#3 Bonding Remediation

I. *(#3-1) How do Ionic bonds form?*
   a. *(#3-1a)Student will be able to use the ideas of Oxidation reduction to justify how an ionic bond is formed.*
   b. *(#3-1b)Student will be able to determine if a substance is using ionic bonding. (honors)*
   c. *(#3-1c)Students will be able to write ionic formulas and names for specific ionic compounds. (honors)*
   d. (#3-1d) Student will be able to interpret a model of a bulk crystal.
      - Bulk crystals are empirical in nature. Students will be able to identify if and or convert a formula to an empirical formula.

II. (#3-2)What are the properties of ionic compounds?
   a. (#3-2a) Students should be able to draw a representation of an ionic crystal and relate that drawing to the chemical formula of that substance.
   b. (#3-2b)Student will be able to write out reactions showing how individual ionic compounds dissociate when dissolving.
   c. (#3-2c)Student should be able to indicate, why or why not, an ionic compound dissolves in a solvent.
   d. (#3-2d) Student will be able to indicate how ionic compounds conduct electricity and the factors that increase or decrease this conductivity.
   e. (#3-2e)A student should be able to determine how ionic charge and ionic radii affects the Melting point of an ionic compound. (Coulombs law)

1. Which of the following properties can describe the substance NaI (s)
   a. Soluble in water? → yes
   b. Electrolyte? → yes, Ions will Be present if dissolved, No as solid
   c. Brittle solid? maybe... Not sure
   d. Solid conductor? No, only as a aqueous
   e. High melting point? yes, ionic

2. Aluminum and Oxygen form an ionic bond. Write out the oxidation and reduction reactions that will produce the appropriate ionic compound. $Al \rightarrow Al^{+3} + 3e^-$ oxidation
   $2e^- + O \rightarrow O^{-2}$ Reduction Al_2O_3

3. Estimate the melting point of aluminum sulfide relative to Aluminum oxide. Use coulombs law to justify. ↑Coulombic
   Al_2S_3 ← Same Charge
   Al_2O_3 ← smaller internuclear distance = ↑ MP

4. A sample of Calcium metal is immersed in a warm container of very concentrated Oxygen gas. After a few moments a fiery reaction takes place with nothing but a white powder remaining.
   a. Write a balanced reaction of this process.

$Ca + O_2 \rightarrow CaO$

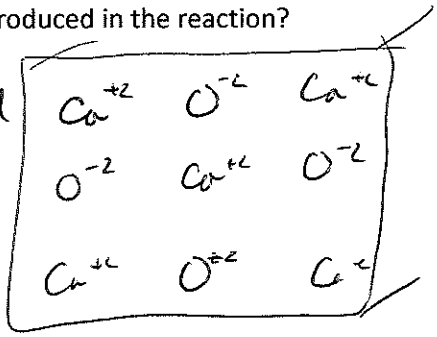
b. The lattice energy is the energy involved in the creation of a bulk crystal. Would the lattice energy of this process be bigger or smaller then the energy of a reaction between sodium and oxygen. Justify. Bigger, Stronger Bond ≈ more energy Released.

c. Student A hypothesis: The product of this process is Ca_2O_2 due to the number of electrons transferred. Nullify, ~~CaO~~, 1:1 Ratio of Bulk Crystal

Student B hypothesis: The product of this process is CaO due to the ratio of atoms present. True

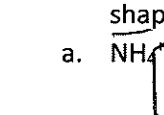
d. Which of the following is an appropriate model the substance produced in the reaction? (if neither, draw a more appropriate model)

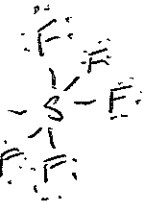
Bulk Crystal

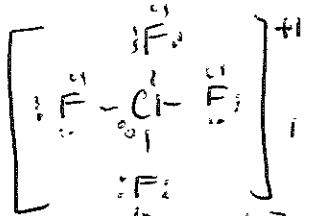


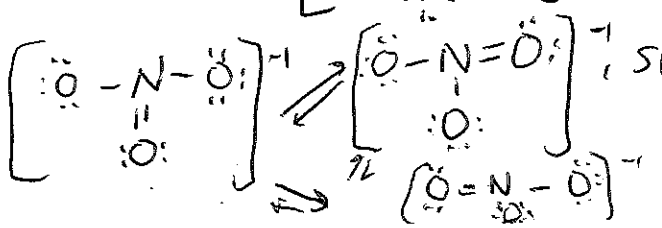
I. (#3-3) How do covalent bonds form?
   a. *(#3-3a) Students will be able to indicate if a chemical formula is of a covalent nature. (honors)*
   b. *(#3-3b) Students will be able to provide the name and formula of a covalent substance.*
   c. (#3-3c) Students will be able to draw out Lewis Dot structures.
   d. (#3-3d) Students will be able to discriminate between bond qualities of various covalent compounds (bond energy, Length, order)
   e. (#3-3e) Students will be able to provide Resonance structures.
   f. (#3-3f) Student will be able to determine the molecular geometry of a molecule.
   g. (#3-3g) Student will be able to classify the molecular geometry in terms of hybridization?

1. For each of the following substances draw a Lewis structure, determine hybridization, molecular shape, Polarity.

a. NH_4^+  sp^3, tetrahedral, NON-polar

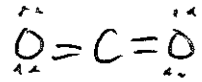
b. Sulfur hexafluoride  sp^3d^2, octahedral, NON-polar

c. ClF_4^+ 7 + 7(4) − 1 = 34 e⁻  , Seesaw, Polar

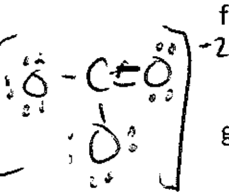
d. NO_3^{-1}  , sp^2, Trigonal planar, NON-polar

* S is the same or

e. Carbon disulfide

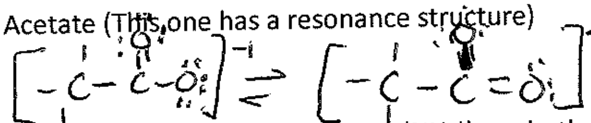
 , linear, SP, NON-polar

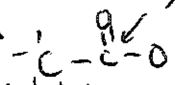
f. Carbonate



→ 2 more Resonance structures, Trigonal Planar, sp^2, NON-Polar

g. Acetate (This one has a resonance structure)

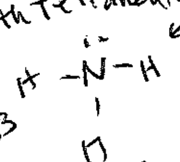


Tetrahedral sp^3 →  ← sp^2, Trigonal Planar

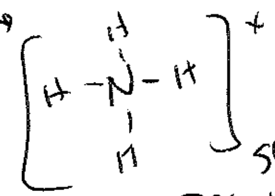
Polar

2. Ammonia (NH_3) and ammonium (NH_4^+) are both common organic substances.
   a. Draw a Lewis structure of each.
   b. Determine the electronic structure of each. ← Both Tetrahedral
   c. Determine the molecular structure of each.
   d. Why the difference between the two?

lone Pair



sp^3 Trigonal Pyramidal

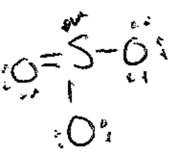


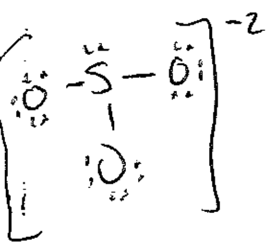
sp^3 Tetrahedral

(#3-4#4-1b) What are the properties of a covalent bond? (Intermolecular forces standard)

- (#3-4a) Student will be able to model, interpret, identify inter and intramolecular forces.
- (#3-4b) Student will be able to link inter and intramolecular forces to properties of solids, liquids, and dissolution
- (#3-4c) Student will be able to demonstrate how a molecule becomes polar.
- (#3-4d) Student will be able to label dipole moments to model a compounds solubility via particulate drawings.

3 Resonance

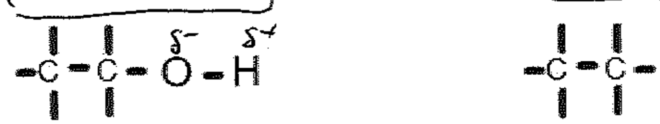




5. (#3-3) Consider the following substances. SO_3 and SO_3^{-2}. Why is the bond energy greater in SO_3 then SO_3^{-2}? ← 26 SO_3^{-2} ↓ Bond energy, only Singles
   └ 6(4) = 24 SO_3 ↑ Bond energy $1\frac{1}{3}$ Bond

1. At STP Ethanol is a liquid and ethane is a gas. With the structure below answer the following questions.

H Bond LDF   LDF

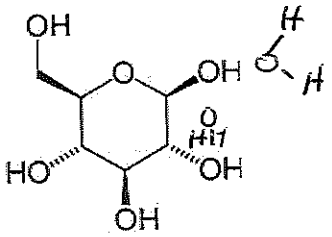


   a. If either of these substances has a dipole moment, write the partial charge in the appropriate location. see above   NONE
   b. What type of intermolecular force is present in each substance.
      See above
   c. Student hypothesis: When ethanol is burned, covalent bonds of are broken and new covalent bonds are formed. Justify or nullify.

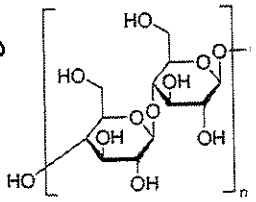
$C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$ ← yes, makes new stuff

2. In oil refining companies like Exxon Mobil separate various lengths of carbon chains by their lengths.
   a. Different lengths of chains will have different Boiling/melting Points due to quantities of intermolecular forces.
   b. Most candles today are considered paraffin wax. Having long carbon chains of nearly 50 carbons or longer are held together by this intermolecular force? LDF

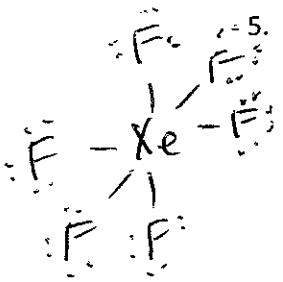
3. Glucose molecules are extremely soluble. See picture.
   a. What force is likely responsible the attraction of water and glucose? Hydrogen Bonding
   b. Add one water molecule to the drawing showing this attraction.



4. Cellulose otherwise known a cotton is simple extremely long chains of glucose molecules, hooked end to end as many as 15000 times in one molecule. This substance is nearly insoluble in water. What intermolecular force will be present in ever larger amounts as this structure gets larger and larger and may be responsible for this property. (see picture) HBonding + LDF



5. Xenon Hexafluoride is a very dense gas.



   a. Draw a Lewis structure of this substance.
   b. What can you say about the type and level of intermolecular forces? LDF, this is a NON-Polar substance due to symmetrical & instead Moderate LDF, it is a gas

I. (#3-5) Alloys a. Student shall be able to create and interpret particulate models of interstitial and substitutional alloys. b. Student shall be able to predict properties of various types of alloys.

Alloys have begun to play an increased role with the new AP chemistry curriculum. There are only a very few number of questions but fairly consistent presence. Properties and function can be a result of the bulk crystal formed. The most constant variable discriminating between these is atomic size.

Interstitial alloy: Large and small atoms. Small atom fits between larger atoms. This causes the metal crystal to be less malleable due to the crystal layers not sliding over one another.

Ex: Iron and carbon making steel.

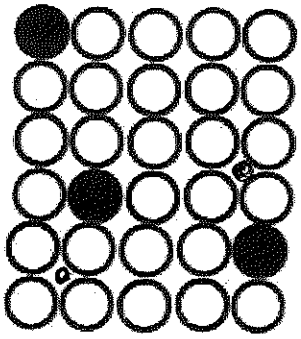
Substitutional alloy : Similar size. One atom simply replaces another one. This can change some of the reactive properties. Gold and silver alloys.

1. A stainless-steel screw is a fairly common product at your local home store. It is an alloy mostly comprised of iron and chromium. Justify or nullify the student hypothesis with knowledge of the alloy present.
    a. Student Hypothesis: Stainless-steel is a very hard durable metal. Which is why it is used for screws. Substitutional alloy → Not hard, Layers can move

    b. Student hypothesis: Stainless-steel is actually fairly soft but does not rust. This is why it is used for screws. yes. chemically different

2. Covalent substances are comprised of molecules and ionic compounds are made up of bulk crystals. What are metal alloys made up of? Bulk crystals

3. Presented here is a sample of Copper nickel alloy.
    a. What type of alloy is this? Substitutional
    b. Beryllium could be added to this alloy to make is stiffer, add 2 Berylliums to this structure in the correct way to achieve this property.



Be = ●