

Formula sheet

$$g = |\vec{a}_{\text{free fall}}| = 9.81 \text{ m/s}^2 \quad \text{near earth's surface}$$

$$0 = ax^2 + bx + c \implies x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2/\text{s}^2 = 1 \text{ N} \cdot \text{m}$$

$$\Delta \vec{r} = \vec{r}_f - \vec{r}_i$$

$$d \equiv |x_1 - x_2|$$

$$b \equiv |\vec{b}| = |b_x| \quad \text{one dimension}$$

$$\vec{r} = x \hat{i} \quad \text{one dimension}$$

$$\vec{b} = b_x \hat{i} \quad \text{one dimension}$$

$$\text{speed} = v = |\vec{v}|$$

$$\vec{v}_{av} \equiv \frac{\Delta \vec{r}}{\Delta t}$$

$$\vec{v} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t} \equiv \frac{d\vec{r}}{dt}$$

$$a_{x,av} \equiv \frac{\Delta v_x}{\Delta t}$$

$$a_x = \lim_{\Delta t \rightarrow 0} \frac{\Delta v_x}{\Delta t} \equiv \frac{dv_x}{dt} = \frac{d}{dt} \left(\frac{dx}{dt} \right) = \frac{d^2x}{dt^2}$$

$$x_f = x_i + v_{x,i} \Delta t + \frac{1}{2} a_x (\Delta t)^2$$

$$v_{x,f} = v_{x,i} + a_x \Delta t$$

$$x(t) = x_i + v_{x,i} t + \frac{1}{2} a_x t^2$$

$$v_x(t) = v_{x,i} + a_x t$$

$$v_{x,f}^2 = v_{x,i}^2 + 2a_x \Delta x$$

$$\Delta \vec{p} = \vec{0} \quad \text{isolated system}$$

$$\vec{p}_f = \vec{p}_i \quad \text{isolated system}$$

$$\vec{p} \equiv m\vec{v}$$

$$m_u = -\frac{\Delta v_{s,x}}{\Delta v_{u,x}} m_s$$

$$\vec{J} = \Delta \vec{p}$$

$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2} \right) v_{1i} + \left(\frac{2m_2}{m_1 + m_2} \right) v_{2i} \quad \text{1D elastic}$$

$$v_{2f} = \left(\frac{2m_1}{m_1 + m_2} \right) v_{1i} + \left(\frac{m_2 - m_1}{m_1 + m_2} \right) v_{2i} \quad \text{1D elastic}$$

$$\Delta E = 0 \quad \text{isolated system}$$

$$K = \frac{1}{2} m v^2$$

$$\vec{v}_{12} = \vec{v}_2 - \vec{v}_1 \quad \text{relative velocity}$$

$$v_{12} = |\vec{v}_2 - \vec{v}_1| \quad \text{relative speed}$$

Power	Prefix	Abbreviation
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10 ⁻¹²	pico	p
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10 ⁻⁹	nano	n
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10 ⁻⁶	micro	μ
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10 ⁻³	milli	m
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10 ⁻²	centi	c
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10 ³	kilo	k
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10 ⁶	mega	M
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10 ⁹	giga	G
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10 ¹²	tera	T
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