Energy Conservation

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

$$E = K + U = const$$

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 a spring, h is height.

Homework

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

a) What will be the eventual speed of the car, if no energy is lost? Mass of the car is 0.2kg.
b) What will be the speed of the car on once it climbs up the ramp of the height h=15 cm (0.15 m)?