

Chapter 1

1.609 km=1 mile

3.281 ft=1 m

2.54cm=1 in

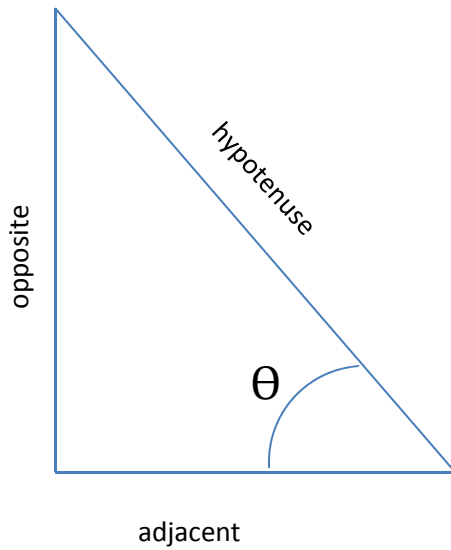
5280 ft=1 mi

milli (m) $1/1000$ or $.001$ or 10^{-3}

centi (c) $1/100$ or 0.01 or 10^{-2}

kilo (k) 1000 or 10^3

Mega (M) 1000000 or 10^6



sohcahtoa

$$\sin \theta = \text{opp/hyp}$$

$$\cos \theta = \text{adj/hyp}$$

$$\tan \theta = \text{opp/adj}$$

Chapter 2

$$d_f - d_i = \Delta d$$

$$v = d/t \quad (\text{m/s}) \quad d = vt \quad t = d/v$$

$$a = v/t \quad (\text{m/s}^2)$$

$$v_f = v_i + at$$

$$d = 0.5t(v_i + v_f)$$

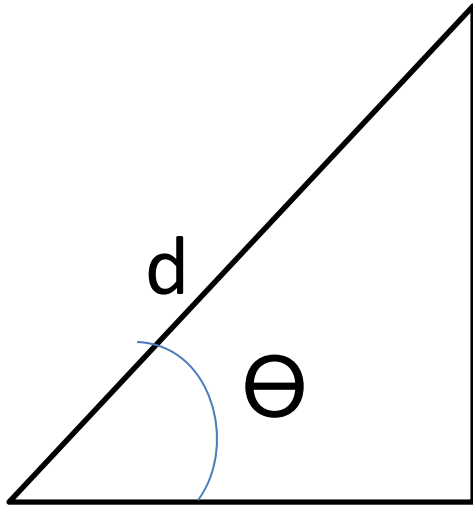
$$d = v_i t + 0.5at^2$$

$$v_f^2 = v_i^2 + 2ad$$

Chapter 3

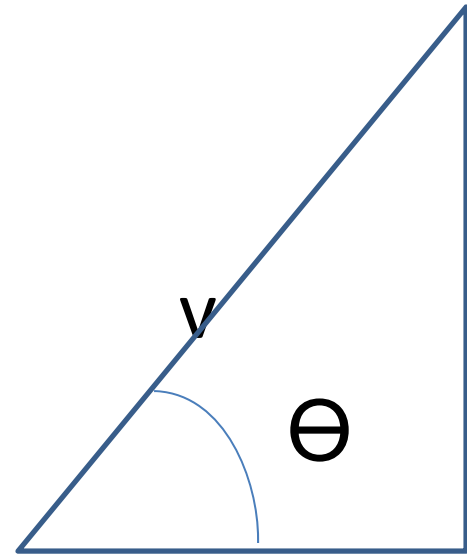
- $v_{fx} = v_{ix}$ since $a_x = 0$
- $d_x = 0.5t (v_{ix} + v_{fx})$
- $d_x = v_{ix} t$
- $v_{fy} = v_{iy} + a_y t$
- $d_y = 0.5t (v_{iy} + v_{fy})$
- $d_y = v_{iy} t + 0.5a_y t^2$
- $v_{fy}^2 = v_{iy}^2 + 2a_y d_y$

$$a_y = -9.8 \text{ m/s}^2$$
$$v_y = 0 \text{ at top}$$



$$d_x = d \cos \Theta$$

$$d_y = d \sin \Theta$$



$$v_x = v \cos \Theta$$

$$v_y^2$$

Chapter 4

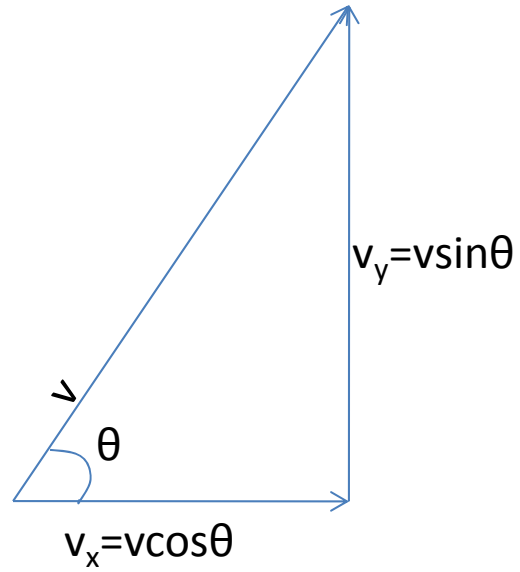
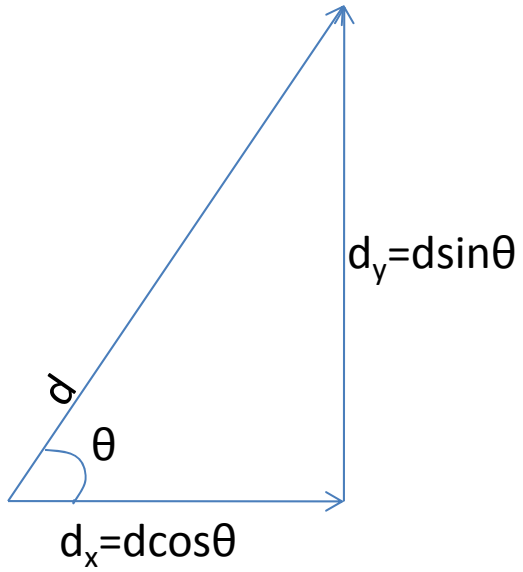
$$\Sigma F = ma$$

$$F_f = \mu F_n$$

$$\text{weight} = mg$$

$a=0$, constant velocity

Chapter 4



Chapter 5

$$W = F \cos \theta d$$

$$KE = 0.5mv^2 \quad PE_g = mgh \quad PE_s = 0.5kx^2$$

$$0.5mv_i^2 + mgh_i + 0.5kx_i^2 = 0.5mv_f^2 + mgh_f + 0.5kx_f^2$$

$$P = W/t = Fv$$

Chapter 6

$$p=mv$$

$$Ft = \Delta p = m(v_f - v_i)$$

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

Elastic

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

Inelastic

Chapter 7

$$\Theta = s/r$$

$$\omega_f = \omega_i + \alpha t$$

$$\Theta = \omega_i t + 0.5 \alpha t^2$$

$$\omega_f^2 = \omega_i^2 + 2 \alpha \Theta$$

$$v_t = r \omega$$

$$a_t = r \alpha$$

$$a_c = v_t^2 / r = r \omega^2 \quad F_c = m a_c$$

$$F_g = G m_1 m_2 / r^2 \quad G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}$$

Rotational Equilibrium

$$\mathbf{T} = \mathbf{F} * \mathbf{r}$$

Solids and Fluids

Stress=Pressure $P=F/A$

Strain= $\Delta L/L_0$

$Y = \text{stress/strain} = (F \cdot L_0)/(A \cdot \Delta L)$

$\beta = \text{stress/strain} = (F \cdot V_0)/(A \cdot \Delta V)$

$\rho = m/V$ $V = lwh, V = 4/3\pi r^3$

$P = P_0 + \rho gh$

Weight= ρVg

$F_B = \text{weight of fluid displaced} = \text{weight of object submerged}$

$Av = \text{volume flow rate}$ $A_1 v_1 = A_2 v_2$ mass flow rate ρAv

$P_1 + 1/2 \rho v_1^2 + \rho gh_1 = P_2 + 1/2 \rho v_2^2 + \rho gh_2$

Heat and Thermodynamics

$$\Delta L = \alpha L_0 \Delta T$$

$$PV = nRT \quad R = 8.31 \text{ J}/(\text{mol} \cdot \text{K}) = 0.082 \text{ L} \cdot \text{atm}/(\text{mol} \cdot \text{K})$$

$$P_1 V_1 / T_1 = P_2 V_2 / T_2$$

$$0.5 m v^2 = 3/2 k_B T \quad k_B = 1.38 \times 10^{-23} \text{ J/K}$$

$$U = 3/2 n R T$$

$$v_{\text{rms}} = \sqrt{(3 k_B T / m)} = \sqrt{(3 R T / M)}$$

$$W = P \Delta V$$

$$\Delta U = Q + W$$

$$e = W_{\text{eng}} / Q_h = 1 - (Q_c / Q_h) \quad W_{\text{eng}} = Q_h - Q_c$$

Mechanical Waves

$$F = -kx$$

$$0.5mv_i^2 + mgh_i + 0.5kx_i^2 = 0.5mv_f^2 + mgh_f + 0.5kx_f^2$$

$$v = \pm \sqrt{k/m(A^2 - x^2)}$$

$$T = 2\pi \sqrt{m/k} \quad T = 1/f$$

$$f = 1/(2\pi) \sqrt{k/m}$$

$$\omega = 2\pi f = \sqrt{k/m}$$

$$T = 2\pi \sqrt{l/g}$$

$$v = fl$$

$$v = \sqrt{F/\mu}$$

Sound

$$v = \sqrt{\beta / \rho}$$

$$f' = f(v + v_o) / v$$

$$v = \sqrt{Y / \rho}$$

$$f' = f(v) / (v - v_s)$$

$$v = 331 \sqrt{T / 273}$$

$$f' = f(v + v_o) / (v - v_s)$$

$$I = P / A$$

$$\lambda = 4L \quad f_1 = v / 4L \quad \text{open 1 end}$$

$$I = I_o 10^{(\beta / 10)}$$

$$\lambda = 2L \quad f_1 = v / 2L \quad \text{open 2 ends}$$

$$\beta = 10 \log (I / I_o)$$

$$v = f\lambda$$

Electrostatics

$$F = kq_1q_2/r^2$$

$$k = 1/(4\pi\epsilon_0)$$

$$E = kq_0/r^2$$

$$\Delta PE = W = qV = Ed$$

$$V = kq/r$$

$$C = Q/V = \epsilon_0 A/d$$

Circuits

Capacitors $C=Q/V$

Series, same Q

$$1/C_T = 1/C_1 + 1/C_2 \dots$$

Parallel, same V

$$C_T = C_1 + C_2 \dots$$

$$P = IV = I^2R = V^2/R$$

Resistors $V=IR$

Series, same I

$$R_T = R_1 + R_2 \dots$$

Parallel, same V

$$1/R_T = 1/R_1 + 1/R_2 \dots$$

Magnetism & Induction

$$F_B = qvB \sin \theta$$

$$F_g = mg$$

$$F_E = qE$$

$$F_B = BIL \sin \theta$$

$$\tau = NBI A \sin \theta = NBI A \sin \theta$$

$$F_c = ma_c = mv^2/r$$

$$B = \mu_0 I / (2pr)$$

$$\Phi = BA \cos \theta$$

$$\varepsilon = N \Phi / t = BLv$$

$$I = \varepsilon / R = BLv / R$$

$$E/B = v = c \quad v = 3 \times 10^8 \text{ m/s}$$

$$v = f\lambda$$

Light Optics

$$n_1 \sin \theta_1 = n_2 \sin \theta_2 \quad n = c / v$$

$$\lambda_1 \backslash \lambda_2 = v_1 \backslash v_2 = n_2 \backslash n_1$$

$$n_{\text{air}} = 1.000293 \quad n_{\text{vac}} = 1.000000$$

$$c = 3 \times 10^8 \text{ m / s}$$

Mirrors & Lenses

$$1/p + 1/q = 1/f \quad 2f=R$$

$$M = -q/p = h'/h$$

Wave Optics

$\delta = d \sin \theta = m \lambda$ constructive interference

$\delta = d \sin \theta = m \lambda / 2$ destructive interference

$2nt = (m + 1/2) \lambda$ thin film-constructive

$2nt = m \lambda$ destructive

$d = 1 / \#$ lines per cm