Name _____

#10 Bonding
Quantitative Chemistry

Student Learning Map

Unit EQ: What forces hold atoms together?

Key Learning: Bonds are the interaction of electrons between atoms.

UNIT CONCEPT:

1. Types of Bonds	2. Molecular Structures	3. Intermolecular Forces
LESSON ESSENTIAL QUESTIONS:		
a. What are ionic bonds, and how are they formed? b. What are polar and nonpolar covalent bonds, and how are they formed?	a. How do we diagram molecular structures? b. How do I determine the geometry of a molecule using VSEPR theory?	What forces hold molecules together?
LESSON ESSENTIAL VOCABULARY:		
Ionic Bond Polar Covalent Bond Nonpolar Covalent Bond Electronegativity Dipole Moment	Lewis Structure Single Bond Double Bond Triple Bond Resonance Valence Shell Electron Pair Repulsion Theory (VSEPR) - Linear - Bent - Trigonal Planar - Trigonal Pyramidal - Tetrahedral - Trigonal Bipyramidal - Octahedral	London Dispersion Forces Dipole-Dipole Attraction Hydrogen Bonding

1a. Ionic Bonds

***EQ*: What are ionic bonds, and how are they formed?**

Computer Lab: Ionic Bonds

Go to http://www.pbslearningmedia.org/asset/lsps07_int_ionicbonding/ (or Google Search: "ionic bonds online activity" to find http://www.pbslearningmedia.org/resource/lsps07.sci.phys.matter.ionicbonding/ionic-bonding/). Read each screen and follow the directions where appropriate. You will also need to answer the questions on the following screens:

#1 Ionic bonds form between _____ and involve the _____ of electrons.

#5 In order to build an ionic compound that will stick together, you'll need both a

_____ ion and a _____ ion.

#6 The positive ion is usually a _____.

#7 The negative ion is usually a _____.

#12 The two ions are held together by the _____.

#22 What is the formula for the compound on this screen? _____

#24 What is the number of Ca ions? _____ What is the number of F ions? _____

#25 What is the formula for the compound on this screen? _____

Packed Sphere Structures - _____

Draw at least 4 cations for each structure.

NaCl

K_2S

CaF_2

Al_2O_3

1b. Covalent Bonds

EQ: What are polar and nonpolar covalent bonds, and how are they formed?

Computer Lab: Covalent Bonds

Go to http://www.pbslearningmedia.org/asset/lsps07_int_covalentbond/ (or Google Search: "covalent bonds online activity" to find https://witf.pbslearningmedia.org/resource/lsps07.sci.phys.matter.covalentbond/covalent-bonding/). Read each screen and follow the directions where appropriate. You will also need to answer the questions on the following screens:

#1 A covalent bond is a bond that forms when atoms are _____ electrons.

#3 Answer the questions on this screen.

1) _____

2) _____

#9 In a covalent bond, the atoms are not really _____ electrons as much as they are _____ over them.

#11 What types of elements form covalent bonds? _____

#12 Covalent bonds will form between two _____. Each of the nonmetal atoms will have a strong attraction for the other atom's _____, but will also tend to hold onto its own _____.

#24 What is the weakest type of bond? (Circle one.)

Single Double Triple

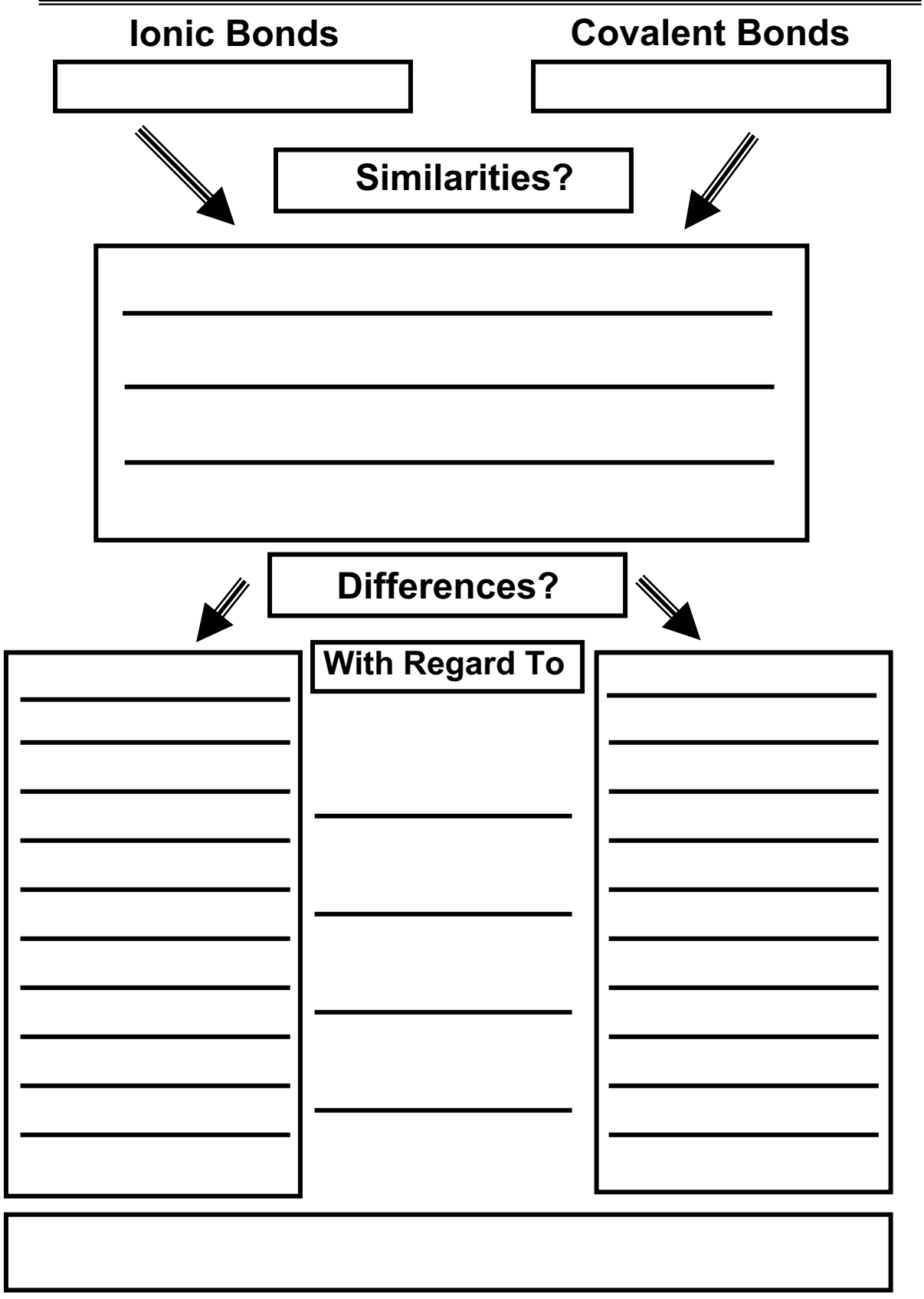
What is the strongest type of bond? (Circle one.)

Single Double Triple

#25 STOP HERE.

1b. Covalent Bonds (cont.)

Compare / Contrast Ionic and Covalent?



1b. Covalent Bonds (cont.)

Electronegativity

Definition: _____

_____

It is a measure of how _____ an atom is for electrons.

Electronegativity Differences can be used to determine the type of bond.

IONIC POLAR COVALENT NONPOLAR COVALENT

Identify the type of bond that would occur between each of the following atoms:

1) Na–Cl
2) O–O
3) O–S
4) P–H
5) C–O
6) K–O
7) N–H
8) Mg–F

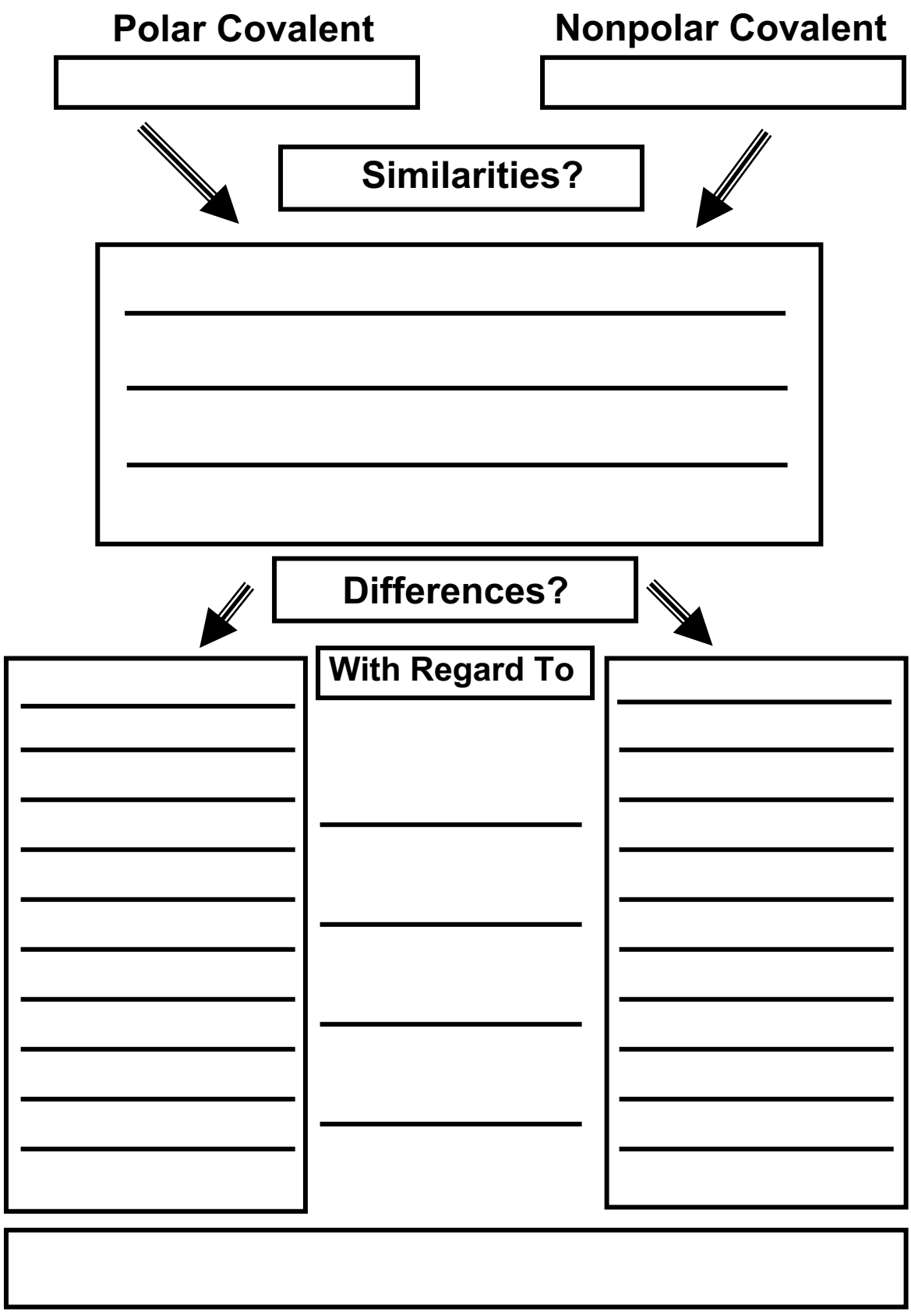
Dipole Moments for Polar Covalent Molecules

Examples:

Water

1b. Covalent Bonds (cont.)

Compare / Contrast Polar and Nonpolar Covalent Bonds?



1b. Covalent Bonds (cont.)

REVIEW

Bonds involve _____.

Types of Bonds

	Ionic	Polar Covalent	Nonpolar Covalent
Electrons			
Elements			
Structure			
Electronegativity Differences			
Bond Strength			
Properties of Compounds			

2a. Molecular (Covalent) Structures

***EQ*: How do we diagram molecular structures?**

Electron Dot Diagrams

A. Rules for Drawing Lewis Structures (Using Electron Dot Diagrams)

Terms

1. Lone Pair –

2. Single Bond –

3. Double Bond –

4. Triple Bond –

2a. Molecular (Covalent) Structures (cont.)

Examples (Single Bonds):

Formula	Atoms	Valence Electrons	Structure	Structure w/ Bonds

2a. Molecular (Covalent) Structures (cont.)

Bond Length	Bond Energy

Examples (Double & Triple Bonds):

Formula	Atoms	Valence Electrons	Structure	Structure w/ Bonds

2a. Molecular (Covalent) Structures

B. Rules for Drawing Lewis Structures (Polyatomic Ions & Resonance)

Terms

1. Delocalization of Electrons –

2. Polyatomic Ion –

3. Resonance –

Examples:

Other Resonance Examples:

O_3 SO_2

2b. VSEPR

***EQ*: How do I determine the geometry of a molecule using VSEPR Theory?**

Notes:

Geometries:

Name	Shape	Atoms Bonded to Central Atom	Lone Pairs of e- on Central Atom	Example
1.				
2.				
3.				
4.				
5.				
6.				
7.				

3. Intermolecular Forces

***EQ*: What forces hold MOLECULES together?**

3 TYPES OF INTERMOLECULAR FORCES

London Dispersion	Dipole-Dipole	Hydrogen Bonding

Computer Lab: Intermolecular Forces

Go to https://www.wisc-online.com/LearningContent/gch6804/index.html (or Google Search: "intermolecular forces wisc online" to find https://www.wisc-online.com/learn/natural-science/chemistry/gch6804/intermolecular-forces). Read each screen and follow the directions where appropriate. You will also need to answer the questions on the following screens:

#2 The strongest intermolecular forces between molecules are less than _____ as strong as the bonds between atoms.
Intermolecular forces cause a substance to form _____ & _____ phases.

#3 **Dipole-dipole forces** result from the _____

_____

#4 **London Dispersion Forces:** The _____ of electrons causes an instantaneous dipole. There is an attraction between these temporary dipoles.

#5 **London Disperson Forces:** *Every* _____ and _____ experiences London forces. The strength of these forces increases as the atomic or molecular weight increases.

3. Intermolecular Forces (cont.)

#8 **Hydrogen Bonding** occurs between molecules that have a hydrogen atom bonded to a more electronegative _____, _____, or _____ atom. Hydrogen bonds are _____ than London and dipole-dipole forces, but weaker than covalent bonds.

Problems:

1. Using your Periodic Table of Electronegativities, identify the type of bonding (polar or nonpolar) that occurs between the following molecules.

2. Using the Bond Type, check the boxes of the forces that occur between these molecules.

		Intermolecular Forces		
Molecule	**Bond Type (PC or NPC)**	**LD** *very weak*	**D-D** *weak*	**HB** *moderate*
H_2				
H_2O				
SO_2				
HF				
CI_4				
PCl_3				
ClBr				
NH_3				
BH_3				
SeO_2				

3. Which of the compounds above would you expect to have the HIGHEST boiling points?

REVIEW