## Answer on Question #54040 – Chemistry – Physical Chemistry

**Question:**

Push bike has got tyres with a 2.25’ rim diameter, 54mm tyre height and 2.5” tyre width. Calculate the a mount of air in the tyres in litres and kilograms if the tyre is pressurised to 60.0psi. How does pressure a ffect the volume of gas?

**Solution:**

Using given size the volume of each tyre can be found:

$V = \pi \times r^2 \times c$, where r – the radius of tyre and c – the circumference of tyre.

$r = d/2 = 2.25'' /2 = 1.125'' = 28.575$ mm, where d - the diameter of tyre

and

$c = 2\pi \times h = 2 \times 3.14 \times 54$ mm = 339.12 mm, where h – the tyre height.

Hence $V = 3.14 \times (28.575)^2 \times 339.12$ mm$^3$ = 869472 mm$^3$ = 0.869472 L for each tyre

According to the ideal gas law:

$pV = \mu RT = (m/M_w)RT$, where $\mu$ - the mass of air, $M_w$ – the molecular weight of air which is of 29,

p = 60 psi = 413.685 kPa,

the gas contact R = 8.31 L kPa K$^{-1}$ Mol$^{-1}$ and T – the normal temperature which equals 293 K (+20 C$^o$)

Thus, $m = (M_w\, pV)/(RT) = (29 \text{ g/mol} \times 413.625 \text{ kPa} \times 0.869472 \text{ L})/(8.31 \text{ L kPa K}^{-1} \text{ Mol}^{-1} \times 293 \text{ K}) = 4.283 \text{ g} = 0.004283 \text{ kg}$ in one tyre.

The total volume of air in two tyres is of 2×0.869472 L = 1.738944 L.

The total mass of air in two tyres is of 2×0.004283 kg = 0.008566 kg.

**Answer:** the volume of air is of 1.738944 L and the mass is of 0.008566 kg.

Increase in pressure yields a reduction of volume of the system at constant temperature.