1.

a. $W = Fd = 70N(4m) = 280J$

b. $P = \frac{W}{\Delta t} = \frac{280J}{6s} = 46.7W$

c. $KE = \frac{1}{2}mv^2 = \frac{1}{2}(10kg)(3m/s)^2$

$KE = 45J$

d. $PE = mgh = 10kg(9.8m/s^2)(1.5m)$

$PE = 147J$

e. $KE_0 + PE_0 + W_{NC} = KE + PE$

W_{NC}: work by external forces or friction — Friction Work and goat work

$0 + 0 + W_{NC} = 45J + 147J$

$W_{NC} = 192J$

W_{NC} = Goat Work + Friction Work

$192J = 280J + W_{Friction}$

$W_{Friction} = -88J$

f. $W_{Friction} = Fd \Rightarrow -88J = F_{Fr}(4m)$

$F_{Fr} = -22N$

g. $W = F_{\parallel}d = \cos 25(70N)(4m) = 254J$

2.

a. $PE = mgh = 15\,kg\,(9.8\,m/s^2)(3\,m) = 441\,J$

b. $PE_{Bot.} + KE_{Bot.} + W_{NC} = PE_{Top} + KE_{Top}$

$0 + 0 + W_{NC} = 441\,J + 0$

W_{NC}: Ladder Pushing child

$W_{NC} = F_{ladder}(d) = 441\,J \Rightarrow F(4\,m) = 441\,J$

$F_{Ladder} = 110\,N$

c. $PE_{Top} + KE_{Top} = PE_{Bot.} + KE_{Bot.}$

$441\,J + 0 = 0 + KE_{Bot.}$

$KE_{Bottom} = 441\,J$

d. $W_{Fr} = \Delta KE = KE - KE_0$ (endpoint: Bottom of slide)

$W_{Fr} = 0 - 441\,J$

$F_{Fr}(15\,m) = -441\,J$

$F_{Fr} = -29.4\,N$

e. $W_{\text{By child climbing ladder}} = W_{\text{By ladder}} = 441\,J$

$0.25\left(\frac{2910\,cal}{PEZ}\right) = 727.5$ usable calories per pez

$\frac{727.5\,cal}{Pez}\left(\frac{4.184\,J}{cal}\right) = 3044\ \frac{\text{usable J}}{pez}$

$\frac{3044\,J}{Pez}\left(\frac{1\,climb}{441\,J}\right) = 6.9\,climbs$