

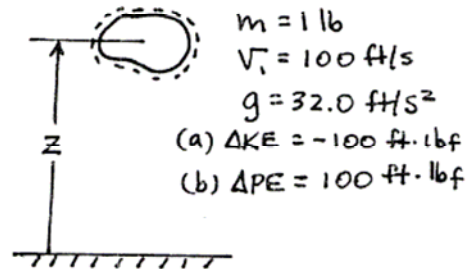
PROBLEM 2.8

KNOWN: An object of known mass moves with a given velocity.

FIND: Determine (a) the final velocity for a given change in kinetic energy, and (b) the change in elevation for a given change in potential energy.

SCHEMATIC & GIVEN DATA:

ENGR. MODEL: (1) The object is a closed system. (2) The acceleration of gravity is constant.



ANALYSIS: (a) The change in kinetic energy is related to the initial and final velocities by

$$\Delta KE = \frac{1}{2} m [v_2^2 - v_1^2]$$

Thus, solving for the final velocity  $v_2$

$$v_2 = \sqrt{\frac{2 \Delta KE}{m} + v_1^2}$$

Inserting values and converting units accordingly

$$v_2 = \sqrt{\frac{(2)(-100 \text{ ft}\cdot\text{lbf})}{(1 \text{ lb})} \left| \frac{32.2 \text{ lb}\cdot\text{ft/s}^2}{1 \text{ lbf}} \right| + 100^2 \frac{\text{ft}^2}{\text{s}^2}}$$

①  $= 59.67 \text{ ft/s}$  ←  $v_2$

(b) The change in potential energy is related to the change in elevation by

$$\Delta PE = mg \Delta Z$$

Thus, the change in elevation is

$$\Delta Z = \frac{\Delta PE}{mg} = \frac{(100 \text{ ft}\cdot\text{lbf})}{(1 \text{ lb})(32.0 \text{ ft/s}^2)} \left| \frac{32.2 \text{ lb}\cdot\text{ft/s}^2}{1 \text{ lbf}} \right|$$

②  $= 100.6 \text{ ft}$  ←  $\Delta Z$

1. The velocity decreases, as expected.
2. The elevation increases, as expected.