Energy Conservation

If all forces are conservative (no friction, engine etc), 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 the spring, k is spring constant, 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 $k=1000N/m$ (Newtons per meter). When shooting, an archer had to pull the string back by approximately x=70 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=60g?

d) If the arrow were shot vertically up, what would be the maximum height it could reach?