PHYSICS 102 "Formula" Sheet

Constants: $k = 9 \times 10^{9}$ $\varepsilon_o = (4\pi k)^{-1} = 8.85 \times 10^{-12}$ $\mu_o = 4\pi \times 10^{-7}$ $c = 3.00 \times 10^{8}$ $h = 6.63 \times 10^{-34}$
$e = 1.602 \times 10^{-19}$ (all in appropriate MKS units)

$1eV = 1.602 \times 10^{-19}$ joule $hc = 1240$ eV-nm Avogadro's Number $= 6.023 \times 10^{23}$ atoms/mole

Force Between Point Charges: $F = k\frac{q_1 q_2}{r^2}$ (repulsive for like charges, attractive for unlike charges)

Electric Field: $\vec{E} = \vec{F}/q = \sum k\frac{q}{r^2}$ Between parallel plates: $E = \frac{\sigma}{\varepsilon_o}$

Potential Energy: Two point charges: $PE = k\frac{q_1 q_2}{r}$ Gravitation (near earth): $PE = mgh$

Electric Potential: $V = \frac{PE}{q}$ Potential of point charges: $V = \sum k\frac{q}{r}$

Capacitance: $C = \frac{Q}{V}$ (coulomb/volt = farad) $PE = \frac{CV^2}{2} = \frac{Q^2}{2C} = \frac{QV}{2}$

Parallel Plates: $C = \frac{\kappa A \varepsilon_o}{d}$

Note: 1 μc = 1 microcoulomb = 1 x 10^{-6} coulomb, 1 μf = 1 microfarad

Electric Current (amperes): $V=IR$ $R = \frac{\rho \ell}{A}$ (volts/ampere ≡ ohms)

Power: $P = I^2 R = IV = \frac{V^2}{R}$

Combinations: Series: $R_{eq} = \sum R_i$ Parallel: $\frac{1}{R_{eq}} = \sum \frac{1}{R_i}$,

$\frac{1}{C_{eq}} = \sum \frac{1}{C_i}$ $C_{eq} = \sum C_i$

Capacitor-Resistor Combination: $\tau = RC$

Kirchhoff's Rules: Junction: $\sum i_{in} = \sum i_{out}$ Loop: $\sum \Delta V = 0$

Magnetic Forces: $\vec{F} = q\vec{v} \times \vec{B}$ $\vec{F} = I\vec{\ell} \times \vec{B}$ $\left|\vec{A} \times \vec{B}\right| = AB\sin\theta$

Magnetic Fields: Long wire: $B = \frac{\mu_o}{2\pi}\frac{I}{r}$ Solenoid: $B = \mu_o NI/\ell$

Faraday's Law, etc: $\xi_{induced} = -N\frac{\Delta\Phi}{\Delta t}$, where $\Phi = \vec{B} \bullet \vec{A} = B\,A\,cos\theta$ $\xi_{inductor} = -L\frac{\Delta I}{\Delta t}$

$U_{inductor} = \frac{LI^2}{2}$ Transformer: $\frac{V_2}{V_1} = \frac{N_2}{N_1} = \frac{I_1}{I_2}$ LC Oscillator: frequency $= \frac{1}{2\pi\sqrt{LC}}$

(OVER)

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