



REVISION NOTES · CLASS 11 AND 12

Chemistry Quick Revision for JEE and NEET

Physical chemistry formulas, inorganic trends and the organic reactions examiners return to most often, condensed onto a few pages for the last weeks before JEE or NEET.

JEE

NEET

CBSE 12

01 Mole concept and solutions

Moles – $n = \text{mass/molar mass} = \text{number of particles}/N_A$

Molarity – $M = \text{moles of solute/litres of solution}$; **molality** $m = \text{moles of solute/kg of solvent}$

Mole fraction – $x_A = n_A/(n_A + n_B)$

Normality – $N = M \times n\text{-factor}$; **dilution** $M_1V_1 = M_2V_2$

Raoult's law – $p_A = x_A p_A^\circ$; **relative lowering** $(p^\circ - p)/p^\circ = x_{\text{solute}}$

Colligative properties – $\Delta T_b = iK_b m$; $\Delta T_f = iK_f m$; **osmotic pressure** $\pi = iCRT$

Henry's law – $p = K_H x$

02 Atomic structure

Bohr energy – $E_n = -13.6 Z^2/n^2 \text{ eV}$; **radius** $r_n = 0.529 n^2/Z \text{ \AA}$

de Broglie – $\lambda = h/mv$; **Heisenberg** $\Delta x \cdot \Delta p \geq h/4\pi$

Quantum numbers – n ; l from 0 to $n - 1$; m_l from $-l$ to $+l$; $m_s = \pm 1/2$

Capacity – $2n^2$ electrons per shell; $2l + 1$ orbitals per subshell

Nodes – radial $n - l - 1$; angular l

Filling order – $(n + l)$ rule, then Pauli exclusion and Hund's rule

03 Gases

Ideal gas – $PV = nRT$, $R = 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1} = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$

Dalton – $p_i = x_i p_{\text{total}}$

Graham – rate $\propto 1/\sqrt{M}$

van der Waals – $(P + a n^2/V^2)(V - nb) = nRT$

Compressibility – $Z = PV/nRT$

Molecular speeds – $u_{\text{rms}} = \sqrt{3RT/M}$, $u_{\text{avg}} = \sqrt{8RT/\pi M}$, $u_{\text{mp}} = \sqrt{2RT/M}$

04 Thermodynamics

First law – $\Delta U = q + w$ ($w = \text{work done on the system}$); $w = -P_{\text{ext}}\Delta V$

Enthalpy – $\Delta H = \Delta U + \Delta n_g RT$; **Hess's law** adds reaction enthalpies

Gibbs energy – $\Delta G = \Delta H - T\Delta S$; spontaneous when $\Delta G < 0$

Link to equilibrium – $\Delta G^\circ = -RT \ln K = -2.303RT \log K$

Link to cells – $\Delta G^\circ = -nFE^\circ_{\text{cell}}$

05 Equilibrium

K_p and K_c – $K_p = K_c(RT)^{\Delta n}$

pH – $\text{pH} = -\log[H^+]$; $\text{pH} + \text{pOH} = 14$ and $K_w = 10^{-14}$ at 25°C

Weak acid – $[H^+] = \sqrt{K_a C}$, **degree of dissociation** $\alpha = \sqrt{K_a/C}$

Buffer (Henderson) – $\text{pH} = \text{p}K_a + \log([\text{salt}]/[\text{acid}])$

Salt of weak acid and strong base – $\text{pH} = 7 + \frac{1}{2}(\text{p}K_a + \log C)$

Solubility product – $K_{\text{sp}} = s^2$ for AB ; $4s^3$ for AB_2

06 Electrochemistry and kinetics

Cell emf – $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$

Nernst equation (298 K) – $E = E^\circ - (0.0591/n) \log Q$

Faraday's law – $m = (M/nF)It$, $F = 96,500 \text{ C mol}^{-1}$

Conductivity – $\Lambda_m = \kappa \times 1000/M$ (κ in S cm^{-1}); **Kohlrausch** $\Lambda_m^\circ = v_+ \lambda_+^\circ + v_- \lambda_-^\circ$

Zero order – $t_{1/2} = [A]_0/2k$

First order – $k = (2.303/t) \log([A]_0/[A])$, $t_{1/2} = 0.693/k$

Arrhenius – $k = Ae^{-E_a/RT}$; $\log(k_2/k_1) = [E_a/2.303R](1/T_1 - 1/T_2)$

07 Periodic trends and bonding

Atomic radius – decreases across a period, increases down a group

Ionisation enthalpy – increases across a period; exceptions $N > O$, $Be > B$, $Mg > Al$

Electronegativity – fluorine is highest (4.0 on the Pauling scale); chlorine has the most negative electron gain enthalpy

Bond order (MOT) – $(N_b - N_a)/2$; O_2 has bond order 2 and is paramagnetic; N_2 has bond order 3

Hybridisation – 2 sp linear; 3 sp² trigonal planar; 4 sp³ tetrahedral; 5 sp³d trigonal bipyramidal; 6 sp³d² octahedral

Shapes – H_2O bent 104.5°; NH_3 pyramidal 107°; SF_4 see-saw; ClF_3 T-shaped; XeF_2 linear; XeF_4 square planar

Formal charge – valence electrons – non-bonding electrons – $\frac{1}{2}$ bonding electrons

08 Coordination compounds

Crystal field (octahedral) – $t_{2g} -0.4\Delta_o$, $e_g +0.6\Delta_o$

Spectrochemical series – $I^- < Br^- < Cl^- < F^- < OH^- < H_2O < NH_3 < en < CN^- < CO$

Magnetic moment (spin only) – $\mu = \sqrt{n(n+2)}$ BM, n = unpaired electrons

09 Named reactions

Aldol – aldehydes or ketones with α -H in dilute alkali give β -hydroxy carbonyl compounds

Cannizzaro – aldehydes without α -H in concentrated alkali give an alcohol and a carboxylate

Wurtz – $2R-X + 2Na$ in dry ether give R-R

Friedel-Crafts – alkylation or acylation of benzene with $AlCl_3$

Reimer-Tiemann – phenol + $CHCl_3$ + NaOH give salicylaldehyde

Kolbe – sodium phenoxide + CO_2 give salicylic acid

Hell-Volhard-Zelinsky – carboxylic acid + X_2 /red P gives the α -halo acid

Hoffmann bromamide – amide + $Br_2/NaOH$ gives an amine with one carbon fewer

Sandmeyer – diazonium salt + CuX gives an aryl halide

Gabriel phthalimide – a route to pure primary amines

Clemmensen and Wolff-Kishner – reduce $C=O$ to CH_2 ($Zn-Hg/HCl$; NH_2NH_2/KOH)

Rosenmund – acid chloride + $H_2/Pd-BaSO_4$ gives an aldehyde

Etard – toluene + CrO_2Cl_2 gives benzaldehyde

Williamson – $RO^-Na^+ + R'X$ gives the ether $R-O-R'$

10 Organic rules of thumb

Markovnikov – H adds to the carbon with more hydrogens; HBr with peroxide adds anti-Markovnikov

Substitution – S_N1 favours $3^\circ > 2^\circ > 1^\circ$ and racemises; S_N2 favours $1^\circ > 2^\circ > 3^\circ$ with inversion

Carbocation stability – $3^\circ > 2^\circ > 1^\circ > \text{methyl}$

Acidity – carboxylic acids > phenols > water > alcohols; electron-withdrawing groups raise acidity

11 Laboratory tests

Tollens' reagent – silver mirror with aldehydes

Fehling's solution – red precipitate with aliphatic aldehydes

Iodoform test – CH_3CO- or $CH_3CH(OH)-$ groups give yellow CHI_3

Lucas test – tertiary alcohols turn cloudy at once

Carbylamine test – primary amines give a foul-smelling isocyanide

Neutral $FeCl_3$ – violet colour with phenols

2,4-DNP – orange precipitate with aldehydes and ketones

Hinsberg's reagent – tells primary, secondary and tertiary amines apart

How to use these notes

- 1 Learn named reactions as reagent $\rightarrow$ product pairs, then test yourself by covering one side.
- 2 For trends, remember the exceptions: they are what the questions ask about.
- 3 NCERT lines are the source for most inorganic questions; read the relevant chapter after this sheet.

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