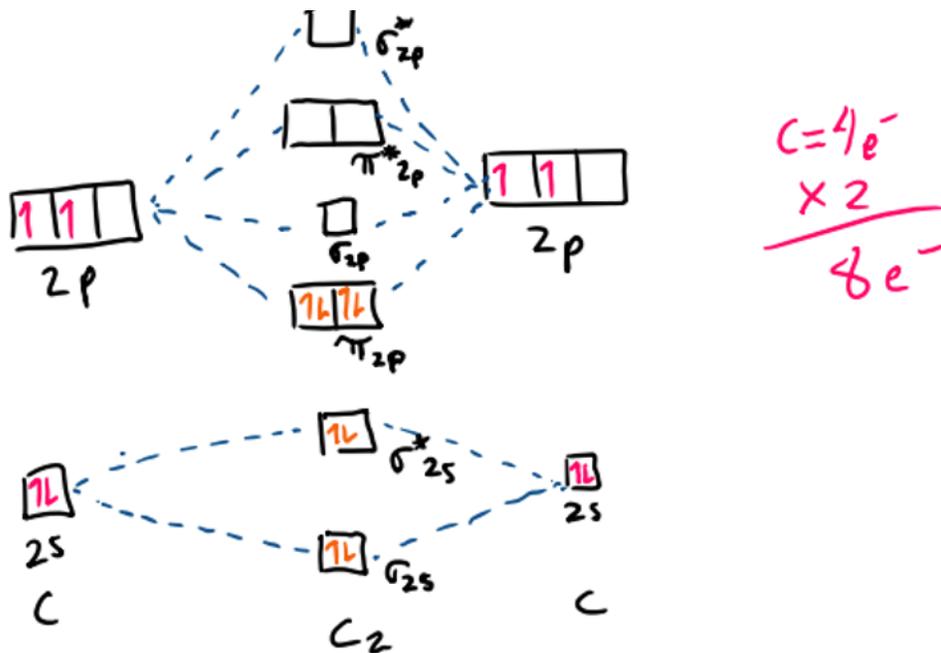
d) A and C

e) All of the above

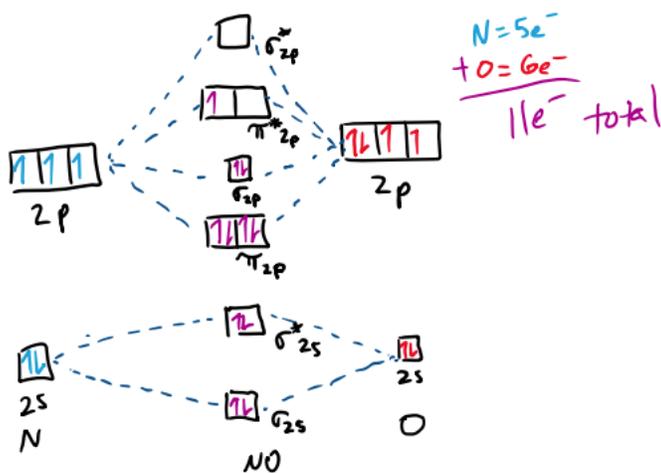
11. Draw the molecular orbital diagram for F₂.



12. Draw the molecular orbital diagram for C₂.



13. Draw the MO for NO.



14. Which of the following is true about σ bonding and π bonding.

- I. A single bond has 1 σ bond.
- II. A single bond has 1 π bond.
- III. A double bond has 1 σ bond and 1 π bond.
- IV. A double bond has 2 π bonds.
- V. A double bond has 2 σ bonds.
- VI. A triple bond has 3 π bonds.
- VII. A triple bond has 1 σ and 2 π bonds.
- VIII. A triple bond has 3 σ bonds.

a) II, III, V, VIII

b) I, III, VII

c) I, V, VI

d) II, IV, VIII

e) I, IV, VI

15. Which hybridization will a molecule with a trigonal bipyramidal electron-group arrangement have?

a) sp

b) sp^2

c) sp^3

d) sp^3d

e) sp^3d^2

16. According to MO theory, which of the following dicarbon species is expected to have the shortest bond length.

Use the following valence MO order: $\sigma_{2s} < \sigma_{2s}^* < \pi_{2py} = \pi_{2pz} < \sigma_{2px} < \pi_{2py}^* = \pi_{2pz}^* < \sigma_{2px}^*$

- a) C_2^+ b) C_2^{2-} c) C_2 d) C_2^- e) They all have the same length

17. Calculate the heat needed to convert 10.0 g of solid bromine from -7.2°C to 70.0°C . Which of the following steps requires the most heat energy: melting the solid bromine, heating the liquid bromine from its melting point to its boiling point, **boiling the bromine**, or heating the gaseous bromine from its boiling point to 70.0°C ?

Melting point for bromine -7.2°C , heat of fusion for bromine = 66.15 J/g; specific heat of liquid bromine = 0.474 J/g $^\circ\text{C}$; boiling point for bromine = 58.7°C , heat of vaporization for bromine = 193.21 J/g, specific heat of gaseous bromine = 0.225 J/g $^\circ\text{C}$.

= 2,931.4 J

18. Which response correctly identifies all the interactions that might affect the properties of BF_3 ?

- A) dispersion force, ion-ion interaction
B) hydrogen bonding force, dispersion force C) permanent dipole force
D) permanent dipole force, dispersion force **E) dispersion force**

19. Which response has the following substances arranged in order of **increasing** boiling point?

Ar, NaClO_3 , H_2O , H_2Se

- A) $\text{NaClO}_3 < \text{H}_2\text{O} < \text{H}_2\text{Se} < \text{Ar}$ B) $\text{NaClO}_3 < \text{H}_2\text{Se} < \text{H}_2\text{O} < \text{Ar}$
C) $\text{Ar} < \text{NaClO}_3 < \text{H}_2\text{Se} < \text{H}_2\text{O}$ D) $\text{Ar} < \text{H}_2\text{O} < \text{H}_2\text{Se} < \text{NaClO}_3$
E) $\text{Ar} < \text{H}_2\text{Se} < \text{H}_2\text{O} < \text{NaClO}_3$

20. Which of the following solutions is matched with its correct intermolecular force between solute and solvent?

- A) NH_3 and F_2 : hydrogen bonding B) CH_2F_2 and CH_2O : dispersion
C) Cl_2 and PH_3 : dipole-induced dipole D) HF and NH_3 : dipole-dipole
E) PH_3 and H_2O : dispersion

21. A certain metal has a specific gravity of 10.200 at 25°C . It crystallizes in a body-centered cubic arrangement with a unit cell edge length of 3.147 Å. Determine the atomic weight, the identity of the metal, and the radius of the atom in Å.

Atomic weight: 95.7 g/mol

Metal: Mo

Radius: 1.37 Å