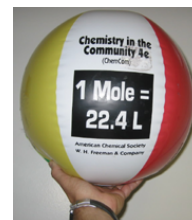


A Mole of Gas

22.4 liters of gas!

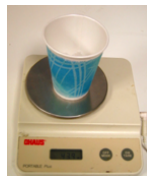


22.4 liters of gas is the volume of 1 mole of gas at STP (Standard Temperature and Pressure = 0 degrees C at 1 ATM). Here's a couple of ways to see what 6.02×10^{23} of gas molecules looks like.

Mole in a bag

Equipment:

- A large garbage bag
- Dry Ice
- Massing scale



To do and notice:

- Place 44 grams of dry ice into a garbage bag.
 - Get rid of all extraneous air and seal the bag.
 - Let dry ice sublime and allow the bag to expand.
 - Optional: To speed up the sublimation process, place the dry ice, while in the sealed bag, into a cup of hot water.
- Note: Always take appropriate precautions when working with dry ice!

What's going on?

Dry Ice is Carbon Dioxide or CO_2 . The molecular weight of CO_2 is:

| | | |
|--------------------------|---|-----------------|
| 1 mole worth of Carbon | = | 12.0gram |
| +2 moles worth of Oxygen | = | 2 x 16.0 grams |
| <u>Total</u> | = | <u>44 grams</u> |



After the gas has all sublimed, the final volume will be 22.4 liters (actually a little bit more since most classrooms are not kept at STP)

A Mole in a bottle

Equipment:

- 11 2-liter bottles
- 1 slightly smashed .5-liter bottle (to make approximately .4 liters)



To do and notice:

Just cap the empty bottles (they're not really emptythey are full of gas)

What's going on?

11 x 2 liters is 22 liters, plus .4 liters makes a total volume of 22.4 liters.

If you want to compensate for pressure and temperature, use $PV = nRT$.

Note: The volume of 1 mole at sea level and room temperature will be closer to 24 liters.

Note: Mole beach balls can be acquired through the American Chemical Society (www.acs.org).