Chemistry Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 4

Chemical Bonding and Molecular Structure

Lewis structures and formal charge

FORMAL CHARGE

$$\text{FC} = V - L - \tfrac{1}{2}B \quad (V = \text{valence},\ L = \text{lone-pair electrons},\ B = \text{bonding electrons})$$

VSEPR and hybridisation

STERIC NUMBER

$$\text{SN} = \tfrac{1}{2}\left(V + M - c + a\right)$$

V valence electrons of the central atom, M monovalent atoms around it, c / a positive / negative charge.

HYBRIDISATION FROM SN

$$2\ sp,\ 3\ sp^2,\ 4\ sp^3,\ 5\ sp^3d,\ 6\ sp^3d^2,\ 7\ sp^3d^3$$

REPULSION ORDER

$$\text{lp–lp} > \text{lp–bp} > \text{bp–bp}$$

DIPOLE MOMENT

$$\mu = q \times d; \qquad 1\ \text{D} = 3.336 \times 10^{-30}\ \text{C m}$$

% IONIC CHARACTER

$$\frac{\mu_{\text{observed}}}{\mu_{\text{ionic}}} \times 100$$

Molecular orbital theory

BOND ORDER

$$\text{BO} = \tfrac{1}{2}(N_b - N_a); \qquad \text{BO}\uparrow \Rightarrow \text{bond length}\downarrow,\ \text{bond energy}\uparrow$$

FILLING ORDER

$$\leq 14\ e^-:\ \sigma1s, \sigma^*1s, \sigma2s, \sigma^*2s, \pi2p_x = \pi2p_y, \sigma2p_z, \ldots; \qquad > 14:\ \sigma2p_z \text{ before } \pi2p$$

PARAMAGNETIC EXAMPLES

$$\mathrm{O_2}\ (2\ \text{unpaired}),\ \mathrm{B_2},\ \mathrm{O_2^+},\ \mathrm{O_2^-},\ \mathrm{N_2^+}$$

Ionic bonding and Fajans' rules

covalent character$\uparrow$ with small cation, large anion, high charge, and $(n-1)d^n ns^0$ cations

Hydrogen bonding

intermolecular: raises boiling point ($\mathrm{H_2O}$, HF, $\mathrm{NH_3}$);

intramolecular: lowers it (o-nitrophenol)

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