Ionic Bond Cheat Sheet

by resaraj via cheatography.com/209482/cs/45045/

DEFINITION

Ionic bonding occurs between a metal and a non metal ion with the electrostatic attraction between the ions. The electron will leave the low electronegative metal and move to the high electronegative non-metal.

Characteristics

electrons placed inside the atoms

strong electrostatic bonds

no directional preference

high melting and boiling points

soluble in polar solvents (water, alcohols, ...)

WHY?
BECAUSE OF LATTICE ENERGY
it is the enthalpy of formation of the ionic compound from gaseous ions, the measurement of the bonds' strength

Type of ionic interactions

electrostatic (main intercation)

repulsive (between the electrons)

repulsive (between the nuclei)

Formulae

For a mole of solid: $E_a = -NA\frac{|q_+||q_-|e^2}{4\pi\varepsilon_0 d}$ 2Ln2 (MADELUNG CONSTANT)

- Depends on the relative position of the ions in the solid
- Is characteristic for each "structure"

Formulae

$$U_{lattice} = \underbrace{E_{attractive}}_{E_a} + \underbrace{E_{repulsive}}_{E_r}$$

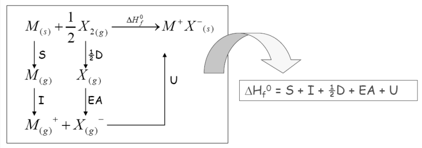
Born-Landé equation

$$U = -\frac{AN_A}{4\pi\varepsilon_0}\frac{|Z_+||Z_-|e^2}{d}\left(1-\frac{1}{n}\right)$$

Born-Haber Cycle

Lattice energy cannot be easily obtained experimentally	Thus , we apply the Hess Law to realize indirect calculations
standard enthalpy of formation	ΔHf
enthalpy of sublimation	ΔHs=S
enthalpy of dissociation	ΔHd=D
ionization energy (take an electron)	ΔHi=I
electron affinity (add an electron)	ΔHEA=EA

Born-Haber Cycle



Ionic Liquids (IL)

Salts in liquid state at room temperature made of ions	Possible when the ionic charges aren't too high and the distance is large enough
Useful properties	
-non volatile	-remain in liquid state up to 400ºC
-non flammable	-good solvents for reactions
-reduced volume	-easy reuse

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Ionic Conductors (Superconductors)

They are solid state ion conductors used primarly in solid oxide fuel cells.	They conduct electricity due to the movementof the ions through the voids.

An example would be yttria-stabilized zirconia (YSZ)

Ionic Solids

Physical behaviour	
-HARD(-NESS)	related with the attractive cohesion force in the ionic structure. This property is related with the absolute value of the lattice energy (dir4ectly to the charge of ions, inversely to their size)
-RIGID	strog attractive forces hold ions in specific positions
-BRITTLE	when enough dorce is applied, ions of similar charge are brought next to eachother, and repulsions between them crack the sample
ELECTRIC CONDUCTIVITY	
-solid state	insulators (the valence electrons aren't mobile and the ions are in fixed positions))
-when molten	electricity conductor (ions are mobile)

Ionic Solids (cont)

-when dissolved in polar solvents	electricity conductor (ions are mobile)
SOLUBILITY	
ΔHsolution=-U+Δ-Hsolvation	the higher the lattice energy of a salt, the less soluble it is
MELTING AND BOILING POINTS	
-high melting point	freeing ions from their positions require large amount of energy
-much higher boiling points	(the higher U is, the higher its boiling/m-elting point is)

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