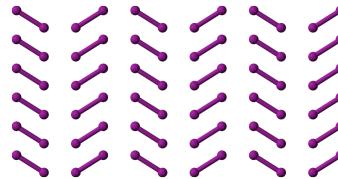
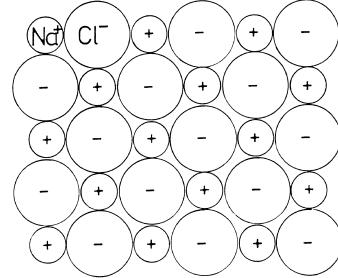
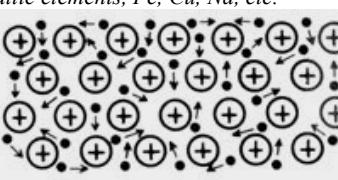


**Matter can be classified by the type of constituent particles present  
and the forces that hold them together in a crystalline solid state.**

Substance type	Structural units	Attractive forces between structural units	Physical properties	Examples
<b>Molecular</b>	Molecules (covalently bonded groups of atoms)	Intermolecular forces (IMFs): <i>*London dispersion forces</i> <i>*dipole-dipole forces</i> <i>*hydrogen-bonding</i>	Fairly soft, low to moderate melting/boiling points, poor thermal and electrical conductor, variable solubility, some dissolve in water and many dissolve in nonpolar solvents	Ex: $H_2O$ , $I_2$ , $CO_2$ , $NH_3$ , $HCl$ , $HCN$ , $C_{12}H_{22}O_{11}$ 
<b>Ionic</b>	Cations and Anions	Ion-ion (electrostatic attraction between cations and anions)	Hard and brittle, high melting/boiling, fair thermal conduction, no electrical conduction as a solid (but excellent electrical conduction when melted), many are soluble in water	Ex: $CaCl_2$ , $MgO$ , $(NH_4)_2SO_4$ , $NaHCO_3$ 
<b>Metallic</b>	Atoms (metal)	Metallic bonding (metal atom cores in an "electron sea")	Soft to very hard, low to very high melting/boiling, highly malleable and ductile, excellent thermal and electrical conductivity, insoluble in water	Ex: all metallic elements, $Fe$ , $Cu$ , $Na$ , etc. 
<b>Network covalent</b>	Atoms (nonmetal)	Covalent bonds (extensive "network" of covalent bonds connecting all atoms of the substance into a single enormous "molecule")	Very hard, very high melting/boiling, often poor electrical conduction (except graphite), fair thermal conduction, insoluble in water	Ex: boron nitride(BN), diamond(C),graphite(C), quartz( $SiO_2$ ) 