CHEMICAL BONDING CHART

INTRAmolecular bond energies 500 1000 1500 2000 2500 3500 4000 kJ/mol kJ/mol 3000 MgO CaO lonic bonds. MgCl₂ in crystal CaCl₂ lattice configuration LiF NaF **KCI** $N \equiv N$ C≡C C=C0=0 Covalent bonds, i.e. as H-Fdiscreet O-Hmolecules C-HN-HN-CF-FW **Metallic bonds** Hg (W=Tungsten) Ionic Lattice Energy Covalent Bond Energy Metallic Lattice Energy **INTERmolecular bond energies** Intermolecular Bond Energy (lots weaker than those above) All these are called "Van der Waals" forces kJ/mol 0 10 20 kJ/mol 15 Permanent Dipole-Ion (salts in aq. solution) Na⁺ & H₂O Hydrogen Bonding (H bonded to F, O, N) ex. H₂O-H₂O Permanent Dipole - Permanent Dipole HCI-HCI

The 3 basic types of Van der Waals forces are 1. Dipole-Dipole, 2. Hydrogen bonds, and 3. Dispersion forces

Permanent Dipole-Induced Dipole HCI–Ar Induced Dipole-Induced Dipole He-He (Disperson or London forces)

CHEMICAL BONDING CHART **Ionic** lattice 1000 kJ/mol NaF Covalent N = N**STRONG BONDS** Metallic 900 kJ/mol A. Ionic Much of the strength of ionic bonding comes about when the ions are packed together in crystal lattices, so that C = Ceach ion is held in an attractive field with several neighbors of the opposite charge. These binding energies 800 kJ/mol NaCl C=0can range up to several thousand kilojoules per mole. **KCI** B. Covalent Covalent bonds are also strong, ranging up to 940 MgCl₂ 700 kJ/mol kilojoules per mole for triple bound N₂. C. Metallic Metals are also strongly bonded, as you can deduce from their strength and hardness, although the liquid C = C600 kJ/mol LiCI metal mercury is an exception. **WEAK BONDS** 500 kJ/mol 0=0Weak bonds, often called intermolecular forces, are several orders of magnitude weaker that strong bonds Si-CI described above. One of the relatively stronger of the weak bonds is hydrogen bonding with energies ranging from two to ten kilojoules per mole. 400 kJ/mol D. **Ion-Permanent Dipole** These would include salts dissolved in a polar substance, e.g., NaCl dissolved in water. NaNO₃ C-N 300 kJ/mol E. Permanent Dipole - Permanent Dipole This class of bond includes hydrogen bonding. F. Ion - Induced Dipole 200 kJ/mol N-O

100 kJ/mol

10 kJ/mol

0-0

В

Α

Hg

C

Weak

Inter-

molecular

D, E, F, G, H

G.

H.

Permanent Dipole - Induced Dipole

Induced Dipole - Induced Dipole