Formula Sheet

Physical Quantity	Value	Physical Quantity	Value
Charge of electron	-1.6×10^{-19} C	Charge of proton	1.6×10^{-19} C
Mass of electron	$m_e= 9.11\times10^{-31}$ kg	Mass of proton	$m_p= 1.67\times10^{-27}$ kg
Coulomb's constant	$k= 9\times10^{9}$ N.m²/C²	Permittivity constant	$\varepsilon_o= 8.85\times10^{-12}$ C²/(N.m²)
Acc. of gravity	$g= 9.8$ m/s²	Permeability constant	$\mu_o= 4\pi\times10^{-7}$ T.m/A

$F_e = \dfrac{k\|q_1\|\|q_2\|}{r^2}$, *Coulomb's Law*	$E = \dfrac{k\|q\|}{r^2}$, *Electric field due to a point charge*
$E = \dfrac{2kp}{r^3}$, *Electric field of an electric dipole*	$p = \|q\|d$, *Dipole moment* $\vec{\tau} = \vec{p} \times \vec{E}$ Sin(θ) *Torque on a dipole* → PE Sin θ
$E = \dfrac{\lambda}{2\pi\varepsilon_0 r}$, *Electric field of a line of charge*	$E = \dfrac{kqz}{(z^2+R^2)^{3/2}}$, *Electric field of a charged ring* z = r ⇒ Small distance
$E = \dfrac{\sigma}{2\varepsilon_0}\left(1 - \dfrac{z}{\sqrt{z^2+R^2}}\right)$, *E.F. of a charged disk*	$E = \dfrac{\sigma}{2\varepsilon_0}$, *Electric field of an infinite sheet*
$E = \dfrac{\rho R^2}{2\varepsilon_0 r}$, *E.F. outside a long charged cylinder*	$E = \dfrac{q}{4\pi\varepsilon_0 R^3} r$, *E. F. inside a charged solid sphere*
$E = \dfrac{q}{4\pi\varepsilon_0 r^2}$, *E. F. outside a charged sphere*	$U = -\vec{p}\cdot\vec{E}$ Cos(θ) *Potential energy of an E. dipole*
$\Phi = \iint \vec{E}\cdot d\vec{A}$, *E. flux through a surface*	$\oiint \vec{E}\cdot d\vec{A} = \dfrac{q_{enc}}{\varepsilon_0}$, *Gauss's Law*
$V = \dfrac{kq}{r}$, *E. Potential of a point charge*	$V_f - V_i = -\int_i^f \vec{E}\cdot d\vec{s}$, *P. difference from the E. field*
$V = \dfrac{kp\cos\theta}{r^2}$, *Electric Potential of an electric dipole*	$V = \dfrac{\sigma}{2\varepsilon_0}\left(\sqrt{z^2+R^2} - z\right)$, *E. Pot. of a charged disk*
$V = \dfrac{kq}{R}$, *Electric Potential of a conducting sphere*	$U = W = \dfrac{kq_1q_2}{r}$, *P. energy of two point charges*
$C = \dfrac{\varepsilon_0 A}{d}$, *Parallel plate capacitor*	$C = 2\pi\varepsilon_0 \dfrac{L}{\ln\left(\frac{b}{a}\right)}$, *Cylindrical capacitor*
$C = 4\pi\varepsilon_0 \dfrac{ab}{b-a}$, *Spherical capacitor*	$C = 4\pi\varepsilon_0 R$, *Isolated sphere*
$C_{eq} = \sum_{j=1}^{n} C_j$, *in parallel*, $\dfrac{1}{C_{eq}} = \sum_{j=1}^{n} \dfrac{1}{C_j}$, *in series*	$U = \dfrac{q^2}{2C} = \dfrac{1}{2}CV^2$, *Potential energy of a capacitor*
$u = \dfrac{1}{2}\varepsilon_0 E^2$, *Energy density*	$I = \iint \vec{J}\cdot d\vec{A}$, *Current Intensity*
$J = \dfrac{i}{A}$, *Current density*	$R = \dfrac{\rho L}{A}$, *Resistance of a conductor*
$R_{eq} = \sum_{j=1}^{n} R_j$, *in series*, $\dfrac{1}{R_{eq}} = \sum_{j=1}^{n} \dfrac{1}{R_j}$, *in parallel*	$\gamma = \dfrac{1}{\rho}$, *Definition of conductivity*
$i = \dfrac{q}{t}$, *Definition of current*	$q = CV$, *charge on the plate of a capacitor*

$\rho = \frac{E}{J}$, *Definition of resistivity*	$V = R.I$, *Ohm's law*
$P = iV = \frac{V^2}{R}$, *Rate of electrical energy transfer*	***Loop Rule.*** *The algebraic sum of the changes in potential encountered in a complete traversal of any loop of a circuit must be zero.*
Junction Rule. *The sum of the currents entering any junction must be equal to the sum of the currents leaving that junction.*	$\vec{F}_B = q\vec{V} \times \vec{B}$ Sin(θ) *Magnetic force*
$\vec{F}_B = I\vec{L} \times \vec{B}$ Sin(θ) *Force on current* $F_B = \frac{\mu_0 I_1 I_2}{2\pi r}$, *Magnetic F. between two parallel currents*	$\mu = iA$ N *Magnetic dipole moment*
$\vec{\tau} = \vec{\mu} \times \vec{B}$ Sin(θ) *Torque on a magnetic dipole* τ = NμB Sin(θ)	$U = -\vec{\mu} \cdot \vec{B}$ Cos(θ) *Potential energy of a magnetic dipole* orientation energy
$B = \frac{\mu_0 I}{2\pi r}$, *Magnetic field of a long straight wire*	$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{enc}$, *Ampere's law*
$B = \mu_0 n I$, *Magnetic field of an ideal solenoid* num of turns	$\vec{B} = \frac{\mu_0 \vec{\mu}}{2\pi z^3}$, *Magnetic field of a magnetic dipole*

if not ideal: $B = \frac{\mu_0 N I}{L}$

Chapter 1

Chapter 2

Chapter 3