MKS Chart

description	distance	mass	time	force	universal gravitational constant	acceleration
unit of measure	**m**eters	**k**ilograms (kg)	**s**econds (sec)	Newtons (N)	N m^2/kg^2	m/sec^2
variable	d	m	t	**F**	G	**a**
	scalar	scalar	scalar	vector	numerical constant	vector
	1 km – 10^3 m 1 cm = 10^{-2} m 1 mm = 10^{-3} m 1 µm = 10^{-6} m	1000 g = 1 kg	60 sec = 1 min 3600 sec = 1 hr 86400 sec = 1 day	N = kg m/sec^2	G = 6.67 x 10^{-11} N m^2/kg^2 **F** = $G(mM/r^2)$ **g** = $G(M/r^2)$ measured in N/kg	freefall a = -g
relationships	height (h) radius (r) displacement (**s**)			**Wt** = m**g** other common forces: tension push/pull normal friction	Gravitational force = weight Gravitational field	**a** = Δ**v**/t **a** = **netF**/m

description	velocity	momentum	impulse	kinetic energy	work	charge
unit of measure	m/sec	kg m/sec	N sec	J	J	C
variable	**v**	**p**	**J**	K or KE	W	Q
	vector	vector	vector	scalar	scalar	scalar
	initial velocity = v_o final velocity = v_f	**p** = m**v**	**J** = **F**t	KE = ½ mv^2	W = **F** • **s** = Fs(cosθ) W = ΔKE	e = 1.6 x 10^{-19} C
relationships	Av velocity = displacement/time Av speed = total distance/time	linear momentum	**J** = Δ(m**v**)		F(cosθ) and **s** parallel, W>0 F(cosθ) and **s** anti-parallel, W<0	$Q_{electron}$ = -e Q_{proton} = +e 1 C = 6.25 x 10^{18} e 1 µC = 10^{-6} C 1 nC = 10^{-9} C 1 pC = 10^{-12} C

description	current	power	Coulomb's constant	resistivity	volt	resistance
unit of measure	Ampere = C/sec	Watt =J/sec	$N\ m^2/C^2$	Ωm	J/C	Ω
variable	**I**	P	k	ρ	V	R
	vector	scalar	numerical constant	material constant	scalar	scalar
	I = Q/t	P = W/t	$k = 9.0 \times 10^{-9}\ N\ m^2/C^2$			R=V/I
relationships	rate of flow of charge past a given position in a circuit $1\ mA = 10^{-3}\ A$ $1\ \mu A = 10^{-6}\ A$	Mechanical $P = Fv_{constant}$ Electrical P = IV $P = I^2R$	$\mathbf{F} = k(qQ/r^2)$ $\mathbf{E} = k(Q/r^2)$ measured in N/Cg	R = ρL/A $\rho = \rho_{20}\left[1+\alpha\left(t_{^\circ C} - 20^\circ C\right)\right]$	potential potential difference $W_{done} = q(\Delta V)$	

description	frequency	period	friction	normal	coefficient of friction	temperature
unit of measure	hz	sec	N	N	dimensionless	Cº or K
variable	f	T	**f**	**N**	μ	T
	scalar	scalar	vector	vector	numerical value	scalar
	frequency = events/sec	period = sec/event	$\boldsymbol{f} = \mu_k \mathbf{N}$			
relationships		f = 1/T frequency and period are reciprocals $T_p = 2\pi(\text{SQRT } L/g)$ $T_s = 2\pi(\text{SQRT } m/k)$	resistive force between two surfaces sliding across each other	supporting force of a surface on an object (incline) $\mathbf{N} = m\mathbf{g}\cos\theta$	value depends on the two surfaces in contact $\boldsymbol{f} = \mu_k \mathbf{N}$ $\boldsymbol{f} \le \mu_s \mathbf{N}$	K = ºC+273

description	spring constant	torque	moment of inertia	angular momentum
unit of measure	N/m	m N	kg m^2	kg m^2/sec
variable	k	τ	I	**L**
	scalar	vector	scalar	vector
	$F_s = -ks$		rotational inertia	
relationships	restoring force within a spring equals the spring constant times the displacement from equilibrium	τ = **F** times moment arm moment arm = perpendicular distance from the line of action of the force to the pivot point (axis)	only applies to rigid bodies depends on the amount of mass and its distribution about the axis $I_{sphere} = 2/5\ mr^2$ $I_{cylinder} = 1/2\ mr^2$ $I_{hoop} = mr^2$ I_{rod} $1/3\ m\ell^2$ (end) $I_{rod} = 1/12\ m\ell^2$ (cg)	$\mathbf{L} = I\omega$ $\tau t = \Delta \mathbf{L}$ point mass = mv $R_{\perp}$

description	rotational kinematics	rotational KE	rotational work	rotational power	rotational impulse	tangential relationships
unit of measure	radians radians/second radians/sec^2	J	J	watts	N m sec	
variable	θ, ω, α	KE_{rot}	W	$\tau\omega$	τt	
	vectors	scalar	scalar	scalar	vector	vectors
		$KE_{rot} = ½I\omega^2$	$W = \tau\ \theta$			
relationships	analogous equations for constant angular acceleration substitute: θ for s ω for v α for a		$\tau\ \theta = \Delta\ (KE_{rot})$		$\tau t = \Delta(I\omega)$	$s_t = r\theta$ $v_t = r\omega$ $a_t = r\alpha$ these equations are used when you want to relate the “linear” behavior of a position on a rotating body to the rotational behavior