Answer on Question #63427, Chemistry / General Chemistry

Chapter 15 (15.74)

A sample of nitrosyl bromide (NOBr) decomposes according to the equation $2NOBr(g) \rightleftharpoons 2NO(g)+Br2(g)$
An equilibrium mixture in a 5.00-L vessel at 100 ∘C contains 3.27 g of NOBr, 3.09 g of NO, and 8.23 g of Br2.
1) Calculate Kc.
2) What is the total pressure exerted by the mixture of gases?
3) What was the mass of the original sample of NOBr?

Solution:

1) Moles = Mass/Mol.mass

Moles NOBr =3.27 g / 109.8 g/mol = 0.0298 mol NOBr
Moles NO =3.09 g / 29.9 g/mol = 0.1033 mol NO
Moles Br2 =8.23 g / 159.9 g/mol = 0.0515 mol Br2

Concentration of NOBr = 0.0298 mol / 5.00 L = 0.00596 mol / L
Concentration of NO = 0.1033 mol / 5.00 L = 0.02066 mol / L
Concentration of Br2 = 0.0515 mol / 5.00 L = 0.0103 mol / L

Kc for the equation = [NO]^2 * [Br2] / [NOBr]^2

Kc = [0.02066 mol / L]^2 * [0.0103 mol / L] / [0.00596 mol / L]^2 = 17.6 x 10^{-3} mol / L

2) Use the ideal gas equation PV=nRT

P=nRT/V
n= 0.0298 mol + 0.1033 mol + 0.0515 mol = 0.1846 mol
T = 100 + 273= 373 K
P= 0.1846 mol x 373 K x 8.3 J/molK / 0.005 m^3 = 114300. 6 Pa = 857.3 Tor

3) We use conservation of mass

m (NOBr) = 3.27 g + 3.09 g + 8.23 g = 14.59 g

Answer: 1) 17.6 x 10^{-3} mol / L; 2) 857.3 Tor; 3) 14.59 g