

Chapter 7 Problem 15 [†]

Given

$$y_0 = 3050 \text{ m}$$

$$x_0 = 18 \text{ km} = 18,000 \text{ m}$$

$$m = 75 \text{ kg}$$

Solution

Find the change in gravitational potential energy going from $\{0\hat{i} + 3050\hat{j}\} \text{ m}$ to $\{18000\hat{i} + 0\hat{j}\} \text{ m}$.

Potential energy is the negative of the work done by gravity. Therefore

$$\Delta U = -W = - \int \vec{F}_g d\vec{r} = - \int_{y_0}^{y_f} -mg dy$$

Notice that only the change in the y direction changes the potential. Then

$$\Delta U = mg(y_f - y_0) = (75 \text{ kg})(9.80 \text{ m/s}^2)(0 - 3050 \text{ m})$$

$$\Delta U = -2.24 \times 10^6 \text{ J} = -2.24 \text{ MJ}$$

[†]Problem from Essential University Physics, Wolfson