

EX 10.3 (Work & Potential Energy)

The KE of the shot is $\frac{1}{2} m v^2$.

The work it takes to draw back the sling shot is $W = \int_0^d F dx = \int_0^d kx dx = \frac{1}{2} k d^2$

This work, stored as elastic PE, is turned into KE, so we set

$$\frac{1}{2} m v^2 = \frac{1}{2} k d^2$$

or $k = m v^2 / d^2$

$$= (0.01 \text{ kg} (200 \text{ m/s})^2) / (20 \text{ m})^2$$

$$k = 1.6 \times 10^3 \text{ kg/s}^2$$

The KE of the shot is $KE = 200 \text{ J}$

If we pull the sling back 21 instead of 20 m, the speed is $v = 210 \text{ m/s}$. The KE of the shot goes as d^2 (not simply proportional).