

CHM151 Quiz 11 25 Pts Spring 2012 Name: \_\_\_\_\_

**Tutors and Instructors, DO NOT HELP WITH THIS Quiz.**

**Take home exam Due Wed. May 9<sup>th</sup>**

1. Which pair is geometrically similar? You must show the Lewis and VSEPR structures to justify your answer.

(A)  $\text{SO}_2$  and  $\text{CO}_2$

(B)  $\text{CO}_2$  and  $\text{OF}_2$

(C)  $\text{PH}_3$  and  $\text{BF}_3$

(D)  $\text{SO}_2$  and  $\text{O}_3$

2. Explain why  $\text{BCl}_3$  is a planar molecule while  $\text{NCl}_3$  is pyramidal.

3. The ammonium ion is symmetrical, with the nitrogen at the center of a tetrahedron of four equivalent hydrogens. What hybridization of nitrogen orbitals is used to represent the bonding in the ion? \_\_\_\_\_

4. Which type of hybrid orbital is used by carbon in  $\text{CO}_2$ ? \_\_\_\_\_

5. Which compound would be expected to have the largest dipole moment? Explain why.

(A)  $\text{CO}_2$

(B)

$\text{BF}_3$

(C)  $\text{SO}_2$

(D)

$\text{CF}_4$

Reason:

6. The molecule  $:\ddot{\text{O}}=\text{C}=\ddot{\text{N}}-\text{H}$  has been detected in gas clouds between stars. What is the predicted C—N—H bond angle? \_\_\_\_\_

7. Provide estimates of each of the following bond angles?

(A) angle O—S—O in  $\text{SO}_4^{2-}$  \_\_\_\_\_

(B) angle Cl—C—Cl in  $\text{HCCl}_3$  \_\_\_\_\_

8. Knowing that F is more electronegative than either B or P, what conclusion can be drawn from the fact that  $\text{BF}_3$  has no dipole moment but  $\text{PF}_3$  does?

9. A compound consisting of an element having a low ionization potential and a second element having a high electron affinity is likely to have

- (A) covalent bonds. (B) metallic bonds. (C) coordinate covalent bonds,  
(D) ionic bonds.

10. In which pair do both compounds exhibit predominantly ionic bonding?

- (A)  $\text{SO}_2$  and  $\text{HCl}$  (B)  $\text{NaF}$  and  $\text{MgO}$  (C)  $\text{KNO}_3$  and  $\text{CH}_4$  (D)  $\text{KCl}$  and  $\text{CO}_2$

11. Which is most likely to be formed by electron transfer and be ionic?

	Main Groups							
	I	II	III	IV	V	VI	VII	(O)
First Period								
Second Period	<b>X</b>	<b>Y</b>	<b>Z</b>	<b>P</b>		<b>Q</b>	<b>S</b>	<b>U</b>
Third Period	<b>W</b>					<b>R</b>	<b>T</b>	<b>M</b>

- (A) a compound of **U** and **S** (B) a compound of **P** and **S** (C) a compound of **Z** and **P**  
(D) a compound of **Y** and **T** (E) a compound of **Q** and **T**

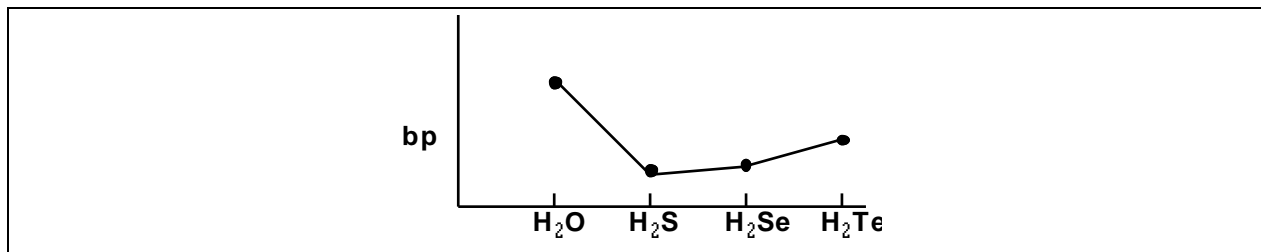
12. What is the explanation for the fact that the bonding in  $\text{SnI}_4$  is more covalent than the bonding in  $\text{SnF}_4$ ?

13. Which characteristic is generally true of nonmetallic oxides?

- (A) They are in general ionic compounds.  
(B) They are in general covalent compounds.  
(C) They react with water to form bases.  
(D) They cannot be prepared directly from the elements.  
(E) They react with acids to form a salt and water.

14. Use structural formulas to show how hydrogen bonding occurs in liquid methanol,  $\text{CH}_3\text{OH}$ .

15. Consider the boiling point of a series of hydrogen compounds.



Explain the abnormally high boiling point for water.

16. Of these metals, interatomic forces are probably weakest in

- (A) Ag      (B) Au      (C) Zn      (D) Hg

17. How many sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds are found in the ethylene molecule  $\text{H}_2\text{C}=\text{CH}_2$  according to modern bonding theory? Sigma \_\_\_\_\_ pi \_\_\_\_\_

18. An acceptable Lewis dot structure for  $\text{N}_2\text{O}$  is



19. Which has a Lewis (electron dot) structure with the greatest number of unshared pairs on the central atom?

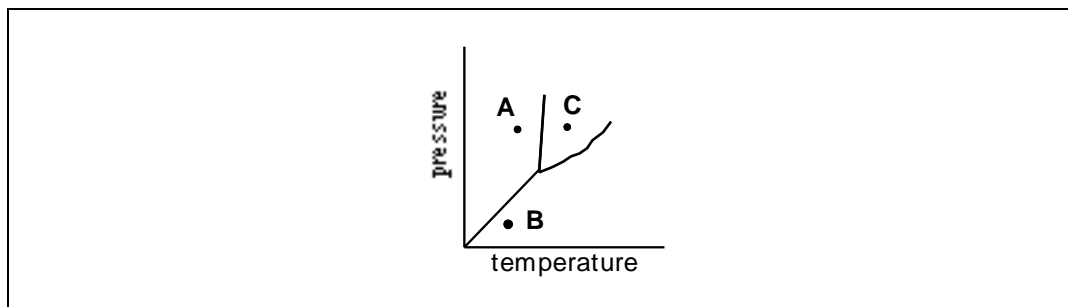
- (A)  $\text{NH}_3$       (B)  $\text{IF}_3$       (C)  $\text{SeCl}_2$       (D)  $\text{ICl}_2^-$

20. Draw Lewis dot representations of all reasonable contributing structures to the resonance hybrid of the nitrate ion.

21. Which substance has the highest boiling point? Explain why in terms of geometry and intermolecular forces.

- (A)  $\text{CH}_4$       (B) He      (C) HF      (D)  $\text{Cl}_2$

22. Consider the phase diagram of a pure compound. Which statement applies?



- (A) The path **A** → **C** represents sublimation.
- (B) Following the path **A** → **B** → **C** the compound would first liquefy and then vaporize.
- (C) If the compound is in state **A**, continued reduction of the pressure (at constant temperature) will cause it to melt.
- (D) None of these statements is correct

23. A crystal of anhydrous  $\text{KNO}_3$  is made up of

- (A) molecules of  $\text{KNO}_3$ .
- (B) atoms of potassium, nitrogen, and 3 atoms of oxygen alternately spaced in the crystal.
- (C) a geometrical pattern of potassium ions and nitrate ions in the crystal.
- (D) potassium nitrate molecules alternately spaced with water molecules.
- (E) molecules of  $\text{KNO}_3$  and water combined into larger molecules.

24. Which group of substances is correctly arranged in order from the highest to the lowest melting point? Also state the primary intermolecular forces for each compound.

- (A)  $\text{HF} > \text{H}_2 > \text{NaF}$       (B)  $\text{NaF} > \text{H}_2 > \text{HF}$       (C)  $\text{HF} > \text{NaF} > \text{H}_2$       (D)  $\text{NaF} > \text{HF} > \text{H}_2$

Primary intermolecular forces for each: \_\_\_\_\_

25. Which inert gas has the highest boiling point? \_\_\_\_\_ Explain why.