Question #62507, Chemistry / General Chemistry |

A glass vessel fitted with a stopcock has a mass of 337.428 g when evacuated. When filled with Ar, it has a mass of 339.857 g . When evacuated and refilled with a mixture of Ne and Ar, under the same conditions of temperature and pressure, it weighs 339.076 g
What is the mole percent of Ne in the gas mixture?

Answer:

According to Mendeleev-Clapeyron equation the volume of the flask equals:

V =(nRT)/p, where n – the number of moles for Ar, T – the temperature, p – the pressure.

$n = m(Ar)/Mr(Ar) = (339.857\ g – 337.428\ g)/40\ g\ mol^{-1} = 60.725\ mmol$

$V= 60.725\times10^{-3}\ (RT)/p$

The mass of the gas mixture is defined:

$m = m(Ne) + m(Ar) = Mr(Ne)\times n_1 + Mr(Ar)\times n_2$ = 339.076 g – 337.428 g = 1.648 g

where n_1 – the number of moles for Ne and n_2 – the number of moles for Ar.

At the same time the total volume is:

$V = [(n_1+n_2)RT]/p = 60.725\times10^{-3}\ (RT)/p$

$n_1+n_2 = 60.725\times10^{-3}$

$20n_1 + 40n_2 = 1.648$

$n_1= 60.725\times10^{-3} – n_2$

$1.2145 – 20n_2 + 40n_2 = 1.648$

$n_2 =21.675\times10^{-3}$ mol

$n_1= 60.725\times10^{-3} – 21.675\times10^{-3} = 39.05\times10^{-3}$ mol

Thus, the mole percent of Ne is:

$\mu = (100n_1)/(n_1+n_2) = (100 \times 39.05\times10^{-3})/ 60.725\times10^{-3} = 64.31\ \%$