Question #36084

Hi! Could you please explain the solution to me step by step?

At a party some balloons are filled with helium. To fill them they have used

gas from a bottle with volume 45 dm^3 and the pressure 1.00 MPa. The

balloons are made to hold a pressure of 150 kPa. How many such balloons you

can inflate if the balloons have an average volume of 4.0 dm^3?

Solution:

Let

$V_{bottle} = 45\ L$

$P_{bottle} = 1.00\ MPa = 1000\ kPa$

$V_{balloons} = 4\ L$

$P_{balloons} = 150\ kPa$

$N_{balloons} =?$

According to the Boyle's law (isothermal process)

$V_{bottle}P_{bottle} = P_{balloons}V_{total}$ were V_{total} is the total volume of the helium after inflating balloons

Such as after inflating the balloons in bottle is the helium too

$V_{total} = N_{balloons}V_{balloons} +\ V_{bottle}$

$V_{bottle}P_{bottle} = P_{balloons}(N_{balloons}V_{balloons} +\ V_{bottle})$

$$N_{balloons} = \frac{\frac{V_{bottle}P_{bottle}}{P_{balloons}} - V_{bottle}}{V_{balloons}}$$

$$N_{balloons} = \frac{\frac{45 * 1000}{150} - 45}{4} = 63.75$$

Such as the number of the balloons must be integer

Answer: 63 balloons.