**AP CHEMISTRY CHAPTER 8: BASIC CONCEPTS OF CHEMICAL BONDING (Pgs. 298-341)**

EQ: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Questions:

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| **Chemical Bonds-2**  Three types of bonds:  -Ionic:  -Covalent:  -Metallic: | **Lewis Symbols-3**  G.N. Lewis developed a method to denote potential bonding electrons by using one dot for every \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ around the element \_\_\_\_\_\_\_\_\_\_\_.  When forming compounds, atoms tend to \_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_, or share electrons until they are surrounded by \_\_\_\_\_\_\_\_\_ valence electrons (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). | |
| **Ionic Formation-4**  Atoms tend to \_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_) or \_\_\_\_\_\_\_\_\_\_\_\_\_ ( \_\_\_\_\_\_\_\_\_\_\_) electrons to make them \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the noble gases. | **Energetics of Ionic Bonding-Born-Haber Cycle-5**  Many factors affect the energy of ionic bonding.  -Start with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:  Ex.  -Make \_\_\_\_\_\_\_\_\_\_\_\_\_\_ atoms:  Ex.  -Make ions:  Ex.  -Combine the ions: Ex. | |
| **Energetics of Ionic Bonding-6**   * It takes energy to convert the elements to atoms. (\_\_\_\_\_\_\_\_\_\_\_\_\_) * It takes energy to create a cation (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). * Energy is released by making the anion (\_\_\_\_\_\_\_\_\_\_\_\_\_\_). * The formation of the solid releases a *huge* amount of energy (\_\_\_\_\_\_\_\_\_\_\_\_). * This makes the formation of salts from the elements *\_\_\_\_\_\_\_\_\_\_\_\_\_*. | **Lattice Energy-7**  Lattice energy:  The energy associated with electrostatic interactions is governed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Law.  Eel= | |
| **Lattice Energy-8**  Lattice energy increases with: | **Covalent Bonding-9**  Atoms \_\_\_\_\_\_\_\_\_\_\_\_ electrons in covalent bonds.  There are several \_\_\_\_\_\_\_\_\_\_\_\_\_\_ interactions in these bonds:       For a bond to form, the attraction must be \_\_\_\_\_\_\_\_\_\_\_\_\_ than the \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | |
| **Lewis Structures-10**  Step 1:  Ex. | **Electrons on Lewis Structures-11**  Lone Pairs:  Bonding Pairs: | |
| **Multiple Bonds-12**  Single bonds:  Double bonds:  Triple Bonds:  Example of each: | **Polar Covalent Bonds-13**  Electrons in \_\_\_\_\_\_\_\_\_\_\_\_\_ bonds are not always shared \_\_\_\_\_\_\_\_\_\_\_\_\_.  \_\_\_\_\_\_\_\_\_\_\_ pulls harder on the electrons it shares with \_\_\_\_\_\_\_\_\_\_\_\_\_ than hydrogen does.  This make it so the \_\_\_\_\_\_\_\_\_\_\_\_\_ end of the molecule has more electron \_\_\_\_\_\_\_\_\_\_ than the \_\_\_\_\_\_\_\_\_\_\_\_ end. | |
| **Electronegativity-14**  What is electronegativity?  Electronegativity generally \_\_\_\_\_\_\_\_\_\_\_\_\_ as you go:  -from left to right across a period  -from the \_\_\_\_\_\_\_\_\_\_\_\_ to the \_\_\_\_\_\_\_\_\_\_\_ of a group. | **Electronegativity and Polar Covalent Bonds-15**  What is it called when atoms share electrons unequally?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Where do electrons tend to spend more time?: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  This results in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  It is represented by \_\_\_\_\_\_\_\_\_.  This makes the other atom \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  It is represented by \_\_\_\_\_\_\_\_. | |
| **Polar Covalent Bonds-16**  The greater the difference in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,  The more \_\_\_\_\_\_\_\_\_\_\_\_ is the bond. | **Dipoles-17**  A dipole forms when two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A dipole moment, \_\_\_\_, is produced by \_\_\_\_\_\_\_ equal but opposite charges, separated by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_.  It is calculated by the formula:  It is measured in \_\_\_\_\_\_\_\_\_\_\_\_ (D) | |
| **Is a Compound Ionic or Covalent?-18**  \_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_ = ionic \_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_ = covalent  Does not take into account \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Electronegativity difference can be used, but it still does not take into account the \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_.  Properties of compounds are often best: \_\_\_\_\_\_\_\_\_\_ melting points mean \_\_\_\_\_\_\_\_\_\_ bonding, for example. | | |
| **Writing Lewis Structures (Covalent Molecules)-19**   1. Sum the \_\_\_\_\_\_\_\_\_\_\_\_ electrons from all atoms, taking into account overall charge.   -If it is an anion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  -If it is a cation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Example:  Keep track of the electrons: | | **Writing Lewis Structures-20**   1. Write the symbols for the atoms, show which atoms are attached to which, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   Example Continued:  Keep track of the electrons: |
| **Writing Lewis Structures-21**   1. Complete \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    Keep track of the electrons: | | **Writing Lewis Structures-22**   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Keep track of the electrons: |
| **Writing Lewis Structures-23**   1. If there are not enough \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to give the central atom an \_\_\_\_\_\_\_\_\_\_, try \_\_\_\_\_\_\_\_\_\_\_\_ bonds. | | |
| **Writing Lewis Structures-24**   1. Then assign \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the charge an atom would have if all of the \_\_\_\_\_\_\_\_\_\_\_\_ in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ bond were shared \_\_\_\_\_\_\_\_\_\_.  Formal Charge = | | |
| **Writing Lewis Structures-25**  The dominant Lewis structure:  -Is the one in which atoms have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  -puts a negative formal charge on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  Which is the dominant Lewis structure? | | |
| **The Best Lewis Structure?-26**  Following our rules, this is the Lewis structure we would draw for ozone, \_\_\_\_\_.  Draw it:  However, it does not agree with what is observed in nature.  What is observed? | | **Resonance-27**  One Lewis structure cannot accurately depict a molecule like ozone.  We use multiple structures called \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ to describe the molecule.  Draw an example: |
| **Resonance-28**  Benzene, \_\_\_\_\_\_\_\_\_, has \_\_\_\_\_\_\_\_ resonance structures.  Draw it:  It is commonly depicted as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  With a circle inside to signify \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Electrons in the ring.  Draw it:  Localized:  Delocalized: | | **Exceptions to the Octet Rule-29**  There are \_\_\_\_\_\_\_\_\_ types of ions or molecules that do not follow the \_\_\_\_\_\_\_\_\_\_ rule. |
| **Odd Number of Electrons-30**  These are relatively \_\_\_\_\_\_\_\_\_\_\_\_\_ and usually quite \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  There are \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  With an odd number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  Example: | | **Fewer Than Eight Electrons-31**  Where can elements be found that make stable compounds with fewer than eight electrons?:  Example:  Why?: |
| **Fewer Than Eight Electrons-32**  If filling the octet of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ atom results in a \_\_\_\_\_\_\_\_\_\_\_\_ charge on the central atom and a \_\_\_\_\_\_\_\_\_\_\_\_ charge on the more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ outer atom, don’t fill the octet of the central atom. | | **More Than Eight Electrons-33**  When an element is in period \_\_\_\_\_\_\_ or below in the PT, it can use \_\_\_\_\_\_\_\_\_\_\_\_ to make \_\_\_\_\_\_\_\_\_ than four bonds.  Example: |
| **Covalent Bond Strength-34**  How is the strength of a bond determined?:  What do we call this? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Example: | | **Average Bond Enthalpies-35**  Average bond enthalpies are positive because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  These are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over many different compounds; not every bond in nature for a pair of atoms has exactly the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  C—H = Cl—Cl = H—Cl = |
| **Using Bond Enthalpies to Estimate Enthalpy of Reaction-36**  One way to estimate Δ*H* for a reaction is to use the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of bonds broken and the new bonds formed.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is added to break bonds, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when making bonds.  In other words:  Δ*Hrxn* = Σ(bond enthalpies of all bonds broken) − Σ(bond enthalpies of all bonds formed). | | **Example-37**  From the figure on the last slide:  CH4(*g*) + Cl2(*g*) ⎯⎯→ CH3Cl(*g*) + HCl(*g*)  Solve: |
| **Answer-38** | | **Bond Enthalpy and Bond Length-39**  An average \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be measured for different bond types.  As the number of bonds between two atoms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the bond length \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |

**SUMMARY**

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