7. (a) In solving $pV = nRT$ for n, we first convert the temperature to the Kelvin scale: $T = 40.0 + 273.15 = 313.15\,\mathrm{K}$. And we convert the volume to SI units: $1000\,\mathrm{cm}^3 = 1000 \times 10^{-6}\,\mathrm{m}^3$. Now, according to the ideal gas law,

$$n = \frac{pV}{RT} = \frac{(1.01 \times 10^5\,\mathrm{Pa})(1000 \times 10^{-6}\,\mathrm{m}^3)}{(8.31\,\mathrm{J/mol \cdot K})(313.15\,\mathrm{K})} = 3.88 \times 10^{-2}\ \mathrm{mol}\ .$$

(b) The ideal gas law $pV = nRT$ leads to

$$T = \frac{pV}{nR} = \frac{(1.06 \times 10^5\,\mathrm{Pa})(1500 \times 10^{-6}\,\mathrm{m}^3)}{(3.88 \times 10^{-2}\,\mathrm{mol})(8.31\,\mathrm{J/mol \cdot K})} = 493\,\mathrm{K}\ .$$

We note that the final temperature may be expressed in degrees Celsius as 220°C.