

Name _____ Period _____

LTHS: Chemistry

Unit 5 Review - Bonding

LT1: I can identify the correct amount of valence electrons in a compound

1. How many valence electrons do each of the main group families have?

a. 1A/1	1	c. 3A/13	3	e. 5A/15	5	g. 7A/17	7
b. 2A/2	2	d. 4A/14	4	f. 6A/16	6	h. 8A/18	8

2. What is the octet rule? How does it apply to bonding?

all atoms want a full valence shell - 8 electrons.
They will give, take, or share to get there.

LT2: I can calculate electronegativity difference to determine if a bond is polar, nonpolar or ionic

3. What are the three bond types? Describe what the electrons are doing for each bond type.

Ionic - transferred to atom with higher electronegativity
Polar covalent - electrons are shared unevenly
non polar covalent - electrons are shared evenly

4. What relationship exists between electronegativity values and bond type (non-polar covalent, polar covalent, ionic)

Non Polar Polar Ionic
0 → .4 .41 → 1.99 2.0 →

LT3: I can explain how the valence electrons determine the type of bond

5. What is an ionic bond?

Bond formed by the attraction between oppositely charged particles.
formed between metal/nonmetal

6. What do the electrons do to form an ionic bond?

transferred from one atom to another

7. Draw a Lewis Diagram to show the process of forming an ionic bond between K and Br.



8. What defines a covalent bond? Be sure to include types of atoms and electronegativity differences in your answer.

bond caused by sharing of electrons
formed between non metals, electronegativity difference < 2.0

LT4: I can use lewis structures to model the structure of a compound

9. How are Lewis structures drawn? What rules dictate the use of dots and lines?

1. Count electrons •• (not shared / lone pair)
2. draw skeleton structure — (shared electrons / bond)
3. add 6 dots to outer atoms
4. if extra electrons remain, add them to center atom
5. verify center atom has octet, if not change lone pairs to bonds

10. How can you tell from a Lewis structure if a given compound is an ion?

Should have [] and a charge

11. How does bond length and strength relate to the type of covalent bond?

longer → weaker → single bond
shorter → stronger → triple bond

12. What is resonance? When is it necessary to include resonance in a Lewis Structure?

when there is another structure possible.
when the bond orders balance out to
an average between single / double

13. Draw the Lewis Structures (with resonance) for the following

<p>CO₂ 4 + 2(6) = 16e⁻</p> $\ddot{\text{O}}=\text{C}=\ddot{\text{O}}$	<p>SO₄⁻² 6 + 4(6) + 2 = 32e⁻</p> $\left[\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \\ \\ \text{:}\ddot{\text{O}}\text{--S--}\ddot{\text{O}}\text{:} \\ \\ \text{:}\ddot{\text{O}}\text{:} \end{array} \right]^{-2}$
<p>NO₃⁻ 5 + 3(6) + 1 = 24e⁻</p> $\left[\begin{array}{c} \text{:}\ddot{\text{O}}\text{=N--}\ddot{\text{O}}\text{:} \\ \\ \text{:}\ddot{\text{O}}\text{:} \end{array} \right]^{-}$	<p>HCN 1 + 4 + 5 = 10e⁻</p> $\text{H--C}\equiv\text{N:}$

NH_3 $5 + 3 = 8e^-$		NH_4^+ $5 + 4 - 1 = 8e^-$	
H_2O $2 + 6 = 8e^-$		BCl_3 $3 + 3(7) = 24e^-$	

LT5: I can use molecular geometry and polarity to predict physical properties

14. What does VSEPR stand for? How is it used?

Valence shell electron pair repulsion theory
 electron pairs/domains will spread out

15. Complete the following table for molecular shapes?

Shape	Bonding Domains	Non-Bonding Domains	Sketch
Linear	2	0	
Bent	2	1 or 2	
Trigonal Planar	3	0	
Trigonal Pyramidal	3	1	
Tetrahedral	4	0	

16. Predict the shape of the following

CO_2 2 Bonding 0 Non-bonding Linear $\text{O}=\text{C}=\text{O}$	SO_4^{-2} 4 Bonding 0 Non-bonding Tetrahedral
NO_3^- 3 Bonding 0 Non-bonding Trigonal Planar	HCN 2 Bonding 0 Non-bonding Linear $\text{H}-\text{C}\equiv\text{N}$
NH_3 3 Bonding 1 Non-bonding Trigonal Pyramidal	NH_4^+ 4 Bonding 0 Non-bonding Tetrahedral
H_2O 2 Bonding 2 Non-bonding Bent	BCl_3 3 Bonding 0 Non-Bonding

LT6: I can predict molecular polarity based on lewis structures and bond polarity

16. What is a dipole? Can you give an example of a compound that has one? Draw this example and diagram the dipole.

Dipole is a molecule that has partial positive and negative charges (2 poles). Water $\delta^+ \text{H}-\text{O}^{\delta-}-\text{H} \delta^+$

17. What does it mean to be partially positive and partially negative?

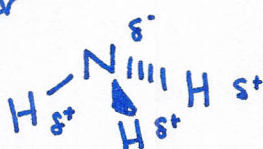
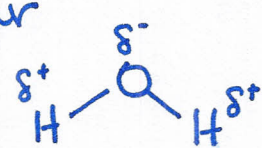
Not completely positive or negative from a transfer of electrons. Instead the atoms are still sharing the electrons, but because of the difference of electronegativities they are closer to one atom.

18. How do you determine if a molecule is going to be polar or non-polar?

Look at "Tug of War Principle" Are the dipoles equal and opposite.

1. Bonds must be polar
2. Dipoles can not cancel out

19. For the following, determine bond types and draw bond polarity vectors as necessary. Determine if there is molecular polarity.

CO ₂ Non polar	SO ₄ ⁻² Non Polar
NO ₃ ⁻ Non polar	HCN Polar $\text{H} - \overset{\delta^+}{\text{C}} \equiv \overset{\delta^-}{\text{N}}$
NH ₃ Polar 	NH ₄ ⁺ Non Polar
H ₂ O Polar 	BCl ₃ Non Polar

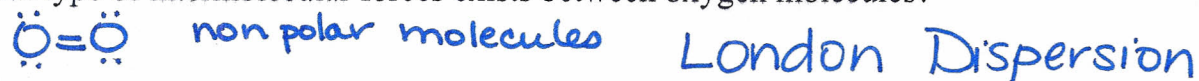
LT7: I can use my knowledge of intermolecular forces to classify the type of forces in a bond and understand how that affects properties

20. Complete the table of intermolecular forces

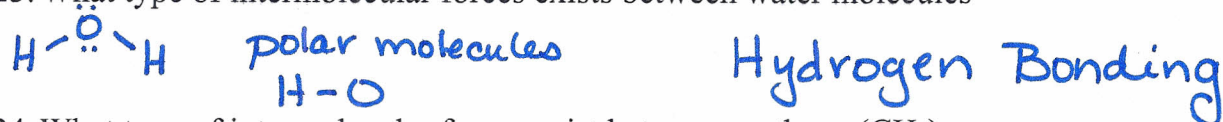
	London Dispersion Force	Dipole-Dipole	Hydrogen bonding
when does it occur	Between non polar molecules	Between polar molecules	Between molecules w/ H-N/O/F
relative strength	weak	medium	very strong
relative freezing point	low	medium	high
relative boiling point	low	high	very high

21. What bonds must be present for a compound to be able to exhibit hydrogen bonding? H bonded to N, O, F

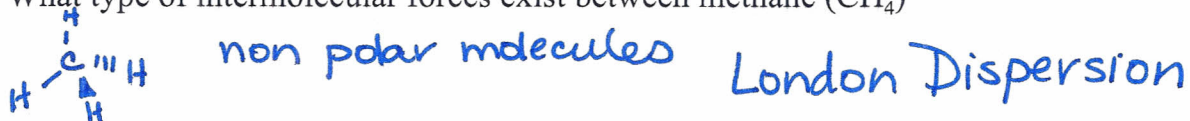
22. What type of intermolecular forces exists between oxygen molecules?



23. What type of intermolecular forces exists between water molecules



24. What type of intermolecular forces exist between methane (CH₄)



25. Order the intermolecular forces in order of least to greatest strength:

London dispersion < Dipole-Dipole < Hydrogen Bonding