

Answer on Question #66938 - Chemistry - General Chemistry

Question:

what is the volume in liters of 15.75g of methane gas (CH₄) at 25.4C and 1.47atm?

Solution:

For this task we use the ideal gas law:

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

P - is the pressure of the gas, Pa. Conversion of atm to Pa: 1 atm = 101325 Pa.

V - is the volume of the gas, m³; Conversion of m³ to liters: 1 m³ = 1000 l.

m - is the mass of gas, g;

M – is the molar mass of the gas, g/mol;

R - is the universal gas constant = 8.31 J mol⁻¹ K⁻¹;

T - is the absolute temperature of the gas, K. Conversion of °C to K: K=°C+273.15.

Express volume from the above and convert result from m³ to liters:

$$V=((m/M)RT/P)*1000$$

Molar mass of methane is 12.01 + (1.01 * 4) = 16.05 g/mol.

Do the calculation:

$$V= ((15.75g / 16.05g/mol) * 8.31 J mol^{-1} K^{-1} * (25.4+273.15) K / (1.47 * 101325) Pa) * 1000 = 16.35 \text{ liters.}$$

Answer:

The volume of methane is 16.35 liters.