

Electric Charges and Fields

Coulomb's Law
 $F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \hat{r}$
 $Q = \pm ne$

Gauss's Theorem
 $\Phi_e = \oint \vec{E} \cdot d\vec{S} = \frac{Q}{\epsilon_0}$

Charge density
 linear $\lambda = \frac{Q}{l}$
 surface $\sigma = \frac{Q}{A}$
 volume $\rho = \frac{Q}{V}$

EF due to infinite Sheet of Charge
 $\vec{E} = \frac{\sigma}{2\epsilon_0} \hat{n}$

EF due to infinite long charged wire
 $E = \frac{\lambda}{2\pi\epsilon_0 r}$

Electric Field
 $\vec{E} = \frac{\vec{F}}{q_0}$
 Due to Point Charge
 $E = \frac{kq}{r^2}$ $k = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$

Electric Dipole moment $\vec{p} = q \cdot 2a \hat{a}$

Electric Field due to dipole
 on axial line $E = \frac{2p}{4\pi\epsilon_0 r^3}$
 on equatorial line $E = \frac{p}{4\pi\epsilon_0 r^3}$

Torque $\vec{\tau} = \vec{p} \times \vec{E}$ or $\tau = pE \sin\theta$
 Due to charged Conducting Sphere

$E = \frac{kq}{r^2}, r > R$ $E = \frac{kq}{R^2}, r = R$ $E = 0, r < R$

Electric Potential & Capacitance

Electric Potential $V = \frac{q}{4\pi\epsilon_0 r}$
 due to dipole: Axial $V = \frac{p \cos\theta}{4\pi\epsilon_0 r^2}$, Equatorial $V = 0$
 at any point $V = \frac{p \cos\theta}{4\pi\epsilon_0 r^2}$

Electric Potential Energy [for two charge]
 due to dipole in external field: $U = -\vec{p} \cdot \vec{E}$
 Relation between E & V : $E = -\frac{dV}{dr}$ or $V = -\int \vec{E} \cdot d\vec{r}$

Capacitance $C = \frac{Q}{V}$
 Series combination $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$
 Parallel Comb. $C_p = C_1 + C_2$
 Spherical Capacitor $C = 4\pi\epsilon_0 \frac{ab}{b-a}$

Capacitance of Parallel Plate Capacitor
 Air filled $C = \frac{\epsilon_0 A}{d}$
 Partially filled with dielectric $C = \frac{\epsilon_0 A}{d} (1 + \frac{1}{2})$
 Completely filled $C = K\epsilon_0 \frac{A}{d}$
 Filled with metal $C = \frac{2\epsilon_0 A}{(d-t)}$

Capacitance of Isolated Sphere
 $C = 4\pi\epsilon_0 R$

Energy stored in a Capacitor
 $U = \frac{1}{2} CV^2 = \frac{1}{2} QV = \frac{1}{2} \frac{Q^2}{C}$

Common Potential
 $V = \frac{q_1 + q_2}{C_1 + C_2} = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$

Energy loss
 $= \frac{1}{2} \frac{C_1 C_2 (V_1 - V_2)^2}{(C_1 + C_2)}$

Energy density
 $u = \frac{U}{V} = \frac{1}{2} \epsilon_0 E^2$

Force between plates of Capacitor
 $F = \frac{Q^2}{2A\epsilon_0}$

Potential due to Non Conducting Sphere

Uniformly charged Sphere
 Outside $r > R$: $V = \frac{q}{4\pi\epsilon_0 r}$
 On the shell $r = R$: $V = \frac{q}{4\pi\epsilon_0 R}$
 Inside $r < R$: $V = \frac{q}{4\pi\epsilon_0 R} \left(\frac{3R^2 - r^2}{2R^3} \right)$

Current Electricity

Electric Current $I = \frac{Q}{t}$
Current density $J = \frac{I}{A}$

Drift velocity $V_d = \frac{eE\tau}{m} = \frac{eV\tau}{ml}$

Mobility $\mu = \frac{|V_d|}{E}$

Resistivity $\rho = \frac{m}{ne^2\tau}$

Relation b/w J & V
 $J = \sigma E$
EMF of a cell $E = \frac{W}{q}$
Terminal Potential diff $V = \frac{W}{q}$
 $E = V + Ir$ $r = R \left[\frac{E - V}{V} \right]$

Ohm's Law $V = IR$
Conductivity $\sigma = \frac{1}{\rho} = \frac{ne^2\tau}{m}$

Principle of Wheat Stone
 $\frac{P}{Q} = \frac{R}{S}$

Principle of Meter bridge
 $\frac{R}{S} = \frac{L}{100-L}$

Principle of potentiometer
 $K = \frac{V}{L} = \frac{IR}{L}$

Combination of identical cells
 Series $i = \frac{nE}{R + nr}$
 Parallel $i = \frac{mE}{mR + r}$
 Mixed $i = \frac{mnE}{mR + nr}$

Temp. coefficient
 $\alpha = \frac{R - R_0}{R_0(T - T_0)}$

Joule's Law
 $H = I^2 R t$ Joule
 $H = I^2 R t$ Calories 4-18

Power $P = VI = I^2 R = \frac{V^2}{R}$
Energy $W = Vq = VIt = I^2 R t = \frac{V^2 t}{R}$

Current Electricity (continued)

Relation b/w I & V_d
 $I = AneV_d$

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Moving Charges and Magnetism

Magnetic force
 $\vec{F}_m = q(\vec{v} \times \vec{B})$
 Pitch $(P) = \frac{2\pi m v \cos\theta}{qB}$

Motion of charge in Uniform Transverse Magnetic Field
 $F_m = qvB = \frac{mv^2}{r}$
 Time period $T = \frac{2\pi R}{v} = \frac{2\pi m}{qB}$
 Radius of Circular path $r = \frac{mv}{qB} = \frac{P}{qB} = \frac{\sqrt{2mK}}{qB} = \frac{\sqrt{2mqV}}{qB}$

Biot-Savart's Law
 $dB = \frac{\mu_0}{4\pi} \frac{idl \sin\theta}{r^2}$
 Force b/w two current carrying parallel straight conductor
 $F = \frac{\mu_0}{4\pi} \frac{2i_1 i_2 l}{r}$

Magnetic force on a current carrying conductor
 $\vec{F} = i(\vec{l} \times \vec{B})$

Magnetic field due to an infinitely long straight wire of radius 'a', carrying current 'i' at a point
 $B = \frac{\mu_0 i}{2\pi a^2}, r < a$ $B = \frac{\mu_0 i}{2\pi a}, r = a$ $B = \frac{\mu_0 i}{2\pi r}, r > a$

MF at Centre of a Circular coil
 $B = \frac{\mu_0 i}{2a}$

MF at a point on the axis of current carrying coil
 $B = \frac{\mu_0}{4\pi} \frac{2\pi Ni a^2}{(a^2 + x^2)^{3/2}}$

Ampere's Circuital Law
 $\oint \vec{B} \cdot d\vec{l} = \mu_0 i$

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Ian Pickup



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1. Understanding the eBook Hickman Guide Physics
 - The Rise of Digital Reading Hickman Guide Physics
 - Advantages of eBooks Over Traditional Books
2. Identifying Hickman Guide Physics
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Hickman Guide Physics
 - User-Friendly Interface
4. Exploring eBook Recommendations from Hickman Guide Physics
 - Personalized Recommendations
 - Hickman Guide Physics User Reviews and Ratings
 - Hickman Guide Physics and Bestseller Lists
5. Accessing Hickman Guide Physics Free and Paid eBooks
 - Hickman Guide Physics Public Domain eBooks
 - Hickman Guide Physics eBook Subscription Services
 - Hickman Guide Physics Budget-Friendly Options
6. Navigating Hickman Guide Physics eBook Formats

- ePub, PDF, MOBI, and More
 - Hickman Guide Physics Compatibility with Devices
 - Hickman Guide Physics Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Hickman Guide Physics
 - Highlighting and Note-Taking Hickman Guide Physics
 - Interactive Elements Hickman Guide Physics
 8. Staying Engaged with Hickman Guide Physics
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Hickman Guide Physics
 9. Balancing eBooks and Physical Books Hickman Guide Physics
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Hickman Guide Physics
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Hickman Guide Physics
 - Setting Reading Goals Hickman Guide Physics
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Hickman Guide Physics
 - Fact-Checking eBook Content of Hickman Guide Physics
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
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 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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web rules for naming ionic compounds containing polyatomic ions polyatomic ions are ions which consist of more than one atom for example nitrate ion NO_3^- contains one nitrogen atom and three oxygen atoms the atoms in a polyatomic ion are usually covalently bonded to one another and therefore stay together as a single charged unit

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web the formulae of compounds containing polyatomic ions are worked out in a similar way to single atom ions except when there is more than one polyatomic ion then its formula is written