COMPARING BONDING: Metallic vs. Ionic vs. Covalent Compounds

Metallic Bonding	**Ionic Bonding**	**Covalent Bonding**
• Positive nuclei of atoms sit next to each other in a lattice • Valance shells of metallic atoms overlap • Electrons are delocalized – they flow through valance shells of all of the atoms • "Sea of electrons"	• Electrons transferred (lost or gained) • Cations and anions are formed so that each atom achieves an octet • Positive and negative charges are attracted to each other to create bond	• Electron pairs shared between two atoms so that both atoms achieve an octet
• Pure metals • Alloys (mixture of metals) • Sit next to each other in a lattice • Left side of staircase	• Metal + Nonmetal • One element from the left side of the staircase, the other from the right side	• Nonmetal + Nonmetal • Both on the right side of the staircase
• "Delocalized electrons" or a "sea of electrons" flow through the valance shells	• Positively charged cations and negatively charges anions attract each other	• Electrons are shared (no charges)
Properties: • Insoluble in water (do not dissolve in water) • Some metals react with water • Conduct electricity • Malleable (can be bent and hammered into a shape) • Ductile (can be stretched into wires) • Melting points vary	**Properties:** • Many are soluble in water (dissolve in water) • Conduct electricity ONLY when dissolved in water (or a solvent) OR when melted ("in the molten state) • Note: ionic substances that dissociate (break into ions) completely ($CaCl_2$)will are strong conductors of electricity compared to ionic substances that do not dissociate completely ($NaHCO_3$), which are weak conductors • Crystalline structure – brittle • High melting points due to strong lattice structure	**Properties:** • Nonpolar covalent molecules are **in**soluble in water (do not dissolve in water) • Polar covalent molecules are **soluble** in water (will dissolve in water) • Do not conduct electricity • Amorphous structure (no lattice structures) • Low melting points due to weak amorphous structure