8. The main challenge for students in this type of problem seems to be working out the trigonometry in order to obtain the height of the ball (relative to the low point of the swing) $h = L - L\cos\theta$ (for angle θ measured from vertical as shown in Fig. 8-29). Once this relation (which we will not derive here since we have found this to be most easily illustrated at the blackboard) is established, then the principal results of this problem follow from Eq. 7-12 (for W_g) and Eq. 8-9 (for U).

   (a) The vertical component of the displacement vector is downward with magnitude h, so we obtain

   $$W_g = \vec{F}_g \cdot \vec{d} = mgh = mgL\,(1 - \cos\theta) \ .$$

   (b) From Eq. 8-1, we have $\Delta U = -W_g = -mgL(1 - \cos\theta)$.

   (c) With $y = h$, Eq. 8-9 yields $U = mgL(1 - \cos\theta)$.

   (d) As the angle increases, we intuitively see that the height h increases (and, less obviously, from the mathematics, we see that $\cos\theta$ decreases so that $1 - \cos\theta$ increases), so the answers to parts (a) and (c) increase, and the absolute value of the answer to part (b) also increases.