Solutions to:

Gas Law Homework Problem Set
Chemistry 145, Chapter 12

1. The volume of a bicycle tire is 1.20 liters and the manufacturer recommends a tire pressure of 150 PSI.

a. If you want the bicycle tire to have the correct pressure at 20.0 ºC, what volume of air is required at STP?

Information given in question:

$V := 1.20 \cdot liter$

$P := 150 \cdot psi \qquad P = 1.034 \cdot 10^{6} \cdot Pa$

$T := (273.15 + 20) \cdot K \qquad T = 293.15 \cdot K$

Note: you may work the problem using any pressure units, BUT you must use the same units for standard pressure and for the tire pressure.

Conditions at STP (Standard Temperature and Pressure):

$P_{STP} := 1 \cdot atm \qquad P_{STP} = 1.013 \cdot 10^{5} \cdot Pa$

$T_{STP} := 273.15 \cdot K \qquad T_{STP} = 273.15 \cdot K$

Mathematical relationship (the combined gas law):

$$\frac{P_1 \cdot V_1}{T_1} = \frac{P_2 \cdot V_2}{T_2}$$

Rearranges to

$$V_1 = P_2 \cdot \frac{V_2}{(T_2 \cdot P_1)} \cdot T_1$$

Substitute in variables for this problem

$$V_{STP} := P \cdot \frac{V}{(T \cdot P_{STP})} \cdot T_{STP}$$

$V_{STP} = 11.413 \cdot liter$