93. (a) The surface are of the cylinder is given by $A_1 = 2\pi r_1^2 + 2\pi r_1 h_1 = 2\pi(2.5 \times 10^{-2}\,\mathrm{m})^2 + 2\pi(2.5 \times 10^{-2}\,\mathrm{m})(5.0 \times 10^{-2}\,\mathrm{m}) = 1.18 \times 10^{-2}\,\mathrm{m}^2$, its temperature is $T_1 = 273 + 30 = 303\,\mathrm{K}$, and the temperature of the environment is $T_{\mathrm{env}} = 273 + 50 = 323\,\mathrm{K}$. From Eq. 19-39 we have

$$\begin{aligned} P_1 &= \sigma\varepsilon A_1(T_{\mathrm{env}}^4 - T^4) \\ &= ()\,(0.85)(1.18 \times 10^{-2}\,\mathrm{m}^2)\left((323\,\mathrm{K})^4 - (303\,\mathrm{K})^4\right) \\ &= 1.39\,\mathrm{W}\ . \end{aligned}$$

(b) Let the new height of the cylinder be h_2. Since the volume V of the cylinder is fixed, we must have $V = \pi r_1^2 h_1 = \pi r_2^2 h_2$. We solve for h_2:

$$h_2 = \left(\frac{r_1}{r_2}\right)^2 h_1$$

$$\begin{aligned} &= \left(\frac{2.5\,\mathrm{cm}}{0.50\,\mathrm{cm}}\right)^2 (5.0\,\mathrm{cm}) \\ &= 125\,\mathrm{cm} = 1.25\ \mathrm{m}\ . \end{aligned}$$

The corresponding new surface area A_2 of the cylinder is

$$A_2 = 2\pi r_2^2 + 2\pi r_2 h_2 = 2\pi(0.50 \times 10^{-2}\,\mathrm{m})^2 + 2\pi(0.50 \times 10^{-2}\,\mathrm{m})(1.25\,\mathrm{m}) = 3.94 \times 10^{-2}\ \mathrm{m}^2\ .$$

Consequently,

$$\frac{P_2}{P_1} = \frac{A_2}{A_1} = \frac{3.94 \times 10^{-2}\,\mathrm{m}^2}{1.18 \times 10^{-2}\,\mathrm{m}^2} = 3.3\ .$$