

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

English Longbow was an extremely powerful weapon that gave England big advantage in the Middle Ages. Consider it to be just a simple Hooke's spring with spring constant $k=1000\text{N/m}$ (*Newtons per meter*). When shooting, an archer had to pull the string back by approximately $x=70\text{ cm}$.

- a) What was the force that an archer had to apply?
- b) How much energy was carried by a single shot?
- c) What was the initial speed of the arrow of mass $m=60\text{g}$?
- d) If the arrow were shot vertically upward, what would be the maximum height it could reach?

