

**37.24** An isentropic air compressor has a volumetric compression ratio of 4 and the entering air is  $68^\circ F$ . What is the temperature of air exiting the compressor?

- A.  $120^\circ F$
- B.  $300^\circ F$
- C.  $460^\circ F$
- D.  $920^\circ F$

For a **Constant Entropy Process** with a known volumetric compression ratio, the relationship between the entering and leaving temperatures is described by the following equation.

$$\frac{T_2}{T_1} = \left(\frac{v_1}{v_2}\right)^{k-1}$$

Treat air as an ideal gas with  $k = 1.4$ . Recognize the process of compression *reduces* the volume, therefore  $v_1 > v_2$ , and the volumetric compression ratio,  $\frac{v_1}{v_2} = 4$ . Substitute into the equation and solve for the exit temperature. Make sure to use absolute temperature units ie. degrees Rankine, then convert back to degrees Fahrenheit for the final answer.

$$T_2 = T_1 \left(\frac{v_1}{v_2}\right)^{k-1} = (528^\circ R) (4)^{1.4-1} = 919.3^\circ R$$

$$T_2 = 919.3^\circ R - 460 = 459.3^\circ F$$

**Answer C**