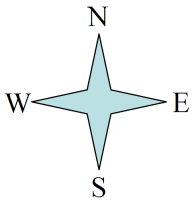
Phys132 - Fund. Physics 2 - Spring 2007 — Final Equation Sheet

Constants



Fundamental Charge: $e = 1.60 \times 10^{-19}\,\mathrm{C}$ $\quad m_e = 9.11 \times 10^{-31}\,\mathrm{kg}$

Coulomb constant $k = 8.99 \times 10^{9}\,\mathrm{N \cdot m^2/C^2}$ $\quad m_p = 1.67 \times 10^{-27}\,\mathrm{kg}$

$\epsilon_0 = 8.85 \times 10^{-12}\,\mathrm{C^2/(N \cdot m^2)}$ $\quad c = 3.00 \times 10^{8}\,\mathrm{m/s}$

$\mu_0 = 4\pi \times 10^{-7}\,\mathrm{T \cdot m/A}$ $\quad g = 9.81\,\mathrm{m/s^2}$

Typical speed of sound: $v = 343\,\mathrm{m/s}$ $\quad n_{\mathrm{air}} = 1$

$n_{\mathrm{water}} = 1.333$ $\quad n_{\mathrm{glass}} = 1.5$

1 Math and Physics 1 Equations

Trigonometry	Vector Components	Mechanics	Circular Motion	SI Prefixes	Geometry
$\sin\theta = \mathrm{opp/hyp}$	$F_x = F\cos\theta$	$\vec{F} = m\vec{a}$	$a = v_\perp^2/r$	$G = 10^9$	$A_{\mathrm{circle}} = \pi r^2$
$\cos\theta = \mathrm{adj/hyp}$	$F_y = F\sin\theta$	$F = ma$	Energy	$M = 10^6$	$C_{\mathrm{circle}} = \pi d = 2\pi r$
$\tan\theta = \mathrm{opp/adj}$	$F = \sqrt{F_x^2 + F_y^2}$	$W = mg$	$\mathrm{KE} = \frac{1}{2}mv^2$	$k = 10^3$	$A_{\mathrm{sphere}} = 4\pi r^2$
$\sin^2\theta + \cos^2\theta = 1$	$\tan\theta = F_y/F_x$	Constant Acceleration	$\mathrm{GPE} = mgh$	$c = 10^{-2}$	$V_{\mathrm{sphere}} = \frac{4}{3}\pi r^3$
		$x = v_{0x}t + \frac{1}{2}a_x t^2$	$W = \Delta\mathrm{KE} = -\Delta\mathrm{PE}$	$m = 10^{-3}$	
			$\Delta\mathrm{KE} + \Delta\mathrm{PE} = 0$	$\mu = 10^{-6}$	
				$n = 10^{-9}$	

Quantities and Units

Charge	q, Q	C	Elec Potential	V, ΔV	$\mathrm{V} = \frac{\mathrm{J}}{\mathrm{C}}$	Energy	KE,W,PE	J
Force	$\vec{F}$	N	Surface Charge	σ	$\mathrm{C/m^2}$	Distance	x,y,R	m
E-Field	$\vec{E}$	$\frac{\mathrm{N}}{\mathrm{C}} = \frac{\mathrm{V}}{\mathrm{m}}$	Dielectric Constant	κ	(none)	Angle	θ	rad=(none)
Flux	Φ	$\frac{\mathrm{N \cdot m^2}}{\mathrm{C}}$	Capacitance	C	$\mathrm{F} = \frac{\mathrm{C}}{\mathrm{V}}$	Angle	θ	$^\circ$
Speed	v	m/s	Velocity	$\vec{v}$	m/s	Acceleration	a	$\mathrm{m/s^2}$
			EMF, Voltage	$\mathcal{E}$, V	V = J/C	Power	P	$\mathrm{W} = \frac{\mathrm{J}}{\mathrm{s}} = \mathrm{VA}$
Period	T	s	Resistance	R	$\Omega = \mathrm{V/A} = \frac{\mathrm{J \cdot s}}{\mathrm{C^2}}$	Wavelength	λ	m
Speed	v	m/s	Frequency	f	$\frac{\mathrm{Cycles}}{\mathrm{s}} = \mathrm{Hz}$	Phase	ϕ	rad
Power	P	$\mathrm{W} = \frac{\mathrm{J}}{\mathrm{s}}$	Amplitude	A	(various)	Sound Level	β	dB
Length	L	m	Intensity	I	$\mathrm{W/m^2}$	Energy		J
Force	F	N	Magnetic Field	$\vec{B}$	T	Current	I	$\mathrm{A} = C/s$
Time	t	s	Electric Field	$\vec{E}$	$\mathrm{N/C} = \mathrm{V/m}$			
Charge	q	C	Velocity	$\vec{v}$	m/s	Angle	θ, ϕ	rad or $^\circ$
Force	$\vec{F}$	N	Angular Speed	ω	rad/s	Mag. Flux	Φ	$\mathrm{T \cdot m^2}$
Energy		J	Capacitance	C	F			
Torque	τ	$\mathrm{N \cdot m}$	Inductance	L	H			
Loops	N		Loops per Meter	n	1/m			
			Index of Refr.	n				
			Focal Length	f	m, cm, mm			

Note, when there is no unit, like forκ and n, you don't write any unit.

Electricity and Magnetism

$F = k\frac{\lvert q_1\rvert\,\lvert q_2\rvert}{r^2}$ $\quad \vec{F} = q\vec{E}$	$V = IR \quad I = \frac{V}{R} \quad R = \frac{V}{I}$	$E_{\text{cap}} = \frac{q}{\epsilon_0 A} = \frac{\sigma}{\epsilon_0}$	Series: $\quad R_{\text{S}} = R_1 + R_2 + ...$
$E_{\text{point charge}} = k\frac{\lvert q\rvert}{r^2}$	$P = IV = I^2R = \frac{V^2}{R}$	$V_{\text{cap}} = ED = \frac{qd}{\epsilon_0 A}$	$I = I_1 = I_2 = ...$
$V_{\text{point charge}} = k\frac{q}{R}$	$Q = I\Delta t$ Energy $= P\Delta t$	$V = \frac{q}{C}$ $\quad q = CV$	$V_{\text{tot}} = V_1 + V_2 + ...$
$\vec{E} = \frac{\vec{F}}{q}$ $\quad \Delta V = \frac{\Delta \text{EPE}}{q_0}$	$\tau = RC \quad I = I_0 e^{-t/\tau}$	Energy $= q\left(\frac{1}{2}V\right) = \frac{1}{2}CV^2$	
$E_{\text{ave}} = \frac{\Delta V}{d}$ $\quad \Delta V = E_{\text{ave}} d$	$R = \rho\frac{L}{A}$	$C = \kappa C_0 = \kappa\left(\frac{\epsilon_0 A}{d}\right)$	Parallel: $\frac{1}{R_{\text{P}}} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$V_{\text{RMS}} = \frac{V_{\max}}{\sqrt{2}}$	$V_{\text{terminal}} = V_{\mathcal{EMF}} - IR_{\text{int}}$	$\sum V_{\text{Rises}} = \sum V_{\text{Drops}}$	$I_{\text{tot}} = I_1 + I_2 + ...$
$P_{\text{ave}} = \frac{P_{\max}}{2} = V_{\text{RMS}} \cdot I_{\text{RMS}}$		$\sum I_{\text{in}} = \sum I_{\text{out}}$	$V = V_1 = V_2 = ...$
$F = qvB\sin\theta_{vB} = qv_\perp B = qvB_\perp$	$F = m\frac{v_\perp^2}{r} = qv_\perp B$	$E = vB$	$\Phi = BA\cos\phi$
$F = I\ell B\sin\theta_{IB} = I\ell_\perp B = I\ell B_\perp$	$r = \frac{mv}{qB} \quad m = \left(\frac{qr^2}{2V}\right)B^2$	$\tau_{\text{motor}} = NIAB\sin\phi$	$\mathcal{E}_{\text{wire}} = vBL \;\; \mathcal{E}_{\text{Coil}} = -N\frac{\Delta\Phi}{\Delta t}$
$B_{\text{current}} = \frac{\mu_0 I}{2\pi r}$	$N\Phi = LI \quad V = L\frac{\Delta I}{\Delta t}$	$\frac{V_P}{V_S} = \frac{N_P}{N_S}$	$\mathcal{E}_{\text{generator}} = \mathcal{E}_{\max}\sin\omega t$
$B_{\text{coil}} = N\frac{\mu_0 I}{2R}$ $\quad B_{\text{solenoid}} = \mu_0 nI$	Energy $= \frac{1}{2}LI^2$		$\mathcal{E}_{\max} = NAB\omega$

Waves and Intensity

$v = f\lambda$ $\quad f = \frac{1}{T}$		$y(x,t) = A\sin\left(2\pi ft - \frac{2\pi}{\lambda}x\right)$
Speed on String: $v = \sqrt{\frac{F_T}{(m/L)}}$		$\lambda_n = \frac{2L}{n}$ (n is integer)
Harmonics: $\quad f_n = nf_1 = \frac{v}{\lambda_n}$		$f_{\text{Doppler}} = f_s\left(\frac{1 + v_o/v}{1 - v_s/v}\right)$
$I = \frac{P}{A}$	$I = \frac{P}{4\pi R^2}$	$f_{\text{Beats}} = f_1 - f_2$
Decibels:Factor $= \frac{I}{I_0} = 10^{\text{dB}/10}$		$\text{dB} = 10 \cdot \log(\text{Factor})$

Light and Optics

$\theta_i = \theta_r$	$d_i = -d_o$	$f = \pm\frac{1}{2}R$	$I = \frac{1}{2}I_0$	$M = N\left(\frac{1}{f} - \frac{1}{d_i}\right)$
$n_1\sin\theta_1 = n_2\sin\theta_2$	$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$	$v = \frac{c}{n}$	$I = I_0(\cos\theta)^2$	$M_{\text{relaxed}} = \frac{N}{f}$
$m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$	$\sin\theta_c = \frac{n_2}{n_1}$	$\theta = \frac{h_o}{d_o} = \frac{h_o}{d_i}$	$M = \frac{\text{Best } \theta \text{ with lens}}{\text{Best } \theta \text{ w/o lens}}$	$M_{\text{best}} = \frac{N}{f} + 1$