Kinematics (Velocity, time, acceleration)

$x = vt$

$v = v_f + v_0$

$v = v_0 \pm at$

$x = v_0 t \pm \frac{1}{2} a t^2$

$v^2 = v_0^2 \pm 2ax$

Projectile Motion

$r = \frac{v_0^2 sin2\theta}{g}$

Otherwise sum forces and take time at $v_y = 0$

Components

$v_y = vsin\theta$

$v_x = vcos\theta$

Sum vectors

$r = \sqrt{x^2 + y^2}$

$\theta = tan^{-1}(\frac{\Delta y}{\Delta x})$

Forces (mass, acceleration, friction, springs, momentum)

F=ma

Weight=mg

$F_{kfriction} = \mu_k F_{normal}$

$F_{sfriction} = tan\theta\ F_n$

$F_{elastic} = -kx$

(k=springconstant)

Work/Energy /Power (Joules)

$W = Fdcos\theta$

Joules = nm

Work=Δenergy

$k = \frac{1}{2} mv^2$

$u = mgy$

$P = work/time$ (watts

Elastic Collisions (mass)

$V_1 = (\frac{m_1 - m_2}{m_1 + m_2}) v_{1_0}$ M2 stationary

$V_2 = (\frac{2m_1}{m_1 + m_2}) v_{1_0}$ M2

Gravity

G = 6.67 x 10^{-11} Nm^2/kg^2

$F_g = m_1 m_2 G / r^2$

$U = -Gm_1 m_2 / r$

Fluids (density, mass, buoyant, flow)

M=dv

$F_B = F_g$ For floating things

$F_B = mg = dvg$ ‘ ‘ ‘

$F_b = dvg$

$\frac{F_g}{F_b} = d_0/d_f$ (buoyancy)

$p_{1or2} = p_0 + dgh_{1or2}$

$dv_1 A_1 = dv_2 A_2$ (area, continuity)

$mass\ flow\ rate = dvA$

Q=Av (volume flow rate)

$p_1 + \frac{1}{2} dv^2 + dgy = p_2 + \frac{1}{2} dv_2^2 + dgy_2$

$F_2 = F\left(\frac{R_2}{R_1}\right)^2$ (hydraulics)

ATM pressure = 1.01 x 10^5 PA

Circular Motion

1 radian = 57.3

$v = r\omega$

ω =θ/t (w is like velocity)

ω =2π/t

$\omega = \omega_0 + \alpha t$

$\theta = \omega_0 t + .5\alpha t^2$

$\omega^2 = \omega_0 + 2\alpha\theta$

$P = \tau\omega$

$\tau = rfsin\theta\ (torque)$

$A_c = v^2/r$

$F_c = mv^2$

Electricity (charge, field, circuits, potential energy, amps)

K=9x10^9 Nm^2/c^2

$q = ne$ (charge)

E=1.6x10^{-19} c (electron)

$M_e = 9.109 \times 10^{-31} kg$

$M_p = 1.672 \times 10^{-27} kg$

$F = \frac{kq_1 q_2}{r^2}$

$E = kq/r^2$ (field)

$\frac{kq_1}{x^2} = \frac{kq_2}{(d-x)^2}$

U=-qed (work)

ED=u/q=J/c= volt

$w = \Delta vq$

I=q/t (current)

V=IR

$JS/c^2 = \Omega$

$P = IV = v^2/r = I^2R$

Series	Parallel
$I=I_1=I_2...$	$I= I_1+I_2...$
$V=V_1+V_2...$	$V=V_1=V_2$
$R=R_1+R_2...$	$1/R=1/R_1 +...$

Magnets (Earth’s field 10^{-5} T)

F=qvBsinθ (B=magnetic field strength)

$B = \frac{\mu I}{2\pi d_{istance}}$ = F/qv = Tesla = N/(c m/s)

$\mu = 4\pi \times 10^{-7}\ Tm/A$ (^^long straight wire)

$B = \frac{\mu I}{2r}\ (center\ of\ circular\ loop)$

$B = \mu n I\ \left(n = \frac{turns}{meter}\right)$

Stress and Strain

$stress = \frac{F}{A}$

$strain = \frac{\Delta L}{L_0}$

Elastic mod=$\frac{F}{A} / \frac{\Delta L}{L_0}$

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ (hydraulic)

Shear force= (F/A)/

Light

C=3x10^8 m/s

Wavelength of white = 10^{-7} m

$$\frac{sin\theta_1}{sin\theta_2} = \frac{V_1}{V_2}$$

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

(n = index of refraction, air=1, water=1.33)

N=c/v