An ore car of mass 4000 kg starts from rest and rolls downhill on tracks from a mine. At the end of the tracks, at an elevation of 10m lower, is a spring with \( k = 400,000 \text{ N/m} \). How much is the spring compressed in stopping the ore car?

Distance spring is compressed = \( 1.4 \text{ m} \)

Solution:

The change in the potential energy of the car is just the negative of the change in the kinetic energy (as energy is conserved). Therefore, the spring is compressed due to the kinetic energy:

\[
mgh = \frac{1}{2}mv^2 = \frac{1}{2}kx^2
\]

or

\[
x = \sqrt{\frac{2mgh}{k}} = 1.4 \text{ m}
\]