Lewis structures

Electron dot diagrams

- Single bonds
- Double bonds
- Triple bonds

Types of solids

Types of bonding

- Metallic
- Molecular
- Covalent network
- Ionic

Type of particles (atoms, ions, molecules)

Attractive forces between particles

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Shapes of molecules – name / drawing

Shapes of molecules

Bond angles

Polar bonds

Polar or non-polar molecules

How properties relate to the bonding

- Electrical conductivity
- Solubility in polar and non-polar solvents
- Hardness
- Malleability
- Melting & boiling points
- etc

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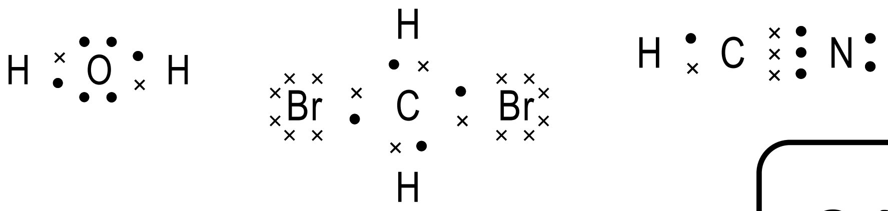
Lewis structures

H_2O CO_2 CS_2 CH_2Br_2 Cl_2O

CS_2 HCN CH_3Cl NCl_3

CH_2O / H_2CO PH_3 F_2O



Types of solids

metallic	molecular	covalent network	ionic
Cu	S_8	C (diamond)	MgO
Zn	Cl_2	C (graphite)	$MgCl_2$
Ag	CO_2	SiO_2	$CaCl_2$
K	H_2O (ice)		KI, KCl
Pb	I_2		Na_2O
	SO_3		Al_2O_3
	PCl_3		NaCl, LiCl
	SCl_2		$CuCl_2$

Shapes of molecules – name / drawing

H_2O CO_2 CH_2Br_2 CH_3Br NCl_3 SO_3 CF_4 OCl_2 CH_4 PCl_3 SO_2 NH_3 $COCl_2$ CH_3Cl CH_2O SiH_4 H_2S SF_2 PBr_3 O_3 F_2O

linear, angular (v-shaped), trigonal planar, trigonal pyramidal, tetrahedral

180^o, 120^o, 109^o

Electronegativity F > O > N/Cl > S… >.. C.. > …H

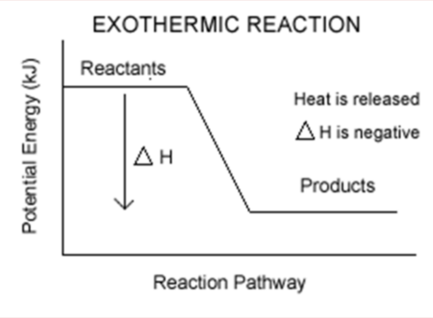
Polar bonds – difference in EN of bonded atoms gives rise to δ- and δ+. Polar molecules: possess polar bonds & dipoles don't cancel out due to asymmetrical molecular shape

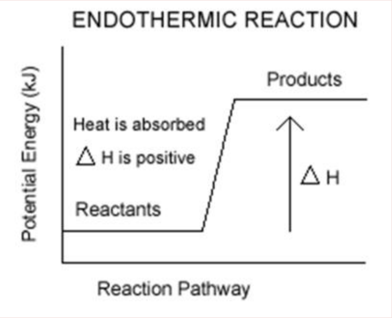
How properties relate to the bonding

- why metals are easily shaped and are good conductors of electricity
- why ionic substances are brittle, have high m.pts, many are soluble in water but not in non-polar solvents, and why they conduct when aqueous solution or molten but not as solids
- why graphite is slippery and can conduct electricity
- why ionic, metallic and covalent network solids have high m.pts but molecular solids have low m.pts.
- etc

Energy

- exothermic and endothermic reactions
- energy (enthalpy) changes associated with differing amounts of substances
- energy (enthalpy) changes associated with changes of state
- enthalpy changes associated with the making and breaking of chemical bonds
- calculations of energy changes using $\Delta_r H$ and reaction stoichiometry
- calculations of energy changes using bond enthalpy.





Exothermic. Reactants energy > products energy, energy is released (surroundings feel hot).

Endothermic. Products energy > reactants energy (surroundings feel cold).

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Chemical reactions and changes in state involve changes in energy (ΔH). It takes energy to overcome the attractive forces between solids and liquids to form a gas, and that energy is released when gases are condensed to make liquids or solids.

Molecules are held together by chemical bonds

- add energy to break bonds (endothermic)
- energy is released when bonds form (exothermic)

Using thermochemical equations

We can treat the energy absorbed or released in a chemical reaction as just another reactant or product, and can solve problems involving energy using balanced equations and mole ratios.

n= m/M or m = nM energy released per mole = Q/n

Calculations

Calorimetery - Steps to calculating the enthalpy change of a reaction

1. Calculate the temperature change. Calculate the energy absorbed or released. $Q = m(\text{water}) \times \Delta T \times c$. $c = 4.2\ \text{J g}^{-1}\ {}^\circ\text{C}^{-1}$ Convert Q to kJ.
2. Divide the energy absorbed or released by the number of moles of reacting substances to find the enthalpy change in kJ per mole.
3. Decide on the sign for ΔH and write the thermochemical equation.

Calculating ΔH using bond energies

Bond energy is a measure of the intramolecular bond strength in a covalent molecule: AB(g) → A(g) + B(g)

ΔH = Σ (bonds broken) + Σ (bonds made) but remember breaking values are + and making values are -. (Σ meansd "sum of")

Of course when using bond energies or enthalpies, you break only the bonds that need breaking and make the bonds that need making. You don't need to break every bond in the molecule if much of its structure is retained after the reaction.