A container has 8360.0 torr of Nitrogen, 5.00 atm of Oxygen, 101.1 kPa of Argon, and 760.0 mm Hg of Carbon Dioxide.
What is the mole fraction of Oxygen?
A. 0.167
B. 0.267
C. 0.278
D. 0.467
E. 0.578

Solution:

A mixing of ideal gases is considered in the task.

According to Dalton's law, $P = \sum_{i=1}^{k} P_i$, where P - the total pressure of gas mixture, P_i - the partial pressure of the i-th component.

Ideal gas law for each component: $P_i = \frac{n_i RT}{V}$.

Then, $P = \sum_{i=1}^{k} P_i = \frac{RT}{V} \sum_{i=1}^{k} n_i$;

$P_i = n_i \frac{RT}{V} = \frac{n_i}{\sum_{i=1}^{k} n_i} P = x_i P$, x_i - the mole fraction of the i-th component in the mixture.

So, $P_1(N_2)$ = 8360.0 torr = 8360.0 mm Hg;

$P_2(O_2)$ = 5.00 atm = 3800.00 mm Hg;

$P_3(Ar)$ = 101.1 kPa = 758.31 mm Hg;

$P_4(CO_2)$ = 760.0 mm Hg.

P = 8360.0 mm Hg + 3800.00 mm Hg + 758.31 mm Hg + 760.0 mm Hg = 13678.31 mm Hg.

$$x(O_2) = \frac{3800.00 \text{mm Hg}}{13678.31 \text{mm Hg}} = 0.278$$

Answer: C. 0.278.