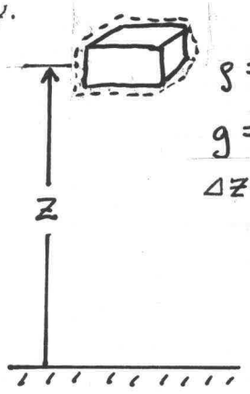
PROBLEM 2.4

KNOWN: A brick of known volume and density experiences a given decrease in elevation.

FIND: Determine the change in potential energy.

SCHEMATIC & GIVEN DATA:



ENGR. MODEL: (1) The brick is a closed system. (2) The acceleration of gravity is constant. (3) The density of the body is uniform throughout.

ANALYSIS:

$$V = (2.5\,\text{in})(3.5\,\text{in})(6\,\text{in})\left|\frac{1\,\text{ft}^3}{12^3\,\text{in}^3}\right| = 0.03038\,\text{ft}^3$$

Based on assumption (3)

$$m = \rho V = (120\,\text{lb/ft}^3)(0.03038\,\text{ft}^3) = 3.651\text{b}$$

The change in potential energy and the elevation are related by

$$\Delta PE = mg\Delta z$$

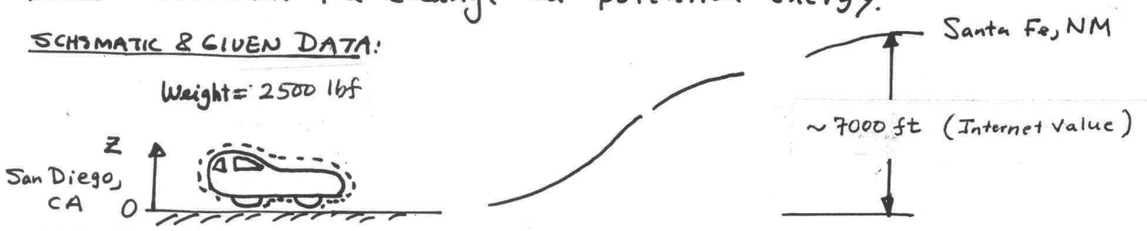
$$= (3.65\,\text{lb})\left(32.0\,\frac{\text{ft}}{\text{s}^2}\right)(-69\,\text{ft})\left|\frac{1\,\text{lbf}}{32.2\,\text{lb}\cdot\text{ft/s}^2}\right| = -250.3\,\text{ft}\cdot\text{lbf}$$

PROBLEM 2.5

KNOWN: An automobile of known weight travels from sea level to a known elevation.

FIND: Determine the change in potential energy.

SCHEMATIC & GIVEN DATA:



ENGR. MODEL: 1. As shown in the schematic, the automobile is the system.
2. The acceleration of gravity is constant.

ANALYSIS: The change in potential energy is

$$\Delta PE = mg(z_2 - z_1)$$

The quantity mg is recognized as the vehicle weight. Thus, inserting known values

$$\Delta PE = (2500\,\text{lbf})(7000\,\text{ft})\left|\frac{1\,\text{Btu}}{778\,\text{ft}\cdot\text{lbf}}\right| = 2.25\times10^4\,\text{Btu}$$