Answer on Question #72994 - Chemistry - Physical Chemistry

Question:

Question 12 : A container with volume 71.9 ml contains water vapor at a pressure of 10.4 atm and a temperature of 465oC. How many grams of the gas are in the container?
0.183 g
0.222 g
0.129 g
0.421 g

Solution:

Ideal gas law can be used to establish the link between the mass of the gas m, its volume V, temperature T and pressure p through the molar mass $M = 18.01528 \cdot 10^{-3} (\text{kg mol}^{-1})$:

$$pV = nRT => pV = \frac{m}{M} RT,$$

where n is the number of the moles of the gas and R is the ideal gas constant, $8.314 (J\ mol^{-1}\ K^{-1})$.

$$m = \frac{pVM}{RT},$$

$$m = \frac{10.4 \cdot 101325 (Pa) \cdot 71.9 \cdot 10^{-6} (m^3) \cdot 18.01528 \cdot 10^{-3} (\text{kg mol}^{-1})}{8.314 (J\ mol^{-1}\ K^{-1}) \cdot (465 + 273.15) (K)}$$

$$m = 2.22 \cdot 10^{-4}\ kg = 0.222\ g$$

Answer: 0.222 g

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