Gabriel Staples
8-15-07

PHYSICS 215 — CONSTANTS AND EQUATIONS — FALL 2007

Electrostatics

$$F_{12} = \frac{K|q_1||q_2|}{r^2}$$ ← dist. between the 2 charges

$$\vec{F} = q\vec{E}$$

$$\vec{E} = \frac{Kq}{r^2}\hat{r}$$

$$\Phi_e = \int_{surface} \vec{E}\cdot d\vec{A} = \frac{Q_{enclosed}}{\varepsilon_o}$$

$$\Delta V = -\int_{s_i}^{s_f} E_s\, ds$$

$$E_s = -\frac{\Delta V}{ds}$$

$$\Delta V = V_{\infty \to r} = \frac{Kq}{r} - \frac{Kq}{\infty} = \frac{Kq}{r} - 0$$

$$K = \frac{1}{4\pi\varepsilon_o}$$

$$\Delta V = \frac{Kq}{r_f} - \frac{Kq}{\infty} = \frac{Kq}{r_f} - 0$$

Energy

$$\Delta U = q\Delta V$$

$$U = \frac{Kq_1q_2}{r}$$

$$U_C = \tfrac{1}{2}C(\Delta V_c)^2$$

$$U_C = \frac{Q^2}{2C}$$

Current

$$Q = I\Delta t$$

$$J = \frac{I}{A}$$

Optics

$$d\sin\theta_m = m\lambda$$

$$a\sin\theta_p = p\lambda$$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$\alpha = 1.22\lambda/D$$

$$M = -\frac{h'}{h} = -\frac{s'}{s}$$

$$n_1\sin\theta_1 = n_2\sin\theta_2$$

Vector Identities

$$|\vec{A}\times\vec{B}| = AB\sin\theta$$

$$\vec{A}\cdot\vec{B} = AB\cos\theta$$

Circuits

$$C = \frac{Q}{\Delta V_C} = \frac{\varepsilon_0 A}{d}$$

$$\Delta V = IR$$

$$P = I\Delta V$$

$$V(t) = V_{\max}(1 - e^{-t/\tau})$$

$$V(t) = V_0 e^{-t/\tau}$$

$$I(t) = \frac{V_0}{R}e^{-t/\tau}$$

$$\tau = RC$$

Waves

$$D(x,t) = A\sin(kx \pm \omega t + \phi_o)$$

$$v = \lambda f \qquad k = \frac{2\pi}{\lambda}$$

$$\omega = 2\pi f$$

Magnetism

$$\vec{F} = q\vec{v}\times\vec{B}$$

$$\vec{F} = I\vec{L}\times\vec{B}$$

$$\vec{\mu} = NI\vec{A}$$

$$\vec{\tau} = \vec{\mu}\times\vec{B}$$

$$\vec{B} = \frac{\mu_o}{4\pi}\frac{I\,\Delta\vec{s}\times\hat{r}}{r^2}$$

$$B = \frac{\mu_0 I}{2\pi d}$$

$$\Phi_m = \int_{surface} \vec{B}\cdot d\vec{A}$$

$$\mathcal{E} = \Delta V = -\frac{d\Phi_m}{dt}$$

Maxwell's Equations

$$\oint \vec{E}\cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_o}$$

$$\oint \vec{B}\cdot d\vec{A} = 0$$

$$\oint \vec{B}\cdot d\vec{s} = \mu_o I_{through} + \mu_o\varepsilon_o\frac{d\Phi_E}{dt}$$

$$\oint \vec{E}\cdot d\vec{s} = -\frac{d\Phi_M}{dt}$$

Physical Constants

Electron Mass	m_e	9.11×10^{-31} kg
Proton Mass	m_p	1.67×10^{-27} kg
Elementary Charge	e	1.60×10^{-19} C
Coulomb Law Constant	K	9×10^{9} Nm^2/C^2
Permittivity of Free Space	ε_o	8.85×10^{-12} C^2/Nm^2
Permeability of Free Space	μ_o	$4\pi \times 10^{-7}$ N/A^2
Planck's Constant	h	6.63×10^{-34} Js
Bohr Radius	a_B	5.29×10^{-11} m
Speed of Light in Vacuum	c	3.00×10^{8} m/s
Stefan-Boltzmann	σ	5.67×10^{-8} W/m^{2}K^4
Boltzmann's	k	1.38×10^{-23} J/K
Gravitational Acceleration	g	9.81 m/s^2

Order Prefixes

T	"tera"	10^{12}
G	"giga"	10^{9}
M	"mega"	10^{6}
k	"kilo"	10^{3}
c	"centi"	10^{-2}
m	"milli"	10^{-3}
μ	"micro"	10^{-6}
n	"nano"	10^{-9}
p	"pico"	10^{-12}
f	"femto"	10^{-15}

Unit Conversions

1 F = 1 C/V

1 V = 1 J/C

1 A = 1 C/s

1 Ω = 1 V/A

1 W = 1 J/s

1 Wb = 1 Tm^2

1 H = 1 Vs/A = 1 Wb/A

1 T = 1 N/Am = 10^4 Gauss (G)

1 eV = 1.6×10^{-19} J

1 amu = 1.66×10^{-27} kg

1 Angstrom (Å) = 10^{-10} m

Note: You must bring the equation sheet template to the GR. This sheet **will not** be provided.