Bonding

Review: bond types, bond energy

- We have been talking about atomic structure, now we are going to focus on molecules
- There are 2 types of bonding: _____,_____
- From 3A: _____ = stealing of electrons to form +ve and –ve ions. +ve and –ve then attract
- _____ = sharing of electrons
- We will see that there is no clear dividing line.

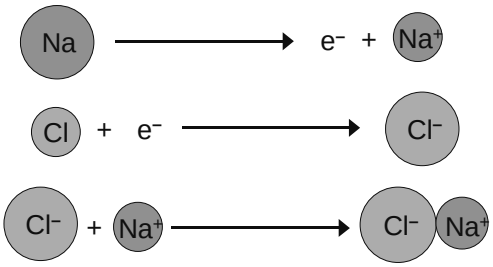
<u>What causes atoms to form molecules?</u>

- Basically, all things that happen spontaneously are energetically favorable (a book dropping)
- You never see a book spontaneously rise
- Something must be energetically favorable about atoms coming together as molecules
- We will look at ionic first and then covalent

Ionic bonding

Ionic bonding involves 3 steps (3 energies)

1) loss of an electron(s) by one element,
2) gain of electron(s) by a second element,
3) attraction between positive and negative



Ionic bonding: energies

- Let's keep track of numerical energy values
- By convention, a requirement for energy is given a + sign (we have to put energy in) and is called _____, a release of energy is given a – sign and is called _____.
- Problem: the sum is +147. A spontaneous change must involve a net lowering of energy
- Solution: the lattice energy provides the energy needed
- Note that although we represent this as a three step process it actual occurs all at once

7.1 questions (pg. 225 – 8)

1. A metal + non-metal gives what kind of bond?
2. What is necessary for any stable compound to form from its elements?
3. Define cation. Define anion.
4. List the 3 energies involved in forming an ionic bond
5. What term describes a release of energy?
6. Is breaking a bond endothermic or exothermic?
7. Define lattice energy.
8. Explain why metals form cations and non-metals form anions.
9. Explain why calcium exists as Ca^{2+} but not as Ca^{3+} in ionic compounds.
10. Explain why most transition metals form a 2+ ion.

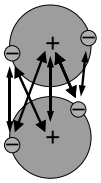
Covalent bonding

- Just as with ionic bonds, covalent bonds must involve a net lowering of energy
- We can explain this net lowering of energy in two ways:

  1) visualizing the combination of attraction as two atoms approach each other

  2) drawing and combining orbital diagrams

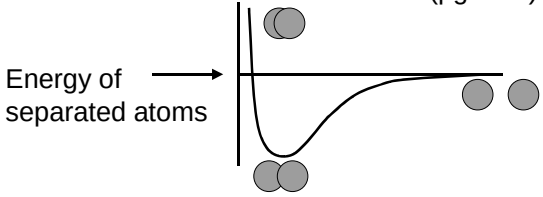
As atoms approach



- Recall that EA for all atoms, except the noble gasses is negative
- In other words we have no trouble adding electrons to atoms
- The attraction for electrons is not limited to free electrons, but also involves electrons that are part of other atoms.
- Thus, atoms are pulled toward each other
- How far they are pulled together will depend on a balance of attraction (nucleus to electrons) and repulsion (nucleus to nucleus and electrons to electrons)

Reducing energy

- The energy associated with moving atoms closer and farther is shown in 7.3 (pg. 231)



- It requires lots of energy to push nuclei close together (top). The atoms bond where energy is most favorable (lowest) similar to position marble would find on a track