Three Bond Types! (Intramolecular Forces)

	Covalent Bonds	Ionic Bonds	Metallic Bonds
smallest units	neutral atoms (may be partially charged)	positive and negative ions	positive metal ions and free moving electrons
nature of bonding force	mutual electrostatic force of attraction between bonding pairs of electrons and the nuclear charge of both atoms involved in the covalent bond quantum mechanical waveforms for electrons dictate what will be a stable bonding arrangement (i.e. octet rule)	electrostatic force of attraction between positively and negatively charged ions	mutual electrostatic force of attraction between free moving electrons and metallic ions, electrons wander through empty valence shells
required elements	a non-metal element above the stairs (include hydrogen) bonded with itself or another element above the stairs (include hydrogen) between atoms that have medium to high electronegativity and ionization energy (i.e above the stairs and hydrogen)	one element with low ionization energy which loses an electron (or electrons) to an element of high electronegativity generally occurs between a metal element (low ionization energy) and a non-metal element (high electronegativity) can also involve covalently bonded polyatomic ions (i.e. NH_4^{1+}, SO_4^{2+})	one (or more in the case of alloys) element with low ionization energy and empty valence shells low ionization energy means the element can loose electrons easily which then travel freely throughout the empty valence shell orbitals throughout the metal
behaviour of electrons involved in bonding	locked into covalent bonds and cannot move "localized" ("delocalization" can occur in 2-d network solids such as graphite or organic molecules containing pi bonds) differences in electronegativity between bonding elements can slightly shift bonding electrons <u>within</u> the bond creating polarized covalent bonds	locked in place around individual ions and cannot move "localized"	free to wander throughout the empty valence shell orbitals of the metal ions, can easily wander from one ion to the next "delocalized"
crystal structure	geometric arrangement (called a crystal lattice) of neutral atoms linked by covalent bonds geometry is based on covalent bonding principles	geometric arrangement (called a crystal lattice) of positive and negative ions geometry is based on a lowest energy arrangement in which (net attractions)-(net repulsion) is a maximum	geometric arrangement of metal ions packed together to minimize volume packing arrangements: -body centered cubic: 8 neighbours -hexagonal close packed 12 " -cubic close packed 12 "
strength of bond considerations	single, double and triple covalent bonds	magnitude of ionic charges, arrangement of ions in crystal	magnitude of metallic ion charge and number of electrons contributed to "electron soup", size of ions