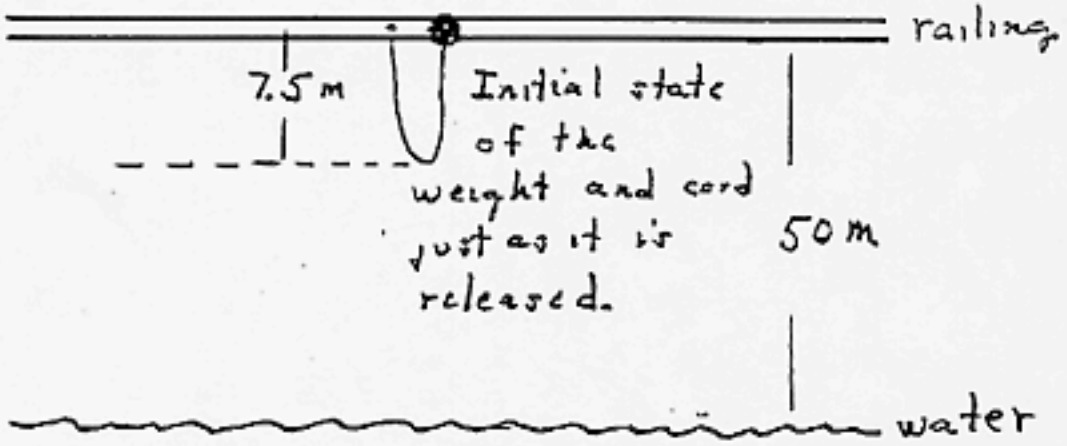
13. (20 pts) You are the proud new owner of a bungee-cord jumping company. Before taking any chances with a customer, you decide to experiment with your bungee cord. You measure the cord and find it has an unstretched length of 15 m. You attach one end of the cord to a 70 kg lead weight and the other end of the cord to the railing of a bridge that spans a river. For some lucky reason there is a sign on the railing that says it is exactly 50 m above the surface of the river. You release the weight by first holding it just beside the railing and over the river, and then letting it go. See the picture below.



(a) (4 pts) To your amazement you find that the cord stops the weight just as it touches the water. Find the spring constant, k, of the bungee cord. You may assume that the weight has negligible dimensions.

$$k = \frac{(2)(70)(9.8)(50)}{(35)^2} \frac{\text{kg met}^2}{\text{sec}^2\ \text{met}^2} = 56 \frac{\text{Newton}}{\text{meter}}$$

Use energy conservation:

$$mgh = \tfrac{1}{2} k (\ell - \ell_0)^2 \Rightarrow (70)(9.8)(50) = \tfrac{1}{2} k \underbrace{(50-15)}_{11}{}^2$$

$$(35)^2$$