

Energy Conservation

If all forces are conservative (no friction, engine etc), Total Mechanical Energy (Kinetic + Potential) is conserved:

$$E = K + U = \text{const}$$

Here K is Kinetic energy:

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

U is Potential energy, which is the work done against the conservative force, when object is moved from point A to point B. Two important cases are gravity and spring force:

Type of force	F	U
Gravity (on Earth surface)	mg	mgh
Hooke's Law (spring force)	kx	$\frac{kx^2}{2}$

Here x is extension of the spring, h is height.

Homework

A toy car is powered by a rubber band with spring constant $k=20 \text{ N/m}$. At initial moment, the band is stretch by amount $x=0.3\text{m}$. The car is released, and get accelerated by the rubber band.

- What will be the eventual speed of the car, if no energy is lost? Mass of the car is 0.2kg .
- Once released, the car climbs up the ramp of the height $h=15 \text{ cm}$ (0.15 m). What will be the speed of the car on top of the ramp?

