HW6-4 Soln)

$$W_{TOTAL} = \Delta K + \Delta U$$

This isn't as bad as the previous example. The force of the hand is always in the direction of motion of the ball. We need to break the trip up into very small displacement intervals $\delta l$. Then the work done by the hand force over one of these intervals is

$$\delta W = F_H\, \delta l_n \cos\theta_{F_H,\delta l} = F_H\, \delta l_n\,.$$

The total work done by the hand force is then

$W_{Hand} = \sum F_H\, \delta l_n = F_H \sum \delta l_n = F_H\, l = F_H\, \pi R = 30\, \pi\, (0.6) = 56.5\ \mathrm{J}$

and,

Wg = conservative.

Then,

$$W_{NC} = \Delta K + \Delta U$$

$$W_{Hand} = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2 + gmy_f - gmy_i$$

Set lowest point as y=0

$y_i = 2R = 1.2$ m

$$W_{Hand} = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2 - gmy_i$$

$$v_f = \sqrt{\frac{2\left(W_{Hand} + \frac{1}{2}mv_i^2 + gmy_i\right)}{m}} = \sqrt{\frac{2\left(56.5 + \frac{1}{2}0.35(12^2) + 10(0.35)(1.2)\right)}{0.35}} = 22.2\ \mathrm{m/s}$$