COMPARISON OF CHEMICAL BOND TYPES

	Ionic	*Covalent*	*Metallic*
What is the basic composition?	Metal + Nonmetal	Nonmetal + Nonmetal	Metal + Metal
What is the goal of bond formation?	Low E = stability	low E = stability	Low E = Stability
What role do the electrons play?	e- transferred (from M to NM)	e- shared between atoms	e- delocalized ("sea of e-" e- migrate throughout cation's)
What is the force responsible for bonding?	electrostatic attraction	shared e-	sea of e-
What results (name) from the bond formation?	Formula Unit	Molecule	—
What are the general properties of the compounds that result from each type of bonding?	• Hard • Brittle • Solid at Room temp + pressure • High melt. pts. • Nonconductive as solid • Sustains current as liquid + when dissolved in solvent • Most are white solids	• Soft • Brittle • most gases at Room Temp + Pressure • Low melt. pts. • Nonconductor in any phase or when dissolved in solvent	• Malleable • Ductile • Solid at Room temp + Pressure • Range of M. Pts. • Excellent Conductors of Heat + electricity • Insoluble in Water • Silver • lusterous

Honors Chem – Chpt 6 Chem Bonding HW

1. **Why do covalent compounds have lower melting points than ionic compounds?**
   Covalent compounds are made of nonmetallic elements that are sharing electrons between atoms, ionic compounds are made of metallic and nonmetallic elements held by electrostatic attraction. The force that is responsible for ionic bonding is much stronger than the force in covalent compounds, therefore less energy will be required to complete a phase change, such as in melting. As a result, covalent compounds will melt at lower temperatures than ionic compounds.
   (*This is also why most covalent compounds are gases at room temperature.)

2. **Why are metals malleable?**
   In metallic compounds, metal cations are held by a sea of delocalized electrons, not locked in place like the ions in ionic compounds or the atoms or molecules in covalent compounds. When force is exerted on metallic compounds, the metal cations move to disperse the force applied, leading to a molding/spreading out of the substance. In contrast, when force is exerted on ionic compounds, the ions resist movement due to the electrostatic attraction, but with enough force applied, like-charged ions are forced to move closer to each other which causes repulsion. This repulsion helps the substance to fracture, leading to the brittleness of ionic compounds. Covalent compounds behave in a similar manner to ionic (brittle, not malleable due to atoms/molecules being held tightly to each other).
   *The ions in an ionic compound are "cemented" in place as opposed to the cations simply being "held" in place in a metallic compound.

3. **Why do ionic solids not conduct electricity?**
   To conduct electricity, free-moving electrons must be present. In an ionic solid there are not any free moving electrons (as in a metal – delocalized electrons), and as a result, ionic compounds do not conduct electricity.
   Ionic compounds do sustain an electrical current (sometimes erroneously called "conducting a current") when in the liquid state and when dissolved in a solvent. In both cases, free moving ions are created, which is the required composition to sustain an electric current. Covalent compounds are not able to conduct or sustain a current, for they do not contain free moving electrons or ions in any state or when dissolved in a solvent.

4. **Why are ionic compounds brittle?**
   Being brittle is the opposite of being malleable. A substance that is brittle fractures (breaks into shards/sharp pieces) when enough force is exerted upon the substance. When enough force is applied upon an ionic compound, the ions that are held tightly by electrostatic attraction are forced to move. This movement forces like-charged ions to come close to each other, causing repulsion, which then aids in the fracturing of the substance.