Answer on the question #59764, Chemistry / General Chemistry

Question:
Being an environmentally conscious person you fill the tires of you car with air when they are cold(10 degrees c) to a pressure of 60 lbs/in2 even though the manufacturer of the tires says not to fill beyond 38 lbs/in2. You then take the car on a trip to Pittsburgh during which the tires heat up to 75 degrees C. Assuming that the volume of the tires can't change because of the hardness of the rubber, what is the pressure in the tires when you reach Pittsburgh?

Solution:
If we treat the air in tires as an ideal gas, we can write:

$$\frac{p}{T} = const.$$

This means, that with all the other equals, ratio of pressure and temperature in the system (air in tires) is constant. Now let's consider the two states of our system: the first when you fill the tires and the second when you reach Pittsburgh.

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

Then, the pressure of air in the tires when you reach Pittsburgh is (don't forget to switch from degrees to Kelvins):

$$p_2 = T_2 \cdot \frac{p_1}{T_1} = (75 + 273.15\ K) \cdot \frac{60\ psi}{(10 + 273.15\ K)} = 74\ psi$$

Answer: 74 psi, or lbf/in2