

Air is about 78% N<sub>2</sub>, 21% O<sub>2</sub>, and 0.90% Ar. What is the mole fraction of each gas?

Solution:

Let  $V_{mixture} = 1L$ .

$$V(N_2) = 0.78 \times 1L = 0.78L;$$

$$V(O_2) = 0.21 \times 1L = 0.21L;$$

$$V(Ar) = 0.009 \times 1L = 0.009L;$$

$$n(N_2) = \frac{0.78L}{22.4 \text{ mole/L}} = 0.03482 \text{ moles};$$

$$n(O_2) = \frac{0.21L}{22.4 \text{ mole/L}} = 0.009375 \text{ moles};$$

$$n(Ar) = \frac{0.009L}{22.4 \text{ mole/L}} = 0.0004018 \text{ moles};$$

$$x(N_2) = \frac{0.03482}{0.03482 + 0.009375 + 0.0004018} = 0.7807;$$

$$x(O_2) = \frac{0.009375}{0.03482 + 0.009375 + 0.0004018} = 0.2102;$$

$$x(Ar) = \frac{0.0004018}{0.03482 + 0.009375 + 0.0004018} = 0.009009.$$

Answer: All numbers are rounded to the nearest 100 and 1000:  $x(N_2) = 0.78$ ,  $x(O_2) = 0.21$ ,  $x(Ar) = 0.009$ .

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