Linear Kinematics

$d = p_2 - p_1$ $\quad v = \frac{p_2 - p_1}{t_2 - t_1}$ $\quad a = \frac{v_2 - v_1}{t_2 - t_1}$ $\quad \text{speed} = \frac{\Delta\text{distance}}{\Delta\text{time}}$

Projectile Equations

$v_2 = v_1 + at$ $\quad d = v_1 t + \frac{1}{2}at^2$ $\quad v_2^2 = v_1^2 + 2ad$

$\text{Maximal Height} = \frac{(v_1)^2}{-2g}$

$\text{Time of Flight} = \frac{(2v_1)}{-g}$ $\quad \text{Time of Flight} = \frac{-v_1 - \sqrt{v_1^2 - 2gh}}{g}$

Linear Kinetics

$W = mg$ $\quad F_F = \mu F_N$ $\quad$ Linear Momentum: $L = mv$ $\quad F_{Slope} = mg\sin\theta$

Perfectly elastic collision: $m_A v_A = m_B v_B$; Static Equilibrium: $\sum F = 0$;

Coefficient of restitution: $e = \sqrt{\frac{bounceheight}{dropheight}}$ or $e = \frac{v_2 - v_1}{u_1 - u_2}$

Law of Gravity

$F = G\frac{m_1 m_2}{d^2}$

Impulse/Momentum: $F\Delta t = m\Delta v$ $\quad$ A version of the conservation of L: $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Work, Power, & Energy

$U = Fd$ $\quad KE = \frac{1}{2}mv^2$ $\quad GPE = m|g|h$ $\quad SE = \frac{1}{2}k\Delta x^2$

$U = \Delta KE + \Delta GPE + \Delta SE$ $\quad P = \frac{U}{t} = Fv$

Tissue Mechanics:
1: Stress(σ) = F/a
2: Strain(ε) = $(l_2 - l_1)/l_1$
3: E = σ/ε

Angular Kinematics

$\omega = \frac{\Delta\theta}{\Delta t}$; $\alpha = \frac{\Delta\omega}{\Delta t}$; $l = \theta r$; $v = \omega r$; $a_T = \alpha r$; $a_c = \omega^2 r$; $a_c = \frac{v^2}{r}$

Locating the Center of Mass

$\Sigma(W \times r) = \Sigma(W) \times r_{com}$; $\quad com_x = X_{prox} + L\%(X_{dist} - X_{prox})$; $\quad com_y = Y_{prox} + L\%(Y_{dist} - Y_{prox})$

Angular Kinetics $\quad$ Static Equilibrium: $\sum T = 0$

$T = F \times r$; $\quad I = mk^2$; $\quad H = I\omega$; $\quad T\Delta t = I\Delta\omega = \Delta H$; $\quad Fc = \frac{mv^2}{r} = mr\omega^2$; $\quad T = I\alpha$

Fluid Mechanics

$P = \frac{F}{A}$ $\quad \rho = \frac{m}{V}$ $\quad F_{Drag} = \frac{1}{2}C_D\rho A v^2$ $\quad F_{Lift} = \frac{1}{2}C_L\rho A v^2$ $\quad v = \sqrt{\frac{-2mg\sin(\theta)}{C_D\rho A}}$

Conversions

1 lb = 4.45 N	1 mile = 1609 m	1 m = 3.28 ft	1 kg = 2.214 lb	1 radian = 57.3 °