Chemistry 11
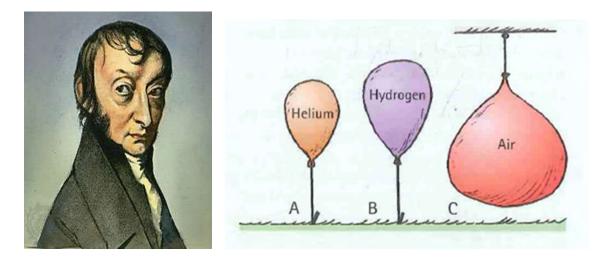**Calculating Molar Volume**

Amedeo Avogadro was fascinated by gases and used them in many of his experiments. After working with gases for many years he came up with the hypothesized:

If gases are subjected to the same temperature and pressure then they will occupy the same volume.

HOW BIG IS <u>MOLAR VOLUME</u>?

o   **Molar volume is dependent on exposing gases to the <u>same conditions</u>**

o   **For the purposes of this course we will be using the <u>S</u>tandard <u>T</u>emperature and <u>P</u>ressures (<u>STP</u>) of:**

   0°C and 1 atm (101.3 kPa)

o   **Please note that is STP is different from the value used in your textbook (where pressure is set at <u>100.0 kPa</u>), therefore some of the answers in the key will be off**

o   **The chemistry staff at EMS have decided to use the volume value for 1atm of pressure which is <u>22.4 L/ mole</u> of gas.**

Types of Molar Volume calculations:

Here are sample calculations that you will be asked to do, calculate the:
      A. **number of moles** of a gas at STP (when given the volume (in L)
      B. **number of moles** of a gas at STP(when given a value other than L)
      C. **volume** of a gas at STP (when given the number of moles)

Example A:

How many **moles** are in 50.0 L of Oxygen gas at STP?

First identify that you have a gas at STP therefore you can use **22.4 L/ mole**

Then set up your expression to allow for unit conversions:

50.0 L O_2 (g)	1 mole	= 2.23 moles O_2 (g)
	22.4 L O_2 (g)	

Example B:

How many **moles** are there in 250.0 mL of Carbon dioxide gas at STP?

First identify that you have a volume value other than L and you need to **convert**!
Second identify that you have a gas at STP therefore you can use **22.4 L/ mole**

Then set up your expression to allow for unit conversions:

250.0 mL O_2 (g)	1×10^{-3} L	1 mole O_2 (g)	= 1.11×10^{-3} moles O_2 (g)
	1 mL	22.4 L O_2 (g)	

Example C:
If you have 0.75 moles of Nitrogen monoxide gas at STP, what **volume** does it fill?

First identify that you have a gas at STP therefore you can use **22.4 L/ mole**
Second identify if you are asked to solve for a volume other than L…if so: **convert**!

Then set up your expression to allow for unit conversions:

0.75 mol NO (g)	22.4 L	= 17 L NO (g)
	1 mole NO (g)	

Molar VOLUME calculations

PART A: Calculate the number of moles of gas present in the following volumes of gas at STP:

MOLAR VOLUME CALCULATIONS
PART A: Calculate the number of moles of gas present in the following volumes of gas at STP

1. 375 mL of phosphorous pentachloride gas

2. 5.0 L of hydrogen gas

3. 450.0 mL of dinitrogen tetroxide gas

4. 30 L of Helium gas

5. 85.7 cL of nitrogen gas

PART B: Calculate the volume occupied by each of these gases at STP.

1. **number of L** in 12.5 mol of NH_3 (g)

2. **number of mL** in 0.350 mol oxygen gas

3. **number of L** in 6.02 x 10^{23} mol of Argon gas

4. **number of dL** in 180 mol of Hydrogen gas

5. **number of L** in 15.0 mol of Nitrogen dioxide gas