Answer on Question #73755, Physics / Molecular Physics | Thermodynamics

A flask weighs 50.26g when completely empty and weighs 50.94g when full of air at 35°C and 80cm Hg. What is the density of air at STP if the capacity of the flask is 500cm^3.

Solution

$$\rho = \frac{m}{V};$$

1) Find the mass of the air:

m = 50.94 – 50.26 = 0,68 (g) = 68 × 10^{-5}(kg)

2) Find the volume at STP

$$\frac{P_1 V_1}{T_1} = \frac{P_{STP} V_{STP}}{T_{STP}};$$

P_1, V_1, T_1 – parameters given in the task,

500 cm^3 = 0.0005 m^3

35°C = 308 K

80 cm Hg = 800 mm Hg

$$V_{STP} = \frac{P_1 V_1 T_{STP}}{T_1 P_{STP}} = \frac{800 \times 0.0005 \times 273}{308 \times 760} = 4{,}67 \times 10^{-4} \ (m^3);$$

$$\rho = \frac{68 \times 10^{-5}}{4.67 \times 10^{-4}} = \textbf{1.46 (kg/m}^3\textbf{)}$$

Answer

The density of air at STP is **1.46 kg/m³**.