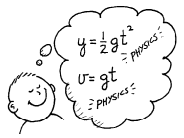
Formula Sheet



Linear Motion

1 - Speed

$$\bar{s} = \frac{d}{t} \qquad t = \frac{d}{\bar{s}} \qquad d = \bar{s}t$$

2 - Average Velocity

$$\bar{v} = \frac{\Delta d}{\Delta t}$$

3 - Average Acceleration

$$\bar{a} = \frac{\Delta v}{\Delta t} \qquad \bar{a} = \frac{v_f - v_o}{\Delta t} \qquad v_f = v_o + \bar{a}t$$

4 - Useful Equations for Uniform Acceleration

		Missing Quantity
Equation 1	$v_f = v_o + at$	Δd
Equation 2	$\Delta d = \frac{(v_o + v_f)}{2}t$	a
Equation 3	$\Delta d = v_o t + \frac{1}{2}a(t)^2$	v_f
Equation 4	$v_f^2 = v_o^2 + 2a\Delta d$	t

Projectile Motion

5 - Horizontal motion of free fall

$$d_h = v_h t$$

6 - Vertically motion of free fall

		Missing Quantity
Equation 1	$v_{fv} = v_{ov} + gt$	Δh_v
Equation 2	$\Delta h_v = \frac{(v_{ov} + v_{fv})}{2}t$	g
Equation 3	$\Delta h_v = v_{ov}t + \frac{1}{2}g(t)^2$	v_{fv}
Equation 4	$v_{fv}^2 = v_{ov}^2 + 2g\Delta h_v$	t

7 - Range formula

$$R = \frac{v_o^2}{g}\sin 2\theta_o$$

Newton's Laws

8 - Weight

$$W = mg$$

9 - Newton's First and Second Law (Mathematically)

Constant Acceleration $\sum F_{net} = ma$

Constant Velocity $\sum F_{net} = 0$

10 - Force due to friction. (Static and sliding)

Kinetic Friction $f_f = F_N \mu_k$

Static Friction $f_f = F_N \mu_s$

11 - Newton's Third Law

$$F_{AB} = -F_{AB}$$

12 - Vectors

$$F_v = F\sin\theta \qquad F_h = F\sin\theta$$

$$F^2 = F_h^2 + F_v^2$$

Momentum

13 - Momentum

$p = mv$

$\Delta p = m\Delta v$ Change in momentum

14 - Impulse-momentum relationship $J = F\Delta t$ $J = \Delta p$ $F\Delta t = m\Delta v$

15 - Conservation of Momentum $p_i = p_f$ $(m_1 + m_2)v_{1,2i} = m_1 v_{1f} + m_2 v_{2f}$

16 - Elastic Collisions $p_i = p_f$ $m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$

17 - Inelastic Collisions $p_i = p_f$ $m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2)v_{1,2f}$

Energy

18 - Work $W = Fd$ $W = \Delta E$

19 - Gravitational Potential Energy $PE = mgh$ $W = \Delta PE = mg\Delta h$

20 - Kinetic Energy $KE = \frac{mv^2}{2}$ $W = \Delta KE = \frac{m\Delta v^2}{2}$

21 - Power $P = \frac{W}{t}$ $P = \frac{\Delta E}{t}$

22 - Conservation of Energy $E_i = E_f$ $PE_i + KE_i = PE_f + KE_f + W$

Circular Motion

23 - Centripetal Acceleration $a_c = \frac{v^2}{r}$

24 - Centripetal Force $F_c = ma_c = \frac{mv^2}{r}$

Rotational Mechanics

25 - Torque in terms of Force $\tau = F_{\perp} r$

26 - Torque at equilibrium $\sum \tau_{ext} = 0$ $\tau_{cw} = \tau_{cc}$

: The sum of all torques clockwise must equal the sum of all torques counter-clockwise.

: Objects rotate around their center of mass!!!!

Universal Gravitation and Gravitational Interactions

27 - Universal Gravitation $F = G\frac{m_1 m_2}{d^2}$ $G = 6.67 \times 10^{-11}\ Nm^2/kg^2$

28 - Acceleration due to gravitational interactions $g_p = \frac{GM_p}{r_p^{\,2}}$

29 - Elevators

Apparent Weight, Elevator up, up is positive!

$F_N - W = ma$ $F_N = m(a + g)$