Given:

Helium gas is compressed by an adiabatic compressor from an initial state of 14 psia and 50°F to a final temperature of 320°F in a reversible manner.

$$P_1 := 14\text{psi} \qquad T_1 := 50\,°\text{F} = 509.67\cdot\text{R} \qquad T_2 := 320\,°\text{F} = 779.67\cdot\text{R}$$

Required:

Determine the pressure of the helium at the exit.

Solution:

Going to Table A-2E @ Helium shows

$$k_{He} := 1.667$$

Since the compressor is adiabatic (i.e. no Q) and it operates in a reverisble manner, the compressor is isentropic (i.e. $\Delta s = 0$). Thus the following relationship is true.

$$\left(\frac{T_2}{T_1}\right)_{s=¢} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$$

Rearranging yields

$$P_2 := P_1\cdot\left(\frac{T_2}{T_1}\right)^{\frac{k_{He}}{k_{He}-1}} = 40.51\cdot\text{psi}$$