Question # 81553

A heliox deep-sea diving mixture contains 2.0 g of oxygen to every 98.0 g of helium.What is the partial pressure of oxygen when this mixture is delivered at a total pressure of 8.7 bar ?

Answer:

The partial pressure of oxygen in this mixture at a pressure of 8.7 bar is equal to 0.02214 bar.

By the Raoult`s law [1], the partial pressure of oxygen is equal to:

$$p_{O_2} = P * \chi,$$

where P – the total pressure of gas mixture;

χ – the mole fraction of oxygen in the mixture.

$$\chi_{O_2} = \frac{\vartheta_{O_2}}{\vartheta_{O_2} + \vartheta_{He}}$$

$$v = \frac{m}{M}$$

First of all, it is needed to calculate the amount of oxygen and helium in the mixture:

$$v = \frac{2}{32} = 0.0625 \ mol$$

$$v = \frac{98}{4} = 24.5 \ mol$$

Next, it is necessary to count the mole fraction of oxygen in the mixture:

$$\chi_{O_2} = \frac{0.0625}{0.0625 + 24.5} = 0.002545$$

Consequently, the partial pressure of oxygen in this mixture at a pressure of 8.7 bar is equal to:

$$p_{O_2} = 8.7 * 0.002545 = 0.02214 \ bar$$

Reference:

[1]   https://en.wikipedia.org/wiki/Raoult%27s_law

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