

Question

$PV=nRT$

Propane is a gas commonly used as a home fuel for cooking and heating.

Calculate the volume that 0.540 mol of propane occupies at STP.

Think about the size of this volume and the amount of propane that it contains. Why do you think propane is usually liquified before it is transported?

Solution

From the ideal gas law

$$V = \frac{nRT}{P}$$

$n = 0.540 \text{ mol}$

universal gas constant $R = 8.314 \text{ J/mol}\cdot\text{K}$

standard temperature $T = 273.15 \text{ K}$

standard pressure $P = 101\,325 \text{ Pa}$

Substituting the values into the formula we obtain

$$V = \frac{0.540 \cdot 8.314 \cdot 273.15}{101\,325} = 0.0121 \text{ m}^3 = 12.1 \text{ l}$$

It is very large volume, considering that the weight of such amount of propane is only

$$m = n \cdot M = 0.540 \cdot 44 = 23.76 \text{ g}$$

So it is clear, that propane is liquified with the aim of its volume minimization.

Answer: 12.1 l