Chapter 7 Problem 13 [†]

Given
$m = 70\ kg$

Solution
a) Find the potential energy at 1900 m above sea level.

Potential energy is the negative of the work done.

$$\Delta U = -W = -\int \vec{F}_g d\vec{r} = -\int_{y_0}^{y} -mgdy$$

Let $U = 0$ at y_0 which is sea level. Then

$$U = mgy = (70\ kg)(9.8\ m/s^2)(1900\ m) = 1.3 \times 10^6\ J$$

$$U = 1.3\ MJ$$

b) Find the potential energy at 86 m below sea level.

From the equation derived above

$$U = mgy = (70\ kg)(9.8\ m/s^2)(-86\ m) = -5.9 \times 10^4\ J$$

$$U = -59\ kJ$$

[†]Problem from Essential University Physics, Wolfson