H2 Chem Chemical Bonding Cheat Sheet

by L_Wen via cheatography.com/193987/cs/40409/

Chemical Bonding

Physical Properties

Melting/ boiling point	strength of bonding	amount of energy required to overcome bond	id-id< pd-pd< H-bond< (metallic/ ionic/ covalent)
Solubility	favourable bonds formed?	bonds formed stronger than bonds broken	
	water + polar => ion-dipole	polar + polar	non-polar + non-polar
Electrical conductivity	presence of electrical carriers	mobile delocalised e^- or ions	

Covalent Compounds

covalent bonds	EFoA between shared pair of e^- and positively charged nuclei		
	dative covalent	one atom contributes both bonding e^-	
overlap or orbitals	sigma (σ) bond	head-on overlap	s- and p-orbital
	pi (π) bond	side-on overlap	p-orbitals only
Strength = bond energy	no of bonding e^- (bond order)	effectiveness of orbital overlap	bond polarity (incr ionic character)
	more bonding e^- = stronger EFoA	larger orbital = more diffused = less effective overlap	more polar = stronger EFoA
simple covalent structure	simple discrete molecules		
	id id	non-polar; weak	size of electron cloud; polarisability
	pd pd	polar; stronger than id id	strength of dipole moment
	H bond	H bonded to NOF + lone pair of electrons on NOF	optimal ratio of H:e- (1:1)
giant covalent structure:			
diamond	each C bonded to 4 other C atoms	giant covalent lattice	
graphite	each C bonded to 3 other C atoms	giant extensive planar layers	weak id id between layers

Molecular Shape and Arrangement

Valence shell electron repulsion theory	VSEPR				
Conditions	e^- pairs arranged as far apart as possible	minimise repulsion			
	LP-LP >	LP-BP>	BP-BP>	BP- Lone e^-	
	Repulsion of e^- incr as electroneg incr	electroneg incr = e^- closer to central atom	= stronger repulsion		
No of e^- pairs	e^- pair geometry	No of BP	No of LP	molecular geometry	Bond angle
2	linear	2	0	linear	180
3	trigonal planar	3	0	trigonal planar	120
		2	1	bent	<120
4	tetrahedral	4	0	tetrahedral	109
		3	1	trigonal pyramidal	107
		2	2	bent	105
5	trigonal bipyramidal	5	0	trigonal bipyramidal	equatorial - 120; axial - 180
		4	1	see-saw (remove from equatorial plane)	equatorial - <120; axial - 180
		3	2	T-shaped	90
		2	3	linear	180
6	octahedral	6	0	octahedral	90
		5	1	square pyramidal	90

Molecular Shape and Arrangement (cont)

4	2	square planar	90

Electronegativity

tendency of an atom to pull electrons towards itself	nuclear charge	stronger = greater pull
	distance of e$^-$ from nucleus	further = weaker pull
trend	down group	decrease
	across period	increase

Ionic compounds

Ionic bond	IMFOA between oppositely charge ions	
structure	giant ionic lattice structure	
strength	lattice energy	(product of charges)/(sum of ionic radius)
coordination number	number of opp-charged ions surrounding central ion	ligand size increase, coordination number decrease

IONIC vs COVALENT CHARACTER

Pure covalent	Approx equal electroneg	no distortion of electron cloud	
Covalent with ionic character	atoms with electroneg diff	dipole moment (δ$^+$, δ$^-$)	incr electroneg diff = incr dipole
Ionic with covalent character	polarisation distorts anion e$^-$ cloud	stronger polarising power of cation (charge density)	= increase distortion = increase covalent character
	some form of e$^-$ sharing	larger e$^-$ cloud = incr polarisability	= increase distortion = increase covalent character
Pure ionic character	complete transfer of e$^-$	e$^-$ cloud remains intact and spherical	

Metallic compounds

Metallic bond	EFoA between metallic cations and sea of delocalised, mobile e$^-$		
	in giant metallic lattice structure		
Factors affecting strength	Charge density	No of e$^-$ delocalised per atom	
Unique physical properties	Malleable (beat into sheets)	Ductile (drawn into wire)	orderly arrangement of cation
	Alloy formation	non-metal atoms disrupts orderly arrangement	tensile strength increase
	Reflectivity	Delocalised e$^-$ absorb light and excited	promoted to higher level
		De-excitation => release E	=> light

Special Cases

Anomalous Mr of organic acid in gaseous phase/benzene solvent	Apparent Mr twice of anomalous Mr	dimerisation	either achieve octet, or due to favourable bonds formed (release E)
Different physical properties of structural isomers	1,2-nitrophenol has lower BP than 1,4-nitrophenol	1,2-nitrophenol has **intramolecular** H-bond	less extensive **inter-molecular** H bond
Bp of HI> HBr>HCl	incr in id-id down group	decrease dipole moment down group	incr id-id more significant
Density of water > ice	ice - hexagonal arrangement of water	large amount of empty spaces	