Answer on Question #81682, Chemistry / Organic Chemistry

Container "A" holds N2 gas with a mass of 54.6 g and is 4.1 times the volume of container "B" which holds argon (Ar) gas at the exact same temperature and pressure. What is the mass of the Ar (in g) within container "B"?

Solution

n=m/M

n(N_2)=$\frac{54.6\ g}{28\frac{g}{mol}} = 1.95\ mol$

Clapeyron-Mendeleev equation for nitrogen is:

$P_1V_1=n_1RT_1$

As n_1=1.95 mol, we get $P_1V_1=1.95RT_1$, $V_1=\frac{1.95RT_1}{P_1}$

Clapeyron-Mendeleev equation for argon is:

$P_2V_2=n_2RT_2$

$V_2=\frac{n_2RT_2}{P_2}$

As $\frac{V_1}{V_2} = 4.1$ and $P_1=P_2$, $T_1=T_2$, we get:

$$\frac{V_1}{V_2} = \frac{\frac{1.95RT_1}{P_1}}{\frac{n_2RT_2}{P_2}} = \frac{1.95RT_1}{P_1} \times \frac{P_2}{n_2RT_2} = \frac{1.95}{n_2}$$

$$\frac{1.95}{n_2} = 4.1$$

$$n_2 = 0.476$$

n(Ar)=0.476 mol

m=M×n

m(Ar)=40 g/mol ×0.476 mol = 19.04 g

Answer: 19.04 g