17.74. Model: The air is assumed to be an ideal gas. Because the air is compressed without time to exchange heat with its surroundings, the compression is an adiabatic process.

Solve: The initial pressure of air in the mountains behind Los Angeles is $p_i = 60 \times 10^3$ Pa at $T_i = 273$ K. The pressure of this air when it is carried down to the elevation near sea level is $p_f = 100 \times 10^3$ Pa. The adiabatic compression of a gas leads to an increase in temperature according to Equation 17.39 and Equation 17.40, which are

$$T_f V_f^{\gamma-1} = T_i V_i^{\gamma-1} \Rightarrow \left(\frac{T_f}{T_i}\right) = \left(\frac{V_i}{V_f}\right)^{\gamma-1} \qquad p_f V_f^{\gamma} = p_i V_i^{\gamma} \Rightarrow \left(\frac{p_f}{p_i}\right)^{\frac{1}{\gamma}} = \frac{V_i}{V_f}$$

Combining these two equations,

$$(T_f/T_i) = (p_f/p_i)^{\frac{\gamma-1}{\gamma}} \Rightarrow T_f = T_i\left(\frac{100\times10^3 \text{ Pa}}{60\times10^3 \text{ Pa}}\right)^{\frac{1.4-1}{1.4}} = (273\text{ K})\left(\frac{5}{3}\right)^{0.286} = 316\text{ K} = 43°\text{C} = 109°\text{F}$$