Chemical Bonding (A level) - H2 #2 Cheat Sheet

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Ionic Bonding

Electrostatic attraction between cations and anions

Formed due to large difference (>2) in electronegativity

Ionic bonding is not always present between nonmetal and metal (eg. AlCl3 is covalent molecule)

Transfer of electrons from a metal atom to a non metal atom

Metal atom gives away electrons and becomes a cation

Non- metal atom accepts electrons and becomes anion

Giant Ionic Structure

In solid state, anions and cation are held in fixed alternate positions in a giant ionic crystal lattice

Cations attract anions in every direction around them

Ionic bonds exist extensively throughout the structure

Strength of ionic bond

Indicated by lattice energy (LE)

LE is the amount of heat energy evolved when 1 mole of solid ionic compound was formed from its gaseous ions

Directly translates to the amount of heat energy required to break the ionic bond

Magnitude of LE : Product of respective charges of the ions/ sum of the respective radius of both ions

More LE -> stronger electrostatic attraction between cation and anion --> more stronger ionic bond

Greater numerator -> higher charge -> greater LE required -> stronger ionic bond

Smaller denominator -> lower radius -> greater LE required -> stronger ionic bond

Strength of ionic bond (cont)

Explain answers in terms of value of (q+ x q-) and (r+ + r-) and then link to the LE formula

Physical properties of Giant ionic structureHi

High MP/BP : large amount of energy required to overcome strong electrostatic forces of attraction between cations and anions

Discussing difference in MP/BP: structure -> compare (q+ x q-) and (r+ + r-) -> compare LE -> strength of esf -> energy required to overcome esf -> link

Electrical Conductivity: ionic compounds are good electrical conductors in molten/aqueous state as the ions are free from their fixed , alternate positions in the giant crystal ionic lattice -> presence of mobile ions able to carry charges throughout the compound

Hardness: **Very** hard (large amount of energy to overcome strong esf) but they are brittle	When a force is applied along a particular plane -> layers of ions slide -> ions of same charge meet and repel one another -> shatters crystal along fault line

Solubility

Ionic compounds are soluble in water (not non-polar solutions)

when ionic compound is added to water -> ion-dipole attraction established between oppositely charged ions and the polar water molecules (ions are completely solvated) -> when ion-dipole attraction releases sufficient energy -> enough to overcome the strong esf between the cations and anions -> breakdown of the solid ionic crystal lattice -> solid dissolved

Covalent character in ionic bond

not all ionic bonds are pure -> some possess a certain degree covalent character

in these cases, cations will polarise the anion (attract the electron cloud towards itself -> part of the electron cloud of O2- gets drawn to the region in between both ions -> electron cloud ends up being shared between ions

factors affecting extent of covalent character -> increased polarising power of cation (increased charge density -> small size and higher charge) and larger anions (easier to polarise) -> size of anions decreases down the group

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