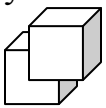
LECTURE 18. SOLIDS

- As you remove energy from a system, IMF attractions increase, and gases turn into liquids, which then lose more energy to become ordered solids.

- Not all solids are ordered (i.e. plastic), but under specific circumstances, crystalline solids form that have specific geometrics

- There are 7 primitive cells (one is a simple cubic comprised entirely of right angles and equal side lengths; the other six vary in angle measure and length)

- Unit cells can be merged by overlapping them to form more complex structures – crystals



Bonding in Solids

4 types of bonds, depending on location of molecules in periodic table:

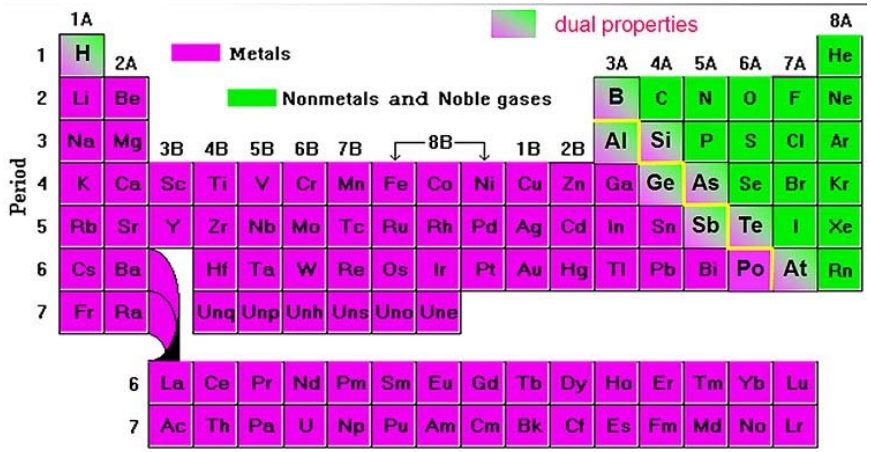


TABLE 5.4 Typical Characteristics of Solids

Class	Examples	Characteristics
metallic	*s*- and *d*-block elements	malleable, ductile, lustrous, electrically and thermally conducting
ionic	$NaCl$, KNO_3, $CuSO_4 \cdot 5H_2O$	hard, rigid, brittle; high melting and boiling points; those soluble in water give conducting solutions
network	B, C, black P, BN, SiO_2	hard, rigid, brittle; very high melting points; insoluble in water
molecular	$BeCl_2$, S_8, P_4, I_2, ice, glucose, naphthalene	relatively low melting and boiling points; brittle if pure

1) **Metallic Bond** -> Metal bonds with Metal; very strong (ex. Cr-V-Cr-V or Al-Al-Al-Al)

2) **Ionic Bond** -> Metal bonds with a Nonmetal; ≈ 200 kJ/mol (ex. Na-Cl-Na-Cl)

3) **Covalent Bond** -> Nonmetal bonds with a Nonmetal; ≈ 400 kJ/mol (ex. graphite C-C-C-C or glass Si-O-Si-O)

4) **IMF between molecules** -> Solids form from H-bonds, dipoles, dispersion (ex. H-O-H ------O-H); These are the weakest solids (1-20 kJ/mol)