Physics Shit Cheat Sheet

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(1) MECHANICS

$$v = \frac{\mathrm{d}x}{\mathrm{d}t}$$
$$a = \frac{\mathrm{d}v}{\mathrm{d}t}$$
$$\bar{v} = \frac{\Delta x}{\Delta t}$$

let V to be a vector space. Then:

$$a \in V \implies v = v_0 + at$$
$$a \in V \implies x = x_0 + v_0 t + \frac{1}{2}at^2$$
$$a \in V \implies x = x_0 + \frac{v_0 + v}{2}t$$
$$a \in V \implies v = \sqrt{v_0^2 + 2a(x - x_0)}$$

(2) FORCES

$$F = mg$$
$$\sum \vec{F} = m\vec{a}$$
$$F = k\,\Delta\ell$$
$$f_s \le \mu_s N$$
$$f_k = \mu_k N$$

(3) ENERGY

$$W = \int \vec{F}(s)\,\mathrm{d}s$$

$$(\exists c \forall x \colon |F(x)| = c) \implies W = F_x \cdot \Delta x = F\cos\theta \Delta s$$

$$E_k = \frac{1}{2}mv^2$$
$$U_g = mgh$$
$$U_{sp} = \frac{1}{2}k(\Delta\ell)^2$$
$$E_{k1} + U_{g1} = E_{k2} + U_{g2}$$
$$W_F = \Delta E = E_{\text{final}} - E_{\text{begining}}$$

(4) ROTATIONAL MOVEMENT

$$f = \frac{1}{T}$$
$$L = r\psi_{\text{rad}}$$
$$\omega = 2\pi f = \frac{2\pi}{T}$$
$$v = \frac{2\pi r}{T}$$
$$\bar{\omega} = \frac{\Delta\theta}{\Delta t}$$
$$v = \omega r$$
$$a_R = \frac{v^2}{r} = \omega^2 r$$
$$P = 2\pi r$$

Critical Velocity at max.:

$$N = 0 \iff v = \sqrt{gr}$$
$$a_T = -g\sin\alpha$$
$$\vec{a} = \vec{a}_T + \vec{a}_r$$
$$|a| = \sqrt{a_T^2 + a_R^2}$$
$$\tan\theta = \frac{|a_T|}{|a_R|}$$

(5) GRAVITY

For a given gravitational system:

$$\exists c \forall i \colon \frac{T_i^2}{r_i^3} = c$$
$$\left(\frac{\bar{r}_1}{\bar{r}_2}\right)^3 = \left(\frac{T_1}{T_2}\right)^2$$
$$F_g = G\,\frac{m_1 m_2}{r^2}$$
$$U_G = -\frac{GMm}{r}$$
$$E_k = \frac{GMm}{2r} = -\frac{U_G}{2}$$
$$\rho = \frac{m}{v}$$

(6) MOMENTUM

$$\vec{P} = m\vec{v} \quad [N\,\mathrm{sec}]$$
$$\vec{J} = \vec{F}\cdot\Delta t = \int F\,\mathrm{d}t \quad \left[\frac{\mathrm{kg}\,m}{\mathrm{sec}}\right]$$
$$\vec{J}_{\Sigma F} = \sum_{i=1}^{n} \vec{J}_{F_i} = \Delta\vec{P}$$
$$\forall t_1, t_2 \in \mathbb{R} \colon \sum_{i=1}^{n} m_i\vec{v}_i(t_1) = \sum_{i=1}^{n} m_i\vec{v}_i(t_2)$$

In an inelastic collision:

$$Q = \Delta E_k$$

In an elastic collision, where v_i before collision and u_i after it:

$$\vec{v}_1 - \vec{v}_2 = -(\vec{u}_1 - \vec{u}_2)$$