Chemical Bonding

Types of chemical bonds (strongest to weakest)

    Metallic: sea of freely moving electrons

    Ionic: transfer of electrons

    Covalent: shared electrons

        Polar covalent – unevenly shared electrons (use ΔEN)

        Nonpolar covalent – evenly shared electrons (use ΔEN)

        Coordinate covalent – both electrons come from a single atom, once formed is identical to any other polar or nonpolar covalent bond (Examples: NH_4^+, H_3O^+, $Ag[NH_3]_2^+$)

    Intermolecular Forces (IMFs)

        Hydrogen bond – particularly strong dipole – dipole bond that occurs when a hydrogen covalently bonded to N, O, or F on one molecule is attracted to the N, O, or F of a molecule next door (Examples: NH_3, H_2O, HF)

        Dipole – dipole bond – oppositely charged ends of polar molecules attract one another (Examples: HCl, CO, SO_2, $CHCl_3$)

        van der Waals forces – (dispersion forces) especially weak dipole – dipole forces that result from the momentary uneven dispersion of electrons in polarizable nonpolar molecules (Examples: F_2, Cl_2, Br_2, I_2, O_2, N_2, H_2, CH_4, CO_2)

Identifying bond type

    When only metals are involved, the bond type is metallic

    When metals bond with nonmetals, the bond type is ionic

    When nonmetals bond with other nonmetals, the bond type is covalent

    Neutral compounds with polyatomic ions have both ionic and covalent bonds

    Hydrogen with any Group 1 metal is ionic

    Using ΔEN

        $\Delta EN \geq 1.7$: ionic bond (except HF which is polar covalent)

        $\Delta EN < 1.7$ and > 0.3: polar covalent bond

        $\Delta EN \leq 0.3$: nonpolar covalent bond

Never confuse polar bonds with polar molecules

    Molecule: group of atoms held together with covalent bonds (polar, nonpolar, or mix)

        Polar molecule: *must* be asymmetrical and has permanent $\delta-$ and $\delta+$ ends due to uneven charge distribution

        Polar molecule: *must* be symmetrical and has even charge distribution

    Chemical bond: attraction of two positively charged nuclei to electrons between the atoms

Types of solids

    Metallic: solids conduct electricity, strong, malleable, ductile, luster, sea of mobile electrons (Examples: Na, Mg, Cu, Fe, Ag, Au)

    Ionic: solids nonconductors, liquids and solutions conduct electricity, high MP, hard, brittle (Examples: NaCl, Na_2CO_3)

    Network: 3D array of covalent bonds, high MP, all are solids, poor conductors of electricity (Examples: diamonds (C), sapphires (Al_2O_3), quartz(SiO_2))

    Molecular: low MP, soft, insulators, poor conductors of heat, many are liquids or gases (Examples: O_2, N_2, H_2O, C_2H_5OH, $CHCl_3$)