Chapter 7: Kinetic Energy and Work

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General

Quantities

$$
\begin{aligned}
K &= \text{kinetic energy} \\
W &= \text{work} \\
\vec{F} &= \text{force} \\
m &= \text{mass} \\
g &= \text{magnitude of free-fall acceleration} \\
v &= \text{velocity} \\
k &= \text{force constant/spring constant} \\
\vec{d} &= \text{displacement} \\
x &= \text{displacement} \\
P &= \text{power} \\
\phi &= \text{smallest angle between two vectors}
\end{aligned}
$$

Constants

$$g = 9.8 \, \text{m/s}^2$$

1 Kinetic Energy

Kinetic energy is energy associated with the state of motion of an object.

$$K = \frac{1}{2}mv^2 \tag{1}$$

2 Work and Kinetic Energy

Work   Work is energy transferred to or from an object by means of a force acting on the object. Energy transferred to the object is positive work, and energy transferred from the object is negative work.

Work Done by a Constant Force
$$W = \vec{F} \cdot \vec{d} = Fd\cos\phi \tag{2}$$

3 Work Done By the Gravitational Force

$$W_g = mgd\cos\phi \tag{3}$$

4 Work Done by a Spring Force

Hooke's Law Hooke's Law can be used as a general rule to approximate the force using a force constant k.

$$F_x = -kx \tag{4}$$

Work Done by a Spring Force

$$W_s = \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2 \tag{5}$$

5 Work Done by a General Variable Force

$$W = \int_{x_i}^{x_f} F(x)\,dx \tag{6}$$

6 Power

$$P = \vec{F} \cdot \vec{v} \tag{7}$$