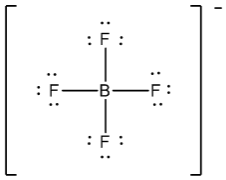
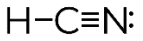
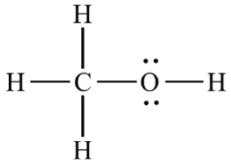
CHM 2045 Exam 3 Review - Fall 2023 - UF Academic Resources

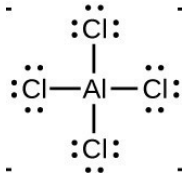
Chapters 10 – 12: This review goes over important concepts needed for your exam but is not exhaustive of everything you need to know and should be used as a supplement (not the sole resource) to your own studying.

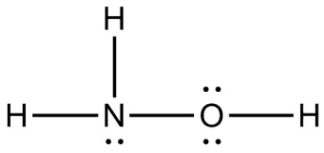
1. Which of the following Lewis structures is incorrect?

a) 

b) 

c) 

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 AXyEz format.

VSEPR Geometries					
Electron Pairs ↓	0 Lone Pair	1 Lone Pair	2 Lone Pair	3 Lone Pair	4 Lone Pair
2					
3					
4					
5					
6					

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

a) H_2O

b) ICl_2

c) SF_4

d) $BeCl_2$

e) CO_3^{2-}

6. Which of the following molecules are polar?

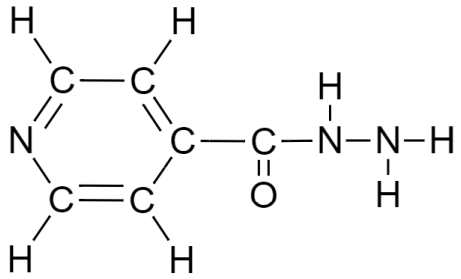
I. NH_3 II. BF_3 III. COS IV. XeF_4 V. IF_5

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 F_2.

12. Draw the molecular orbital diagram for C_2.

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 to110.0°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°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°C.

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) $NaClO_3 < H_2O < H_2Se < Ar$
B) $NaClO_3 < H_2Se < H_2O < Ar$
C) $Ar < NaClO_3 < H_2Se < H_2O$
D) $Ar < H_2O < H_2Se < NaClO_3$
E) $Ar < H_2Se < H_2O < NaClO_3$

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 3.147Å. Determine the atomic weight, the identity of the metal, and the radius of the atom in Å.