

1.37

1.37 A rigid tank contains air at a pressure of 90 psia and a temperature of 60 °F. By how much will the pressure increase as the temperature is increased to 110 °F?

$$p = \rho R T \quad (\text{Eq. 1.8})$$

For a rigid closed tank the air mass and volume are constant so $\rho = \text{constant}$. Thus, from Eq. 1.8 (with R constant)

$$\frac{p_1}{T_1} = \frac{p_2}{T_2} \quad (1)$$

where $p_1 = 90 \text{ psia}$, $T_1 = 60^\circ\text{F} + 460 = 520^\circ\text{R}$,
and $T_2 = 110^\circ\text{F} + 460 = 570^\circ\text{R}$. From Eq. (1)

$$p_2 = \frac{T_2}{T_1} p_1 = \left(\frac{570^\circ\text{R}}{520^\circ\text{R}} \right) (90 \text{ psia}) = \underline{\underline{98.7 \text{ psia}}}$$