

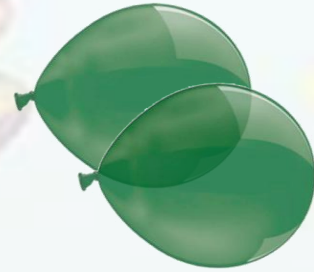


fivogadro's Law

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The Obvious Truth

- You blow up two balloons.
 - They are both the same size.
 - Why?



They both contain the same amount of air.

- You blow up two more balloons.
 - One is twice as big as the other.
 - Why?



The bigger one contains twice as much air.

The Law



- Under the same conditions of temperature and pressure, equal volumes of gases contain the same number of moles of particles.

$$V = k n$$

V = volume; k = constant; n = number of moles

The Consequences

- If, as Avogadro says, under the same conditions of temperature and pressure, equal volumes of gases contain the same number of moles of particles, then . . .



under the same conditions of temperature and pressure, 1 mole of different gases must always have equal volumes.

- The volume of 1 mole of gas at STP (Standard Temperature and Pressure) is always the same –

22.4L

Problem 1



Sample Problem 1: Moles to Volume

- How many liters do 3.50 moles of oxygen occupy at STP?

$$(3.50 \text{ mol}) \left(\frac{22.4 \text{ L}}{1 \text{ mol}} \right) = 78.4 \text{ L}$$

Problem 2



Sample Problem 2: Volume to Moles

- How many moles of nitrogen occupy 186 L at STP?

$$(186 \text{ L}) \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) = 8.30 \text{ mol}$$

Problem 3



Sample Problem 3: Grams to Volume

- What is the volume of 84.21 g of methane (CH_4) at STP?

$$(84.21 \text{ g}) \left(\frac{1 \text{ mol}}{16.04 \text{ g}} \right) \left(\frac{22.4 \text{ L}}{1 \text{ mol}} \right) = 118 \text{ L}$$

Problem 4



Sample Problem 4: Volume to Grams

- What is the mass of 25.0 *mL* of dinitrogen trioxide (N_2O_3) at STP?

$$(25.0 \text{ mL}) \left(\frac{10^{-3} \text{ L}}{1 \text{ mL}} \right) \left(\frac{1 \text{ mol}}{22.4 \text{ L}} \right) \left(\frac{76.02 \text{ g}}{1 \text{ mol}} \right) = 8.48 \times 10^{-2} \text{ g}$$