

Answer on Question # 72990 - Chemistry - Physical Chemistry

Question 18 : A container with volume 71.9 ml contains water vapor at a pressure of 10.4 atm and a temperature of 465°C. How many grams of the gas are in the container?

0.421 g

0.129 g

0.222 g

0.183 g

Solution

The mass of a gas can be calculated using the Ideal gas law:

$$m = MPV/(RT),$$

where M is the molar mass, P is the pressure, V is the volume and T is a temperature (R is a universal gas constant).

Converting the values given to SI units:

$$P = 10.4 \text{ atm} (101325 \text{ Pa/atm}) = 1053780 \text{ Pa},$$

$$M = 18 \text{ g/mol (for H}_2\text{O)},$$

$$V = 71.9 \text{ mL} (1 \text{ m}^3/10^6 \text{ mL}) = 7.19 \cdot 10^{-5} \text{ m}^3,$$

$$T = 465 \text{ }^\circ\text{C} + 273.15 = 738.15 \text{ K}.$$

Computing the mass using the Ideal gas law:

$$m = (18 \cdot 1053780 \cdot 7.19 \cdot 10^{-5}) / (8.314 \cdot 738.15) = 0.222 \text{ g}.$$

Answer: 0.222 g.