TYPES OF COMPOUNDS

	IONIC (macromolecules)	**COVALENT**			**METALLIC** (macromolecules)
		NETWORK SOLID (macromolecules)	**DISCRETE COVALENT MOLECULES**		
			POLAR	**NON-POLAR**	
STRUCTURE	a very large number of positive metallic ions and negative non-metallic ions formed by a transfer of electrons, organized into a crystal lattice structure, held together by strong electrostatic forces of attraction between oppositely charged ions, ions obey the octet rule, entire crystal is electrically neutral, macromolecule	many neutral non-metallic atoms, organized into a crystal lattice structure, held together by a network of strong covalent bonds, bonding obeys the octet rule, macromolecule	a specific number of non-metallic atoms bonded together by covalent bonds, any bond polarizations will add to give a net polarization with regions of partial negative and partial positive charge, discrete molecule	a specific number of non-metallic atoms bonded together by covalent bonds, any bond polarizations will cancel out giving no net polarization, discrete molecule	many positively charged metallic ions surrounded by a sea of free moving electrons, metal ions are packed together as close as possible, held together by strong electrostatic forces of attraction between positive ions and free moving electrons, macromolecule
EXAMPLES	KCl, CaF_2, Cs_2S, MgO, LiF, NaCl (empirical formula)	$C_{(N)}$ - diamond, SiO_2 - quartz SiC, Si (empirical formula)	H_2O, ICl, NH_3, CH_3COOH (molecular formula)	CH_4, C_4H_{10}, wax, O_2, N_2, Cl_2 (molecular formula)	Cu, Au, Ag, Na, U, and many alloys
MELTING AND BOILING POINTS	high, strong intramolecular forces must be overcome for melting/boiling to occur**	high, strong intramolecular forces must be overcome for melting/boiling to occur**	low to moderate, due to weaker intermolecular electrostatic interactions*	low due to very weak intermolecular interactions*	usually high, strong intramolecular forces must be overcome for melting/boiling to occur**
PHYSICAL APPEARANCE AND RESPONSE TO PHYSICAL STRESS	well defined solid crystals, will shatter or cleave*** along a plane surface within the crystal lattice	well defined solid crystals, will shatter or cleave*** along a plane surface within the crystal lattice	often liquids or gases at room temperature, solid may be crystalline, often crumbly when stressed	often liquids or gases at room temperature, solids will be soft and mushy like wax or bacon grease	high luster solids, malleable and ductile when stressed, can be cast into forms, positive metallic ions can carefully slip past each other when stressed
SOLUBILITY	insoluble in non-polar solvents, variable solubility in polar solvents such as water (lattice**** energy versus hydration**** energy)	insoluble in all solvents, neutral atoms do not have a solvent/solute interaction capability	insoluble in non-polar solvents, soluble in polar solvents (like dissolve like), good solvent/solute interactions between δ^+ and δ^-	soluble in non-polar solvents (like dissolves like), insoluble in polar solvents	insoluble, electrons cannot dissolve because they move to fast (soluble in liquid mercury - like dissolves like)
CONDUCTIVITY	solid - non conductive, liquid (molten) state - conductive (free moving ions), aqueous solution - conductive (free moving ions)	non conductive in any state (no charged particles)	non conductive in any state (no particles that carry a net charge)	non conductive in any state (no charged particles)	conductive in solid and liquid state due to free moving electrons

* when melting/boiling a discrete covalent molecules only intermolecular attractions need be overcome to create a particle that is small enough to behave as a liquid or a gas

** when melting/boiling a macromolecule the intramolecular forces between atoms/ions must be overcome to create particles small enough to form a gas or a liquid, since intramolecular forces are 10 to 100 times stronger than intermolecular forces, macromolecules have a much higher melting/boiling point than discrete covalent molecules

*** cleavage is the property exhibited by a substance when it can fracture along a plane of particles in the crystal lattice resulting in smooth plane surfaces

**** lattice energy is the energy that corresponds to bonding within a lattice, hydration energy is the energy that corresponds to attraction between ions and water molecules