

CHEMICAL BONDING CHART

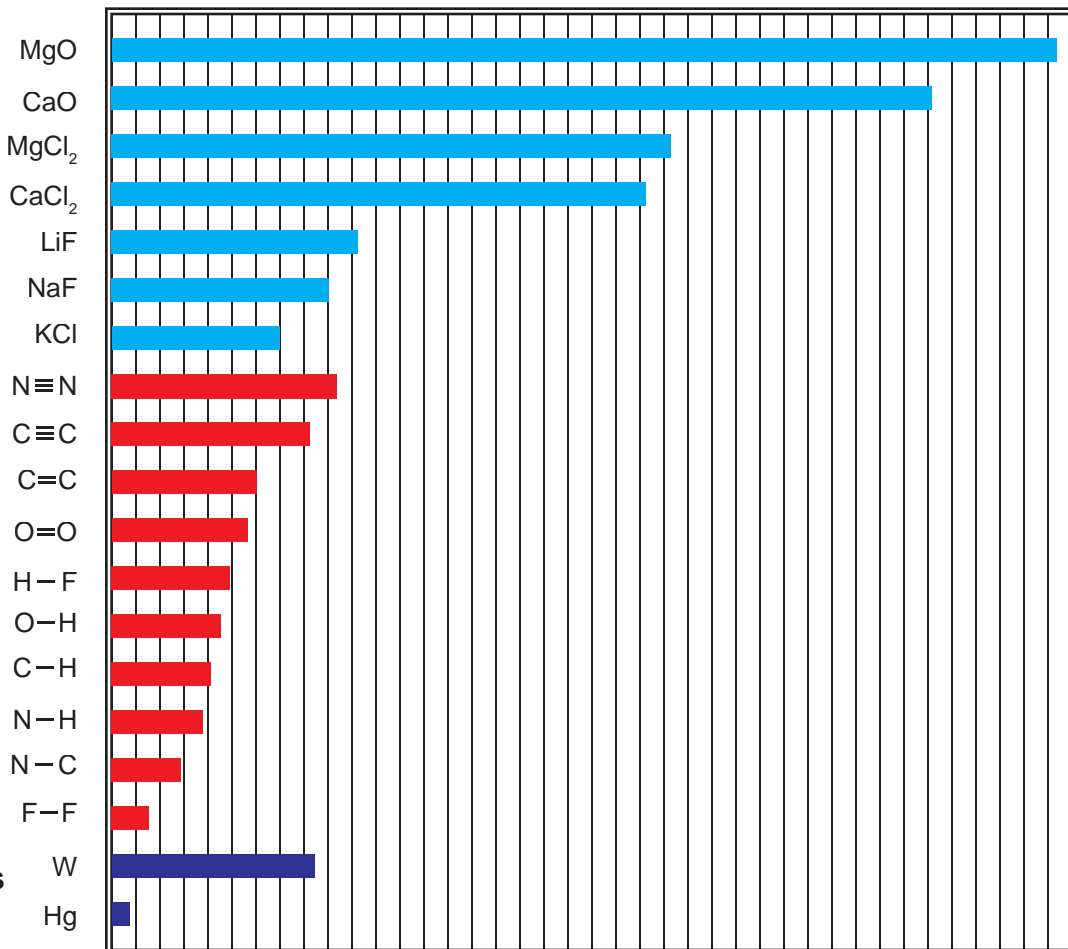
INTRAmolecular bond energies

kJ/mol 0 500 1000 1500 2000 2500 3000 3500 4000 kJ/mol

Ionic bonds, in crystal lattice configuration

Covalent bonds, i.e. as discrete molecules

Metallic bonds
(W=Tungsten)

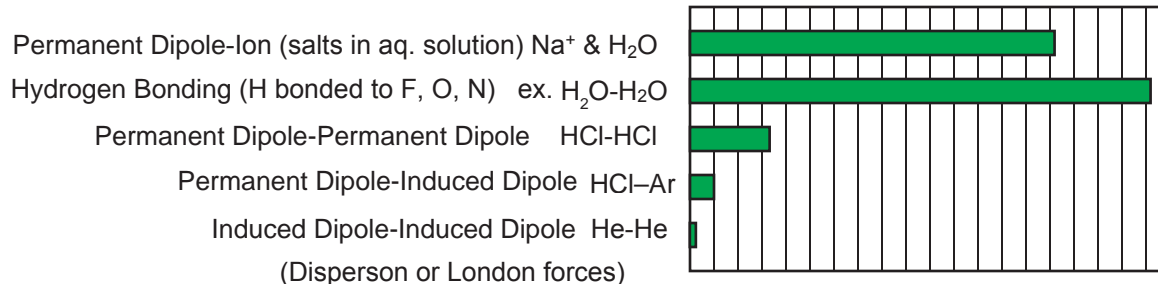


- Ionic Lattice Energy ■
- Covalent Bond Energy ■
- Metallic Lattice Energy ■
- Intermolecular Bond Energy ■

INTERmolecular bond energies (lots weaker than those above)

All these are called "Van der Waals" forces

kJ/mol 0 5 10 15 20 kJ/mol



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

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STRONG BONDS

A. Ionic

Much of the strength of ionic bonding comes about when the ions are packed together in crystal lattices, so that each ion is held in an attractive field with several neighbors of the opposite charge. These binding energies can range up to several thousand kilojoules per mole.

B. Covalent

Covalent bonds are also strong, ranging up to 940 kilojoules per mole for triple bond N_2 .

C. Metallic

Metals are also strongly bonded, as you can deduce from their strength and hardness, although the liquid metal mercury is an exception.

WEAK BONDS

Weak bonds, often called intermolecular forces, are several orders of magnitude weaker than strong bonds described above. One of the relatively stronger of the weak bonds is hydrogen bonding with energies ranging from two to ten kilojoules per mole.

D. Ion-Permanent Dipole

These would include salts dissolved in a polar substance, e.g., NaCl dissolved in water.

E. Permanent Dipole - Permanent Dipole This class of bond includes hydrogen bonding.

F. Ion - Induced Dipole

G. Permanent Dipole - Induced Dipole

H. Induced Dipole - Induced Dipole

