NEET Chemistry Formula Sheet - Complete Guide

PHYSICAL CHEMISTRY

1. MOLE CONCEPT & STOICHIOMETRY

Basic Formulas:

- Number of moles: $n = m/M = V/22.4$ (at STP) $= N/N_A$
- Avogadro's number: $N_A = 6.02 \times 10^{23}$
- Molar mass: $M = m/n$
- Molarity: $M = n/V$ (in liters)
- Molality: $m = n/W$ (in kg)
- Mole fraction: $X_A = n_A/(n_A + n_B)$

Percentage Composition:

- Mass %: (Mass of element / Total mass) $\times$ 100
- Volume %: (Volume of component / Total volume) $\times$ 100

Limiting Reagent:

- Calculate moles of each reactant
- Divide by stoichiometric coefficient
- Smallest value = limiting reagent

2. ATOMIC STRUCTURE

Bohr's Model:

- $E_n = -13.6/n^2$ eV (for hydrogen)
- $r_n = 0.529n^2$ Å
- $v_n = 2.18 \times 10^6/n$ m/s

De Broglie:

- $\lambda = h/mv$

Heisenberg Uncertainty:

- $\Delta x \cdot \Delta p \geq h/(4\pi)$

Quantum Numbers:

- n: 1, 2, 3, ... (principal)
- l: 0 to n-1 (azimuthal)
- m: -l to +l (magnetic)
- s: $+\frac{1}{2}$ or $-\frac{1}{2}$ (spin)

3. CHEMICAL BONDING

VSEPR Theory:

- Linear: AB_2 (180°)
- Trigonal planar: AB_3 (120°)
- Tetrahedral: AB_4 (109.5°)
- Trigonal bipyramidal: AB_5 (90°, 120°)
- Octahedral: AB_6 (90°)

Hybridization:

- sp: 2 orbitals, linear
- sp^2: 3 orbitals, trigonal planar
- sp^3: 4 orbitals, tetrahedral
- sp^3d: 5 orbitals, trigonal bipyramidal
- sp^3d^2: 6 orbitals, octahedral

Bond Order:

- Bond Order = (N_b - N_a)/2
- N_b = electrons in bonding MO
- N_a = electrons in antibonding MO

4. STATES OF MATTER

Gas Laws:

- Boyle's Law: PV = constant (T constant)
- Charles's Law: V/T = constant (P constant)
- Gay-Lussac's Law: P/T = constant (V constant)

- Combined: $P_1V_1/T_1 = P_2V_2/T_2$
- Ideal Gas: $PV = nRT$

Van der Waals Equation:

- $(P + an^2/V^2)(V - nb) = nRT$

Graham's Law:

- $r_1/r_2 = \sqrt{(M_2/M_1)}$

Dalton's Law:

- $P\_total = P_1 + P_2 + P_3 + ...$

5. THERMODYNAMICS

First Law:

- $\Delta U = q + w$
- $\Delta H = \Delta U + P\Delta V$

Enthalpy:

- $\Delta H = H\_products - H\_reactants$
- $\Delta H = \Delta U + \Delta nRT$

Entropy:

- $\Delta S = q\_rev/T$

Gibbs Free Energy:

- $\Delta G = \Delta H - T\Delta S$
- $\Delta G° = -RT \ln K$
- $\Delta G° = -nFE°$

Hess's Law:

- $\Delta H\_rxn = \Sigma\Delta H\_f(products) - \Sigma\Delta H\_f(reactants)$

6. CHEMICAL EQUILIBRIUM

Equilibrium Constant:

- $K\_c = [C]^c[D]^d / [A]^a[B]^b$
- $K\_p = K\_c(RT)^{\Delta n}$

- Δn = moles of gaseous products - moles of gaseous reactants

Le Chatelier's Principle:

- System shifts to counteract change

Kw (Water):

- $K_w = [H^+][OH^-] = 1 \times 10^{-14}$ (at 25°C)

pH:

- $pH = -\log[H^+]$
- $pOH = -\log[OH^-]$
- $pH + pOH = 14$

Henderson-Hasselbalch:

- $pH = pK_a + \log([A^-]/[HA])$

7. REDOX REACTIONS

Oxidation State Rules:

- Free element = 0
- Monatomic ion = charge
- H = +1 (except in hydrides: -1)
- O = -2 (except in peroxides: -1)
- Sum in compound = 0
- Sum in ion = charge

Half-Reaction Method:

- Balance atoms (except O, H)
- Balance O with H_2O
- Balance H with H^+
- Balance charge with e^-
- Equalize electrons in both half-reactions
- Add and simplify

8. ELECTROCHEMISTRY

Nernst Equation:

- $E = E° - (2.303RT/nF) \log Q$

- $E = E° - (0.059/n) \log Q$ (at 25°C)

Faraday's Laws:

- $W = ZQ = Zit = (E/F)it$
- $m = (M/nF)Q$

Conductance:

- $\Lambda_m = \kappa \times 1000/M$
- Kohlrausch's Law: $\Lambda°_m = \lambda°_+ + \lambda°_-$

9. CHEMICAL KINETICS

Rate Law:

- Rate $= k[A]^m[B]^n$

Integrated Rate Laws:

- Zero order: $[A] = [A]_0 - kt$
- First order: $\ln[A] = \ln[A]_0 - kt$
- Second order: $1/[A] = 1/[A]_0 + kt$

Half-Life:

- Zero order: $t_{1/2} = [A]_0/(2k)$
- First order: $t_{1/2} = 0.693/k$
- Second order: $t_{1/2} = 1/(k[A]_0)$

Arrhenius Equation:

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

10. SOLUTIONS

Colligative Properties:

- $\Delta T_b = K_b \times m$ (elevation)
- $\Delta T_f = K_f \times m$ (depression)
- $\pi = MRT$ (osmotic pressure)
- $P_A = X_A \times P°_A$ (Raoult's Law)

Van't Hoff Factor:

- i = (observed colligative property) / (calculated colligative property)

INORGANIC CHEMISTRY

11. PERIODIC TABLE

Periodic Trends:

- Atomic radius: decreases across, increases down
- Ionization energy: increases across, decreases down
- Electronegativity: increases across, decreases down
- Electron affinity: generally increases across
- Metallic character: decreases across, increases down

Effective Nuclear Charge:

- $Z\_eff = Z - S$
- Z = atomic number
- S = shielding constant

12. S-BLOCK ELEMENTS

Alkalimetals (Group 1):

- General formula: $M + H_2O \rightarrow MOH + \frac{1}{2}H_2$
- Reducing power: Li < Na < K < Rb < Cs

Alkaline Earth Metals (Group 2):

- General formula: $M + 2H_2O \rightarrow M(OH)_2 + H_2$
- Solubility of carbonates: Be > Mg > Ca > Sr > Ba

13. P-BLOCK ELEMENTS

Nitrogen Family (Group 15):

- Basicity of hydrides: $NH_3 > PH_3 > AsH_3$
- Oxidation states: +3, +5

Oxygen Family (Group 16):

- Bond angle: $H_2O > H_2S > H_2Se$
- Oxidation states: -2, +4, +6

Halogens (Group 17):

- Oxidizing power: $F_2 > Cl_2 > Br_2 > I_2$
- Oxidation states: -1, +1, +3, +5, +7

14. D-BLOCK & F-BLOCK

Crystal Field Theory:

- Δ_o (octahedral splitting)
- Δ_t (tetrahedral splitting)
- $\Delta\_t = (4/9)\Delta\_o$

Magnetic Moment:

- $\mu = \sqrt{n(n+2)}$ BM
- n = number of unpaired electrons

ORGANIC CHEMISTRY

15. GENERAL ORGANIC CHEMISTRY

Resonance Effect:

- +R: -OH, -OR, $-NH_2$, -X
- -R: $-NO_2$, -CN, -CHO, -COOH

Inductive Effect:

- +I: $-CH_3$, $-C_2H_5$
- -I: -F, -Cl, -Br, -I, $-NO_2$, -CN

Hyperconjugation:

- No. of α-H determines stability

Acidity Order:

- Carboxylic acid > Phenol > Alcohol > Water

16. ISOMERISM

Types:

- Structural: Chain, Position, Functional, Metamerism

- Stereoisomerism: Geometrical, Optical

Optical Isomerism:

- Number of stereoisomers = 2^n (n = chiral centers)

17. ALKANES, ALKENES, ALKYNES

Alkanes:

- General formula: $C_nH_{(2n+2)}$
- Combustion: $C_nH_{(2n+2)} + (3n+1)/2\ O_2 \rightarrow nCO_2 + (n+1)H_2O$

Alkenes:

- General formula: C_nH_{2n}
- Markovnikov's Rule: H → more H
- Anti-Markovnikov (with peroxide): H → less H

Alkynes:

- General formula: $C_nH_{(2n-2)}$

18. AROMATIC COMPOUNDS

Benzene:

- Molecular formula: C_6H_6
- Resonance energy: 36 kcal/mol
- Delocalizedπ electrons: 6

Electrophilic Substitution:

- Activating: -OH, -NH$_2$, -OR, -R
- Deactivating: -NO$_2$, -CN, -CHO, -COOH

19. ALDEHYDES & KETONES

Nucleophilic Addition:

- With HCN: Cyanohydrin
- With NH_2OH: Oxime
- With NH_2NH_2: Hydrazone

Aldol Condensation:

- Requires α-hydrogen

Cannizzaro Reaction:

- No α-hydrogen needed
- $2HCHO \rightarrow CH_3OH + HCOONa$

20. CARBOXYLIC ACIDS

Acidity:

- $RCOOH + NaOH \rightarrow RCOONa + H_2O$

Decarboxylation:

- $RCOOH \rightarrow RH + CO_2$

Esterification:

- $RCOOH + R'OH \rightleftharpoons RCOOR' + H_2O$

IMPORTANT CONSTANTS

- Avogadro's Number: $N\_A = 6.02 \times 10^{23}$
- Gas Constant: $R = 8.314$ J/(mol·K) = 0.0821 L·atm/(mol·K)
- Faraday Constant: $F = 96500$ C/mol
- Planck's Constant: $h = 6.63 \times 10^{-34}$ J·s
- Speed of Light: $c = 3 \times 10^8$ m/s
- STP: 273 K (0°C), 1 atm, 22.4 L/mol