Name: _____ Date: _____ Period: _____

Lesson CHEM 3.1 Part 2– Investigating Chemical Compounds

Evidence Notebook

Key Ideas

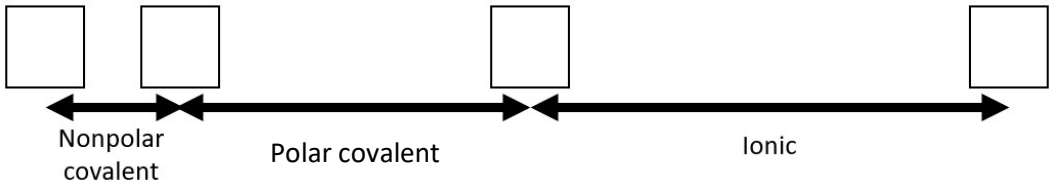
1. _____ bonds are formed between two oppositely charged ions.
2. _____ bonds form when atoms share pair of electrons with each other.
3. Electronegativity
    a. Electronegativity is the ability to _____.
    b. (*Circle the best choices*) Electronegativity increases are you move to the right | left and when you move down | up on the periodic table. Francium | Fluorine would be more electron negative than francium | fluorine. The smaller | greater the difference in electronegativity between atoms the more *ionic* the bond. The smaller | greater the difference in electronegativity between atoms the more *covalent* the bond.
4. *Explain* AND *illustrate* the differences in electron distribution between the following types of bonds:
    a. Covalent
    b. Polar covalent
    c. Ionic

5. Place the following bond pairs in order of least polar to most polar:

H—Cl, H—H,.H—F, H—S

6. Complete the following values in the electronegative chart:

DIFFERENCE IN ELECTRONEGATIVITIES



7. Determine the bond types and complete the table below:

ELEMENTS BONDED	ELECTRONEGATIVITY DIFFERENCE	BOND TYPE	MORE ELECTRONEGATIVE ATOM	EXAMPLE COMPOUND
C and O				
C and S				
O and H				
Na and Cl				
Mg and O				

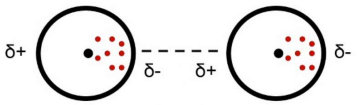
8. Dipole moment

a. How would you determine where to place a dipole moment on a molecule?

b. Illustrate a dipole moment on a *water* molecule:

c. Illustrate a dipole moment on an *ammonia* molecule:

9. Van der Waals Forces are the forces that attract molecules together. The positive end of one molecule is attracted to the _____ end of another molecule. Dipole-dipole attractions are very strong | weak. Most substances held together by van der Waals forces only are usually _____ or _____ *(states of matter)* at room temperature.
10. _____ bonds are the strongest dipole-dipole bonds. They form when _____ from one molecule is attracted to _____, _____, or _____ of another molecule.
11. London Dispersion Forces (LDF)
    a. LDF are the strongest | weakest intermolecular force. They occur when electrons of two adjacent atoms occupy positions to form _____ dipoles.
    b. Illustrate how LDF can happen:



    c. Would O_2 or N_2 have greater LDF and why? *(Hint look at the periodic table)*

    d. Based on your last answer, oxygen | nitrogen would have a higher boiling point than oxygen | nitrogen.

12. Illustrate the difference between intramolecular bonds and intermolecular bonds using two hydrogen chloride molecules:

13. List the different types of bonds in order from strongest to weakest:

BOND TYPE	INTRAMOLECULAR OR INTERMOLECULAR	NOTES	EXAMPLE ILLUSTRATION

14. Analyzing the Properties of Compounds

    a. What type of bond holds the following together: (*prevents them from melting)*

        i. Sodium chloride (NaCl)

        ii. Citric acid ($C_6H_8O_7$)

        iii. Wax ($C_{31}H_{64}$)

    b. Based on the different types of bonds holding salt, wax, and citric acid together, place them in order from lowest melting point to highest melting point.

15. What are the two steps in creating a Valence shell electron pair repulsion (VSEPR) model?

16. Complete the following table:

BOND ANGLES	NUMBER OF BONDS	NUMBER OF LONE ELECTRON PAIRS	GEOMETRIC SHAPE NAME	ILLUSTRATION EXAMPLE
180	2	0		
120	3	0		
	2	1		
109.5	4	0		
	3	1		
	2	2		

17. Draw the Lewis structure, identify the geometric shape, and bond angles for:

    a. CF_4.

    b. PCl_3

    c. OF_2

    d. CO_2

    e. AsH_3

    f. SiH_4

    g. NHO

    h. CH_2O

CHECKPOINTS –PARTS 1 AND 2

18. Which of the following best explains why ionic crystals are brittle?
    a. They have low melting points.
    b. They have high melting points.
    c. The strong ionic bonds do not allow flexibility within the structures.
    d. The forces of attraction between positive and negative ions are weak, so they break easily.
19. Categorize each compound as exhibiting *ionic* bonding or *covalent* bonding.

    a. LiF
    a. Cl_2
    b. NH_3
    c. $CaCl_2$
    d. NaOH
    e. FeO
    f. NO_2
    g. H_2O

20. A student tests a solid sample of a compound and determines that it does not conduct an electric current. When the compound is dissolved in water, the solution does conduct an electric current. What type of bonding does the compound have?
    a. Covalent
    b. Ionic
    c. Metallic
21. A long, thin sample of a substance bends easily. When the substance is placed in an electric circuit and the switch is closed, an LED light turns on. What type of bonding holds the particles of the substance together?
    a. Covalent
    b. Ionic
    c. Metallic
22. What is the ionic formula for aluminum sulfide?

23. Which statements correctly describe the compound potassium bromide? *Select all correct answers.*
    a. The compound is considered a salt.
    b. It contains potassium and bromide ions in a one-to-one ratio.
    c. Potassium bromide likely has a higher melting point than does candle wax.
    d. The electronegativities of the two component atoms are very similar.
24. The electronegativities of carbon and sulfur are almost the same. Both elements form covalently bonded compounds with oxygen. Why are the molecular shapes of carbon dioxide, CO_2, and sulfur dioxide, SO_2, different?
    a. Carbon has a smaller atomic radius than sulfur.
    b. A molecule of SO_2 has a lone pair of electrons, but CO_2 does not.
    c. A molecule of CO_2 has one single and one double bond, but SO_2 does not.
    d. A molecule that contains carbon cannot have a linear shape.

25. Which pair of elements forms a bond with the least ionic character? Refer to the periodic table.
    a. K and Cl
    b. O and Cl
    c. Na and Cl
    d. Mg and Cl
26. How would you illustrate a carbon atom in the steps before a final Lewis dot structure is built?
    a. the carbon symbol C with two dots on the left and right sides
    b. the carbon symbol C with two dots on the top and two dots on the bottom
    c. the carbon symbol C with one dot on each the top, bottom, left, and right sides
    d. the carbon symbol C with two dots on the top, two dots on the bottom, and one dot on each side
27. Which type of bonding forms due to electrical attractions between oppositely charged elements?
    a. Covalent
    b. Ionic
    c. Metallic
    d. Subshell
28. Which term describes a negative ion?
    a. Anion
    b. Cation
    c. Ionic radius
    d. Valence electron
29. Which type of structure do most ionic compounds form?
    a. Molecule
    b. Crystal lattice
    c. Polyatomic ion
    d. Electron-dot structure
30. Which statement explains covalent bonding between two atoms in a molecule?
    a. Electrons are shared between the atoms.
    b. The atoms are drawn together by their opposite charges.
    c. Loosely held electrons are able to move about within a crystal lattice.
    d. One atom loses at least one electron, and the other gains at least one electron.
31. Which type of chemical bond is formed by the attraction between positive ions and surrounding mobile electrons?
    a. Ionic
    b. Metallic
    c. Polar covalent
    d. Nonpolar covalent
32. What is the formula for the compound formed by calcium ions and chloride ions? Refer to the periodic table.
    a. CaCl
    b. Ca_2Cl
    c. $CaCl_3$
    d. $CaCl_2$

33. Which idea behind the shape of molecules includes the concept that electrostatic repulsion between electron pairs surrounding an atom causes these pairs to be separated as far as possible?
    a. VSEPR theory
    b. electron-dot theory
    c. electron-sea model
    d. hybridization model
34. Which type of covalent bond is the strongest?
    a. double bond
    b. triple bond
    c. one in which two electrons are shared
    d. one in which four electrons are shared