

Answer on Question #43568 - Chemistry - Physical Chemistry

Question:

What volume would 48 g of methane (CH₄) gas occupy at STP?

Answer:

The ideal gas equation is:

$$PV = nRT$$

where **P** is the absolute pressure (atm), **V** is the volume of gas (L), **n** is number of moles of CH₄, **T** is the thermodynamic temperature (K), R is the gas constant with value $0.0821 \frac{\text{L atm}}{\text{mol K}}$.

$$n = \frac{m}{M}$$

where *m* – is mass of CH₄, *M* – is molecular mass of CH₄ and it is 16 g/mol.

273 K and 1 atm pressure are referred to as **the standard temperature and pressure (STP)**.

Then

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

$$V = \frac{48 \text{ g} \cdot 0.0821 \frac{\text{L atm}}{\text{mol K}} \cdot 273 \text{ K}}{16 \frac{\text{g}}{\text{mol}} \cdot 1 \text{ atm}} = 67.2399 \approx 67.2 \text{ L}$$

Answer: d) 67.2 L