Chm.1.2.1 Compare (qualitatively) the relative strengths of ionic, covalent, and metallic bonds

- Describe metallic bonds: "metal ions plus 'sea' of mobile electrons".
- Describe how ions are formed and which arrangements are stable (filled d-level, or half-filled d-level).
- Appropriately use the term cation as a positively charged ion and anion as negatively charged ion. ***(question 9)***
- Predict ionic charges for representative elements based on valence electrons. ***(question 9)***
- Apply the concept that sharing electrons form a covalent compound that is a stable (inert gas) arrangement. ***(question 1)***
- Draw Lewis (dot diagram) structures for simple compounds and diatomic elements indicating single, double or triple bonds. ***(questions 6, 10, 15, 20)***

Chm.1.2.2 Infer the type of bond and chemical formula formed between atoms

- Determine that a bond is predominately ionic by the location of the atoms on the Periodic Table (metals combined with nonmetals) or when $\Delta EN > 1.7$. ***(questions 1, 2, 3, 4, 13, 14, 17, 18, 19)***
- Determine that a bond is predominately covalent by the location of the atoms on the Periodic Table (nonmetals combined with nonmetals) or when $\Delta EN < 1.7$. ***(questions 1, 2, 3, 4, 13, 14, 17, 18, 19)***
- Predict chemical formulas of compounds using Lewis structures. ***(questions 6, 18)***

Chm.1.2.4 Interpret the name and formula of compounds using IUPAC convention

- Write binary compounds of two nonmetals: use Greek prefixes (di-, tri-, tetra-, …). ***(question 12)***
- Write binary compounds of metal/nonmetal*.
- Write ternary compounds (polyatomic ions)* using the polyatomic ions on the reference table. ***(questions 9, 11)***
- Write, with charges, these polyatomic ions: nitrate, sulfate, carbonate, acetate, and ammonium. ***(question 9)***
- Know names and formulas for these common laboratory acids: HCl, HNO_3, H_2SO_4, $HC_2H_3O_2$, (CH_3COOH)

Chm.1.2.5 Compare the properties of ionic, covalent, metallic, and network compounds

- Explain how ionic bonding in compounds determines their characteristics: high MP, high BP, brittle, and high electrical conductivity either in molten state or in aqueous solution.
- Explain how covalent bonding in compounds determines their characteristics: low MP, low BP, poor electrical conductivity, polar nature, etc. ***(question 5)***
- Explain how metallic bonding determines the characteristics of metals: high MP, high BP, high conductivity, malleability, ductility, and luster.
- Apply Valence Shell Electron Pair Repulsion Theory (VSEPR) for these electron pair geometries and molecular geometries, and bond angles - Electron pair - Molecular (bond angle); Linear framework – linear; Trigonal planar framework– trigonal planar, bent; Tetrahedral framework– tetrahedral, trigonal pyramidal, bent; Bond angles (include distorting effect of lone pair electrons – no specific angles, conceptually only) ***(questions 7, 8, 10, 13, 16, 19)***
- Describe bond polarity. Polar/nonpolar molecules (relate to symmetry) ; relate polarity to solubility—"like dissolves like" ***(questions 4, 8, 13, 19)***
- Describe macromolecules and network solids: water (ice), graphite/diamond, polymers (PVC, nylon), proteins (hair, DNA) intermolecular structure as a class of molecules with unique properties

1) Describe the bonds used in NaCl and I_2. What is the role of electronegativity in these different types of bonds?

2) What determines if a **bond** is polar or non-polar?

3) Identify the type of bonding for each of the following pairs of atoms as ionic, polar covalent or non-polar covalent:

a) KBr b) SO c) SF d) CuCl e) Br_2

4) What two conditions determine if a **molecule** is polar or non-polar?

5) Of single, double, and triple covalent bonds, which is the longest? Which is the strongest?

6) For the ion CHO_2^-, there are two resonance structures. Draw the resonance structures for CHO_2^-. **Do the two structures represent different molecules?**

7) What does VSEPR stand for?

8) According to VSEPR theory, what determines the shape of molecules?

9) How many nitrate ions are necessary to combine with the cation of aluminum? **Why?**

10) Why is water bent and not linear?

11) Which of the following is the correct formula for calcium phosphate?
   a. $Ca_3(PO_4)_2$
   b. $CaPO_4$
   c. $Ca_2(PO_4)_3$
   d. $Ca_4(PO_2)_2$

12) Which of the following is the correct name for the molecular compound, N_2O_5?
   a. nitrogen oxide
   b. pentanitrogen dioxide
   c. dinitrogen pentoxide
   d. nitrogen (II) oxide

13) Which type of molecule is CF_4?
   a. polar, with a symmetrical distribution of charge
   b. polar, with an asymmetrical distribution of charge
   c. nonpolar, with a symmetrical distribution of charge
   d. nonpolar, with an asymmetrical distribution of charge

14) The bonds between hydrogen and oxygen in a water molecule are classified as:
   a. polar covalent
   b. nonpolar covalent
   c. ionic
   d. metallic

15) Which molecule contains a triple covalent bond between its atoms?
   a. N_2
   b. O_2
   c. F_2
   d. H_2

16) Which molecule has an asymmetrical shape?
   a. N_2
   b. NH_3
   c. Cl_2
   d. CCl_4

17) Which compound contains only covalent bonds?
   a. NaOH
   b. $Ba(OH)_2$
   c. $Ca(OH)_2$
   d. CH_3OH

18) When phosphorus and chlorine atoms combine to form a molecule of PCl_3, 6 electrons will form:
   a. nonpolar covalent bonds
   b. polar covalent bonds
   c. ionic bonds
   d. hydrogen bonds

19) For the following molecules or ions, draw the Lewis structures, determine the geometry and tell whether the molecule or ion is polar. Be sure to show each resonance structure if necessary.

SO_2 Valence e- ___		VSEPR Term Geometry	Polar, Non Polar, Ion? Why?
SCN^- Valence e- ___		VSEPR Term Geometry	Polar, Non Polar, Ion? Why?
$CHCl_3$ Valence e- ___		VSEPR Term Geometry	Polar, Non Polar, Ion? Why?
CO_3^{2-} Valence e- ___		VSEPR Term Geometry	Polar, Non Polar, Ion? Why?

20) Here are two incorrect Lewis Structures. The formulas are correct but the structures are not ideal. Change ***(Redraw)*** each structure to make it fit all of the rules for Lewis dots (Structures).