Unit 2 – Chapters 8,9: Bonding & Hybridization

Exercises

Period ____

1) What geometry do the following hybrid bonds possess?

a. sp

c. sp

b. sp^2

d. sp³d

e. sp^3d^2

2) Predict the geometries of the following compounds:

a. SF₂

c. XeF₂

b. SF₄

d. XeF₄

e. IF₅

f. CIF₃

3) Predict the geometry about the indicated atom and identify the hybridization of each atom

a. the two carbon atoms and the nitrogen atom of glycine



b. the carbon atom in CF₂Cl₂

c. the phosphorous atom in PCI₅

d. the nitrogen atom in NH₂-

4) The structure of urea is

a. How many σ bonds are there?

b. How many π bonds are there?

c. What is the hybridization at the carbon?

d. How are the nitrogen atoms hybridized?

e. What is the N-C-N bond angle expected to be?

f. How many lone pairs of electrons are there?

5. What hybridization describes square planar geometry?

a. sp³

c. sp^3d^2

b. spd

 $d. sp^2$

____ 6. Formaldehyde is used as a preservative. In the presence of air, formaldehyde is oxidized to formic acid, HCOOH. What hybridization does the carbon atom have in formic acid?

a. sp²

c. sp

b. sp^3

d. spd

	ed upon reaction of phosphorous trichloride with at in the phosphorus atom of PCl ₃ and PCl ₅ molecules,
respectively?	
a. spd, sp ³ d ²	c. sp³, sp³d²
b. sp³, sp³d	d. sp³d², sp³d
8. How many σ , and how many π bonds,	respectively, are there in the following molecule:
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH=C=	=C=CH ₂
(Remember that carbon nee	ds to have four bonds to be satisfied.)
a. 19, 3	c. 16, 3
b. 16, 7	d. 20, 4
9. The following molecule CH ₃ CH ₂ CHO, is probably used in the reduction proces	reduced to CH ₃ CH ₂ CH ₂ OH. What orbital is most s?
a. π orbital of one of the sp ³ can b. σ orbital of one of the sp ² can	·
10. What is the hybridization of phospho	rus in PCl ₆ -?
a. d²sp³	c. sp³
b. dsp ³	d. sp ²
$___$ 11. How many π bonds are in the followi	ng molecule?
CH₃-CH=CH-CH=C=CH-C	H ₃
a. 4	c. 0
b. 3	d. 1
12. The bond in RbF is:	
a. Covalent	c. Molecular
b. Polar covalent	d. Ionic
13. Which of the following bonds do you	expect to be polar covalent?
a. H-N	c. Cs-F
b. H-H	d. H-O
14. In a polar bond, electrons:	
a. spend equal time around both nuclei	c. spend more time around the bigger nucleus
b. are localized between both nuclei	 d. spend more time around one of the nuclei than the other one
15. What is the electronegativity differen	nce between At and H?
a. 0.1	c. 4.3
b0.1	d. 0.0

16. Which of the following bonds is the most polar one?		
a. H-O b. Cs-Cl	c. N-O d. C-H	
17. Order the following bonds in order of	of increasing bond polarity:	
H-F, Se-Cl, C-O, C-At		
a. C-At <se-cl<c-o<h-f b. C-O<se-cl<h-f<c-at< td=""><td>c. H-F<c-o<se-cl<c-at d. C-At<c-o<se-cl<h-f< td=""></c-o<se-cl<h-f<></c-o<se-cl<c-at </td></se-cl<h-f<c-at<></se-cl<c-o<h-f 	c. H-F <c-o<se-cl<c-at d. C-At<c-o<se-cl<h-f< td=""></c-o<se-cl<h-f<></c-o<se-cl<c-at 	
18. Order the following bonds in order of decreasing bond polarity (Use 2.0 for boron, not 1.5):		
Ca-O, Ca-Cl, P-Cl, Fe-O, B-O, N-O		
a. N-O>P-Cl>B-O>Fe-O>Ca-Cl>(b. Ca-Cl>P-Cl>Ca-O>Fe-O>B-O>		
19. Which of the following molecules would exhibit the greatest polarity? All molecules are tetrahedral in shape.		
a. CHCl₃ b. CH₄	c. CCl₄ d. CH₃Cl	
20. Which of the following molecules ha	as a dipole moment equal to 0?	
a. SiO₄ (tetrahedral) b. H₂O (bent)	c. $C_2H_2F_2$ (tetrahedral) d. $CBrCl_2F$	
21. Which ion could the following electrons.	on configuration describe? 1s ² 2s ² 2p ⁶ 3s ² 3p ⁴	
a. K ⁺ b. Cl ⁺	c. S ²⁻ d. Ca ²⁺	
22. Which of the following ions does not have the following configuration? 1s ² 2s ² 2p ⁶ 3s ² 3p ⁴		
a. V ⁺ b. Nb ³⁺	c. Mn ²⁺ d. all of them	
23. Place the following species in order a. B^{3+} < Be^{2+} < Ne < O^{2-} b. Ne < B^{3+} < Be^{2+} < O^{2-}	of increasing size: Ne, B^{3+} , O^{2-} , and Be^{2+} c. O^{2-} <ne<be<sup>2+<b<sup>3+ d. Ne<o<sup>2-<b<sup>3+<be<sup>2+</be<sup></b<sup></o<sup></b<sup></ne<be<sup>	
24. Determine the formula for the following sets of atoms when they combine to form binary compounds: Cs and F, Al and O, B and F, Ag and Cl		
a. Cs₂F, Al₂O₃, BF, AgCl b. CsF, Al₂O₃, BF₃, AgCl	c. CsF ₂ , AlO, B ₃ F, AgCl ₂ d. Cs ₂ F ₂ , Al ₃ O ₅ , B ₂ F ₂ , Ag ₂ Cl ₂	

25.	Select the crystal that would have the largest lattice energy. Assume that the internuclear distance is the same in all these crystals.		
	a. NaCl b. KCl	c. K₂S d. CaO	
26.	Chemical bonds between two atoms result be	oecause:	
	a. The atoms can thus achieve a state ofb. The atoms can thus achieve a state ofc. The atoms fit together nicelyd. The atoms can react better when both	of lower energy	
27.	Two bonded atoms:		
	a. React more readily with other substanceb. Are less reactive compared to whenc. Share all their electrons.d. Behave in unpredictable ways.		
28	28. The reaction of hydrogen with fluorine gas is highly exothermic (releases a high degree of energy). Calculate the F-F bond energy knowing that: H-H = 432 kJ/mol, H-F = 565 kJ/mol, and Δ H = -543 kJ.		
	a. 155 kJ/mol b. 543 kJ/mol	c. 698 kJ/mol d. 1019 kJ/mol	
29	29. A truck uses propane (C ₃ H ₈) to power its engine. Calculate how much heat will be released when 5 moles of propane are burned, knowing that the reaction of propane with oxygen gas produces carbon dioxide and water.		
	a. 7330 kJ b. 75 kJ	c. 10,000 kJ d. 4784 kJ	
30	30. Chlorine trifluoride is prepared by reacting chlorine gas with fluorine gas. The heat of the reaction is -803 kJ/mol of chlorine reacted. Calculate the Cl-Cl bond energy.		
	a. 1091 kJ/mol b. 155 kJ/mol	c. 238 kJ/mol d. 50 kJ/mol	
31.	How many valence electrons does selenium	have?	
	a. 6 b. 4	c. 3 d. 5	
32.	32. How many of the 6 valence electrons in sulfur are used in covalent bonding in sulfur tetrachloride and disulfur difluoride?		
	a. 4 and 2 b. 3 and 2	c. 6 and 1 d. 2 and 2	

33.	_ 33. How many of the 6 valence electrons in oxygen are usually used in covalent bonding?		
	a. 4	c. 6	
	b. 3	d. 2	
34. In the POCl₃ molecule, how many double bonds are there? How about single bonds?			
	a. 1 and 3	c. 2 and 1	
	b. 4 and 1	d. 1 and 2	
35. Which one of the following molecules possesses a triple bond?			
	a. SF ₄	c. C_2H_2	
	b. PCl ₅	d. C ₂ H ₆	
36.	36. Which one of the following molecules does not possess a double bond?		
	a. C₂F₄	c. OCH ₂	
	b. $C_2H_4F_2$	d. HOCOCI	
37. Which one of the following molecules contains a central atom that violates the octet rule			
	a. SF ₄	c. Si(OH) ₄	
	b. COF ₂	d. PBr ₃	
$_$ 38. Calculate the formal charge on chlorine in ClO_4			
	a. 1-	c. 6+	
	b. 3+	d. 4+	