Question #79173, Engineering / Mechanical Engineering

The pressure in an isochoric automobile tire increases from 40.0 psia at 80.0 °F to 50.0 psia on a trip during hot weather. Assume the air behaves as an ideal gas. a) What was the air temperature inside the tire at the end of the trip. b) How much heat was absorbed per unit mass of air in the tire during the trip?

Solution

40.0 psia = 276 kPa

50.0 psia = 345 kPa

80.0 °F = 300 K

a) For isochoric gas,

$$\frac{p_1}{T_1} = \frac{p_2}{T_2};$$

$$T_2 = \frac{p_2 T_1}{p_1} = \frac{345 \times 300}{276} = 375\,\text{K}$$

b) $Q = Cm\Delta T$;

$$\frac{Q}{m} = C\Delta T = 1.008 \times 10^3 \times 75 = 75.6 \times 10^3\,\text{J/kg}$$