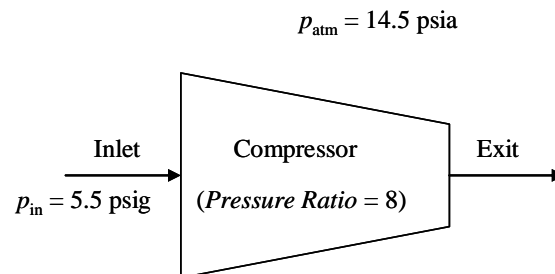**1.33** A gas enters a compressor that provides a pressure ratio (exit pressure to inlet pressure) equal to 8. If a gage indicates the gas pressure at the inlet is 5.5 psig, what is the absolute pressure, in psia, of the gas at the exit? Atmospheric pressure is 14.5 lbf/in.$^2$

**KNOWN:** Gas pressure is measured at the inlet of a compressor for which the pressure ratio is known.

**FIND:** Determine the absolute pressure of the gas at the compressor exit.

**SCHEMATIC AND GIVEN DATA:**

$$p_{atm} = 14.5 \text{ psia}$$

Inlet     Compressor     Exit

$p_{in} = 5.5$ psig     (*Pressure Ratio* = 8)

**ENGINEERING MODEL:**
1. Atmospheric pressure is 14.5 lbf/in.$^2$

**ANALYSIS:**
From the compressor pressure ratio, the exit pressure can be determined from

$$\text{pressure ratio} = p_{exit}/p_{in} \quad \rightarrow \quad p_{exit} = p_{in}(\text{pressure ratio})$$

Inlet pressure must be expressed as absolute pressure to solve for exit pressure. Conversion from the inlet pressure gage reading to absolute pressure is determined from

$$p_{in}(\text{gage}) = p_{in}(\text{absolute}) - p_{atm}(\text{absolute})$$

Rearranging the equation to solve for $p_{in}$(absolute) and substituting values yield

$$p_{in}(\text{absolute}) = p_{in}(\text{gage}) + p_{atm}(\text{absolute}) = 5.5 \text{ psig} + 14.5 \text{ psia} = 20 \text{ psia}$$

Substituting absolute pressure at the inlet into the equation for exit pressure yields

$$p_{exit} = (20 \text{ psia})(8) = \underline{\textbf{160 psia}}$$