| Unit 2 – Chapters 8, 9 | | | Name |
|------------------------|-----------------------------------|-------------------------------|--------|
| Exercises | | | Period |
| 1) | What geometry do the fol | llowing hybrid bonds possess? | |
| | a. sp | c. sp ³ | |
| | b. sp ² | d. sp³d | |
| | e. sp ³ d ² | | |
| 2) | Predict the geometries of | the following compounds: | |
| | a. SF ₂ | c. XeF ₂ | |

| b. SF ₄ | d. XeF4 |
|--------------------|---------------------|
| e. IF₅ | f. CIF ₃ |

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 $\mathsf{CF}_2\mathsf{Cl}_2$
- c. the phosphorous atom in PCI_5
- d. the nitrogen atom in NH_2^-
- 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. | sp ³ | c. | sp²d |
|----|-----------------|----|------|
| b. | spd | d. | sp² |

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. sp ² | c. sp |
|--------------------|--------|
| b. sp ³ | d. spd |

| 7. Phosphorous pentachloride is produced up chlorine. What hybridization is present in respectively? a. spd, sp³d² b. sp³, sp³d | pon reaction of phosphorous trichloride with the phosphorus atom of PCl ₃ and PCl ₅ molecules, c. sp ³ , sp ³ d ² d. sp ³ d ² , sp ³ d | |
|---|---|--|
| 8. How many σ , and how many π bonds, resp | pectively, are there in the following molecule: | |
| CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH=C=C=C | CH ₂ | |
| (Remember that carbon needs to a. 19, 3 b. 16, 7 | o have four bonds to be satisfied.) c. 16, 3 d. 20, 4 | |
| 9. The following molecule CH₃CH₂CHO, is red probably used in the reduction process? a. π orbital of one of the sp³ carbor b. σ orbital of one of the sp² carbor | ns c. σ orbital of one of the sp ³ carbons | |
| 10. What is the hybridization of phosphorus a. d²sp³ b. dsp³ | in PCl ₆ ⁻ ? c. sp ³ d. sp ² | |
| 11. How many π bonds are in the following r | nolecule? | |
| CH₃-CH=CH-CH=C=CH-CH₃ a. 4 b. 3 | c. 0 d. 1 | |
| 12. The bond in RbF is: | | |
| a. Covalent b. Polar covalent | c. Molecular d. Ionic | |
| 13. Which of the following bonds do you exp | ect to be polar covalent? | |
| | Cs-F H-O | |
| 14. In a polar bond, electrons: | | |
| a. spend equal time around both nucleib. are localized between both nuclei | c. spend more time around the bigger nucleusd. spend more time around one of the nuclei than the other one | |
| 15. What is the electronegativity difference between At and H? | | |
| a. 0.1 b0.1 | c. 4.3 d. 0.0 | |

16. Which of the following bonds is the most polar one? a. H-O c. N-O b. Cs-Cl d. C-H 17. Order the following bonds in order of increasing bond polarity: H-F, Se-Cl, C-O, C-At a. C-At<Se-Cl<C-O<H-F c. H-F<C-O<Se-Cl<C-At b. C-O<Se-Cl<H-F<C-At d. C-At<C-O<Se-Cl<H-F 18. Order the following bonds in order of decreasing bond polarity: Ca-O, Ca-Cl, P-Cl, Fe-O, B-O, N-O a. N-O>P-Cl>B-O>Fe-O>Ca-Cl>Ca-O c. Ca-O>Ca-Cl>Fe-O>B-O>P-Cl>N-O d. Fe-O>Ca-O>B-O>N-O>Ca-Cl>P-Cl b. Ca-Cl>P-Cl>Ca-O>Fe-O>B-O>N-O _ 19. Which of the following molecules would exhibit the greatest polarity? All molecules are tetrahedral in shape. a. CHCl₃ c. CCl₄ b. CH₄ d. CH₃Cl 20. Which of the following molecules has a dipole moment equal to 0? a. SiO₄ (tetrahedral) c. C₂H₂F₂ (tetrahedral) b. H₂O (bent) d. CBrCl₂F 21. Which ion could the following electron configuration describe? 1s²2s²2p⁶3s²3p⁴ c. S²⁻ a. K⁺ b. Cl⁺ d. Ca²⁺ 22. Which of the following ions does not have the following configuration? 1s²2s²2p⁶3s²3p⁴ a. V⁺ c. Mn²⁺ b. Nb³⁺ d. all of them 23. Place the following species in order of increasing size: Ne, B³⁺, O²⁻, and Be²⁺ a. B³⁺<Be²⁺<Ne<O²⁻ c. O²⁻<Ne<Be²⁺<B³⁺ b. Ne<B³⁺<Be²⁺<O²⁻ d. Ne<O²⁻<B³⁺<Be²⁺ 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 c. CsF₂, AlO, B₃F, AgCl₂ b. CsF, Al₂O₃, BF₃, AgCl d. Cs₂F₂, Al₃O₅, B₂F₂, Ag₂Cl₂

_ 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 | c. K ₂ S |
|---------|---------------------|
| b. KCl | d. CaO |

- _____ 26. Chemical bonds between two atoms result because:
 - a. The atoms can thus achieve a state of higher energy
 - b. The atoms can thus achieve a state of lower energy
 - c. The atoms fit together nicely
 - d. The atoms can react better when bonded
- _____ 27. Two bonded atoms:
 - a. React more readily with other substances.
 - b. Are less reactive compared to when free.
 - c. Share all their electrons.
 - d. Behave in unpredictable ways.
- 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 ΔH = -543 kJ.

| a. 155 kJ/mol | c. 698 kJ/mol |
|---------------|----------------|
| b. 543 kJ/mol | d. 1019 kJ/mol |

29. A truck uses propane (C₃H₈) 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 | c. 10,000 kJ |
|------------|--------------|
| b. 75 kJ | d. 4784 kJ |

_____ 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 | c. | 238 kJ/mol |
|----|-------------|----|------------|
| b. | 155 kJ/mol | d. | 50 kJ/mol |

____ 31. How many valence electrons does selenium have?

| a. 6 | с. | 3 |
|------|----|---|
| b. 4 | d. | 5 |

_ 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 | c. 6 and 1 |
|------------|------------|
| b. 3 and 2 | d. 2 and 2 |

| 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 POCl ₃ molecule, how many dou | ble 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 ₂ H ₂ |
| b. PCl₅ | d. C ₂ H ₆ |
| 36. Which one of the following molecules | does not possess a double bond? |
| a. C ₂ F ₄ | 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. SF4 | c. Si(OH)4 |
| b. COF ₂ | d. PBr ₃ |
| 38. Calculate the formal charge on chlorin | e in ClO₄ ⁻ |
| a. 1- | c. 6+ |
| b. 3+ | d. 4+ |