NEET Physics Formula Sheet - Complete Guide

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MECHANICS

1. KINEMATICS

Equations of Motion (Constant Acceleration):

- $v = u + at$
- $s = ut + \frac{1}{2}at^2$
- $v^2 = u^2 + 2as$
- $s_n = u + (a/2)(2n-1)$

Average Velocity:

- $v_{avg} = (u + v) / 2$
- v_{avg} = Total displacement / Total time

Projectile Motion:

- Time of flight: $T = (2u \sin\theta) / g$
- Maximum height: $H = (u^2 \sin^2\theta) / (2g)$
- Range: $R = (u^2 \sin 2\theta) / g$
- Maximum range: $R_{max} = u^2/g$ (at $\theta = 45°$)

Circular Motion:

- Angular velocity: $\omega = \theta/t = 2\pi/T = 2\pi f$
- Linear velocity: $v = r\omega$
- Centripetal acceleration: $a_c = v^2/r = r\omega^2$
- Centripetal force: $F_c = mv^2/r = mr\omega^2$
- Time period: $T = 2\pi r/v = 2\pi/\omega$

2. LAWS OF MOTION

Newton's Laws:

- $F = ma = dp/dt$
- $F_{AB} = -F_{BA}$

Friction:

- $f = \mu N$
- Static friction: $f_s \leq \mu_s N$
- Kinetic friction: $f_k = \mu_k N$

Momentum:

- $p = mv$
- Impulse: $J = \Delta p = F\Delta t$

3. WORK, ENERGY & POWER

Work:

- $W = F \cdot d = Fd\cos\theta$
- Work-Energy Theorem: $W_{net} = \Delta KE = \frac{1}{2}m(v^2 - u^2)$

Energy:

- Kinetic Energy: $KE = \frac{1}{2}mv^2$
- Potential Energy: $PE = mgh$
- Spring PE: $PE = \frac{1}{2}kx^2$
- Conservation: $KE_1 + PE_1 = KE_2 + PE_2$

Power:

- $P = W/t = F \cdot v = Fv\cos\theta$
- Average Power: P_{avg} = Total work / Total time

4. GRAVITATION

Newton's Law of Gravitation:

- $F = G(m_1m_2)/r^2$
- $G = 6.67 \times 10^{-11}\ Nm^2/kg^2$

Important Formulas:

- Gravitational PE: $U = -GMm/r$
- Escape velocity: $v_e = \sqrt{(2GM/R)} = \sqrt{(2gR)}$
- Orbital velocity: $v_o = \sqrt{(GM/r)} = \sqrt{(gR^2/r)}$

- Time period: $T = 2\pi\sqrt{(r^3/GM)}$
- Relation: $v_e = \sqrt{2} \times v_o$

Acceleration due to Gravity:

- At height h: $g' = g(1 - 2h/R)$ [for $h << R$]
- At depth d: $g' = g(1 - d/R)$
- At center: $g = 0$

ELECTROSTATICS & CURRENT

5. ELECTROSTATICS

Coulomb's Law:

- $F = k(q_1q_2)/r^2$
- $k = 9 \times 10^9\ Nm^2/C^2$

Electric Field:

- $E = F/q = kQ/r^2$
- Unit: N/C or V/m

Electric Potential:

- $V = kQ/r$
- Unit: Volt (V)

Capacitance:

- $C = Q/V$
- Unit: Farad (F)
- Parallel plate: $C = \varepsilon_0 A/d$

Capacitors:

- Series: $1/C = 1/C_1 + 1/C_2 + 1/C_3$
- Parallel: $C = C_1 + C_2 + C_3$
- Energy: $U = ½CV^2 = ½Q^2/C = ½QV$

6. CURRENT ELECTRICITY

Ohm's Law:

- $V = IR$

Resistance:

- $R = \rho L/A$
- Series: $R = R_1 + R_2 + R_3$
- Parallel: $1/R = 1/R_1 + 1/R_2 + 1/R_3$

Power:

- $P = VI = I^2R = V^2/R$
- Unit: Watt (W)

Heating Effect:

- $H = I^2Rt$
- Unit: Joule (J)

Kirchhoff's Laws:

- KCL: $\Sigma I_{in} = \Sigma I_{out}$
- KVL: $\Sigma V = 0$ (closed loop)

MAGNETISM & WAVES

7. MAGNETISM

Magnetic Force:

- $F = qvB \sin\theta$ (on moving charge)
- $F = BIL \sin\theta$ (on current-carrying conductor)

Magnetic Field:

- $B = \mu_0 I/(2\pi r)$ (straight conductor)
- $B = \mu_0 NI/L$ (solenoid)

8. ELECTROMAGNETIC INDUCTION

Faraday's Law:

- $\varepsilon = -d\Phi/dt = -N(d\Phi/dt)$

Lenz's Law:

- Induced current opposes the change

Motional EMF:

- $\varepsilon = BLv$

9. WAVES

Wave Equation:

- $v = f\lambda$
- $v = \omega/k$

Sound Waves:

- $v_{sound} = \sqrt{(\gamma RT/M)}$
- Doppler Effect: $f' = f(v \pm v_o)/(v \mp v_s)$

OPTICS & MODERN PHYSICS

10. RAY OPTICS

Mirror Formula:

- $1/f = 1/v + 1/u$
- Magnification: $m = -v/u = h'/h$

Lens Formula:

- $1/f = 1/v - 1/u$
- Power: $P = 1/f$ (in meters)
- Magnification: $m = v/u = h'/h$

Lens Maker's Formula:

- $1/f = (\mu - 1)(1/R_1 - 1/R_2)$

11. WAVE OPTICS

Young's Double Slit:

- Fringe width: $\beta = \lambda D/d$
- Bright fringes: $x_n = n\lambda D/d$

- Dark fringes: x_n = (2n-1)λD/(2d)

12. MODERN PHYSICS

Photoelectric Effect:

- KE_max = hf - φ = hf - hf_0
- Stopping potential: eV_0 = KE_max

De Broglie Wavelength:

- λ = h/p = h/(mv)

Energy-Mass Relation:

- E = mc²

Bohr's Model:

- E_n = -13.6/n² eV (for hydrogen)
- r_n = 0.529n² Å

Radioactivity:

- N = N_0e^(-λt)
- Half-life: $T_1/_2$ = 0.693/λ

THERMODYNAMICS

13. HEAT & THERMODYNAMICS

First Law:

- ΔQ = ΔU + ΔW

Work Done:

- W = PΔV (at constant pressure)

Specific Heat:

- Q = mcΔT

Ideal Gas:

- PV = nRT
- PV^γ = constant (adiabatic)

Efficiency:

- $\eta = (W/Q_1) = 1 - (Q_2/Q_1)$
- Carnot: $\eta = 1 - (T_2/T_1)$

QUICK REFERENCE CONSTANTS

- Speed of light: $c = 3 \times 10^8$ m/s
- Planck's constant: $h = 6.63 \times 10^{-34}$ J·s
- Electron charge: $e = 1.6 \times 10^{-19}$ C
- Electron mass: $m_e = 9.1 \times 10^{-31}$ kg
- Proton mass: $m_p = 1.67 \times 10^{-27}$ kg
- Avogadro's number: $N_A = 6.02 \times 10^{23}$
- Gas constant: R = 8.314 J/(mol·K)
- Permittivity: $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m
- Permeability: $\mu_0 = 4\pi \times 10^{-7}$ H/m
