

Answer on 45487, Physics, Molecular Physics | Thermodynamics

Question

If the mass of one litre of a gas at 273k and pressure 760mm/Hg equals 5.236gm, calculate the mass of one mole of that gas.

Solution

According to Mendeleev-Clapeyron equation:

$$PV = (m/M)RT ,$$

where M is a molar mass (the mass of 1 mole of a given substance),

R - gas constant,

V- volume,

P – pressure,

T – temperature,

m - mass.

From it:

$$M = mRT/PV$$

After units conversion to SI we can calculate M:

$$M = 5.236 \cdot 10^{-3} \cdot 8.314 \cdot 273 / 101325 \cdot 1 \cdot 10^{-3} = 0.117289 \text{ Kg} \approx 117.3 \text{ g}$$

Answer: the mass of one mole of that gas is 117.3 g. Probably, boron trichloride (BCl₃) is that gas.