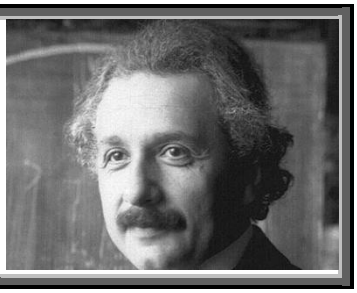
Ruiz ~ Houston's Physics Equation Sheet

Never memorize something that you can look up.
~ Albert Einstein ~



Background ~ Error Calculations

Absolute&Relative Error~Accuracy

$$\text{Absolute Error} = |\text{Observed} - \text{Accepted}|$$

$$E_A = |O - A|$$

$$\text{Relative Error} = \frac{\text{Absolute Error}}{\text{Accepted}} \bullet 100\%$$

$$E_R = \frac{E_A}{A} \bullet 100\% = \frac{|O-A|}{A} \bullet 100\%$$

Absolute&Relative Deviation~Precision

$$\text{Absolute Deviation} = |\text{Observed} - \text{Mean}|$$

$$D_A = |O - M|$$

$$\text{Relative Deviation} = \frac{\text{Absolute Deviation}}{\text{Mean}} \bullet 100\%$$

$$D_R = \frac{D_A}{M} \bullet 100\% = \frac{|O-M|}{M} \bullet 100\%$$

Chapter 2 ~ Motion in One Dimension

Speed, Velocity & Acceleration

$$\text{Speed}_{av} = \frac{\text{Distance}}{\text{ElapsedTime}} \qquad v_{av} = \frac{x_f - x_i}{t_f - t_i} = \frac{\Delta x}{\Delta t}$$

$$a_{av} = \frac{v_f - v_i}{t_f - t_i} = \frac{\Delta v}{\Delta t}$$

Linear Kinematics

$$v_f = v_i + a\Delta t \qquad \Delta x = \tfrac{1}{2}(v_i + v_f)\,\Delta t$$

$$v_f^2 = v_i^2 + 2a\Delta x \qquad \Delta x = v_i t + \tfrac{1}{2} a \Delta t^2$$

Chapter 3 ~ Motion in Two Dimensions

Pythagorean Theorem

$$c^2 = a^2 + b^2$$

Trigonometric Functions

$$\sin\theta = \frac{opposite}{hypotenuse} \qquad \cos\theta = \frac{adjacent}{hypotenuse}$$

$$\tan\theta = \frac{opposite}{adjacent}$$

Resultant

$$Magnitude = R = \sqrt{R_x^2 + R_y^2}$$

$$Direction = \theta = \tan^{-1}\frac{R_y}{R_x}$$

Projectiles ~ Horizontal Launch

$v_x = \text{constant}$
$v_{x,i} = v_i$
$\Delta x = v_i \Delta t$

$g = -9.81\ m/s^2$
$v_{y,i} = 0\ m/s$
$\Delta y = \tfrac{1}{2} g \Delta t^2$
$v_{y,f} = g\Delta t$
$v_{y,f}^2 = 2g\Delta y$

Projectiles ~ @ an Angle Launch

$v_x = \text{constant}$
$v_{x,i} = v_i(\cos\theta)$
$\Delta x = v_i(\cos\theta)\Delta t$

$g = -9.81\ m/s^2$
$v_{y,i} = v_i(\sin\theta)$
$\Delta y = v_i(\sin\theta)\Delta t + \tfrac{1}{2} g \Delta t^2$
$v_{y,f} = v_i(\sin\theta)\Delta t + g\Delta t$
$v_{y,f}^2 = v_i^2(\sin\theta)^2 + 2g\Delta y$

Chapter 4 ~ Forces & Newton's Laws

Newton's Second Law

@ Equilibrium ΣF=0

$$\sum F = ma$$

$$\sum F_x = ma_x = \ldots \qquad \sum F_y = ma_y = \ldots$$

$$F_f = \mu F_N$$

Force of Friction

$$F_f = \mu F_N$$

$$F_{Static} = F_s = \mu_s F_N \qquad F_{Kinetic} = F_k = \mu_k F_N$$

Chapter 5 ~ Work & Energy

Net Work

$$W_{net} = F_{net} d(\cos\theta)$$

Work-KE Theorem

$$W_{net} = \Delta KE$$

Power

$$P = \frac{Work}{Time} = \frac{W}{t} = \frac{Fd}{t} = Fv$$

Kinetic Energy

$$KE = \tfrac{1}{2} mv^2$$

Potential Energy

$$PE_{gravitational} = U = mgh$$

$$PE_{elastic} = \tfrac{1}{2} kx^2$$

Conservation of Mechanical Energy

$$\sum ME_i = \sum ME_f$$

$$KE_i + PE_{g,i} + PE_{e,i} + U_i = KE_f + PE_{g,f} + PE_{e,f} + U_f$$

$$\tfrac{1}{2} mv_i^2 + mgh_i + \tfrac{1}{2} kx_i^2 = \tfrac{1}{2} mv_f^2 + mgh_f + \tfrac{1}{2} kx_f^2$$

Chapter 6 ~ Momentum & Collisions

Momentum

$$p = mv$$

Impulse-Momentum Theorem

$$F\Delta t = \Delta p = mv_f - mv_i$$

Conservation of Momentum

$$mv_{1i} + mv_{2i} = mv_{1f} + mv_{2f}$$

Perfectly Inelastic Collisions

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

$$(m_1 + m_2) v_i = mv_{1,f} + mv_{2,f}$$

Elastic Collisions

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

$$\tfrac{1}{2} m_1 v_{1,i}^2 + \tfrac{1}{2} m_2 v_{2,i}^2 = \tfrac{1}{2} m_1 v_{1,f}^2 + \tfrac{1}{2} m_2 v_{2,f}^2$$

Chapter 7 ~ Circular Motion

Centripetal Acceleration

$$a_C = \frac{v_T^2}{r} = r\omega^2$$

Centripetal Force

$$F_C = \frac{mv_T^2}{r} = mr\omega^2$$

Torque

@ Equilibrium Στ=0

$$\sum \tau = Fl\cos\theta$$

Universal Law of Gravitation

$$G = 6.6732 \bullet 10^{-11}\ N \bullet m^2/kg^2$$

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

Orbital Period

$$T = 2\pi\sqrt{\frac{r^3}{Gm}}$$

Orbital Speed

$$v_T = \sqrt{G\frac{m}{r}}$$

Appendix J ~ Rotational Kinematics

Arc Length

$$\Delta s = r\Delta\theta$$

Tangential Speed

$$v_T = r\omega$$

Tangential Acceleration

$$a_T = r\alpha$$

2π rad = 360° = 1 rev

Angular Velocity

$$\omega_{av} = \frac{\theta_f - \theta_i}{t_f - t_i} = \frac{\Delta\theta}{\Delta t}$$

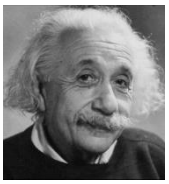
Angular Acceleration

$$\alpha_{av} = \frac{\omega_f - \omega_i}{t_f - t_i} = \frac{\Delta\omega}{\Delta t}$$

Rotational Kinematics

$$\omega_f = \omega_i + \alpha\Delta t \qquad \Delta\theta = \tfrac{1}{2}(\omega_i + \omega_f)\Delta t$$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta \qquad \Delta\theta = \omega_i t + \tfrac{1}{2}\alpha\Delta t^2$$



Any fool can know.
The point is to understand.
~ Albert Einstein ~

A person who never made a mistake never tried anything new. ~ Albert Einstein ~