1 Kinetic Energy and Work

Basic Definitions

Quantity	Equation	Units
Kinetic Energy	$\frac{1}{2}mv^2$	J
Work Done by a Constant Force	$W = \begin{cases} Fd\cos\phi \\ \vec{F}\cdot\vec{d} \end{cases}$	$N \cdot m$, J
Average Power	$P_{\text{avg}=\frac{W}{\Delta t}}$	W
Instantaneous Power	$P = \frac{dW}{dt}$	W
Spring Force	$F_s = -kx$	N

Applications

Name	Equation
Work-Kinetic Energy Theorem	$\Delta K = K_f - K_i = W$ $K_f = K_i + W$
Work Done by the Gravitational Force	$W_g = mgd\cos\phi$
Work Done in Lifting and Lowering an Object	$\Delta K = K_f - K_i = W_a + W_g$
Work Done by a Spring Force	$W_s = \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2$
Work by a General Variable Force	$W = \begin{cases} \int_{x_i}^{x_f} F(x)\,dx \\ \int_{x_i}^{x_f} F_x\,dx + \int_{y_i}^{y_f} F_y\,dy \\ + \int_{z_i}^{z_f} F_z\,dz \end{cases}$
Instantaneous Power at an Angle ϕ	$P = Fv\cos\phi = \vec{F}\cdot\vec{v}$