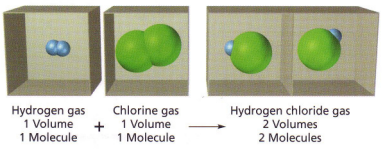
# Volume of a Gas

Mr. Sudbury

## Gay-Lussac

- ***Gay-Lussac's Law of combining volumes of gases*** says that at a constant temperature and pressure, the volume of gaseous reactants and products can be expressed as ratios of small whole numbers.




## Mole Ratios for Reactions Involving Gases

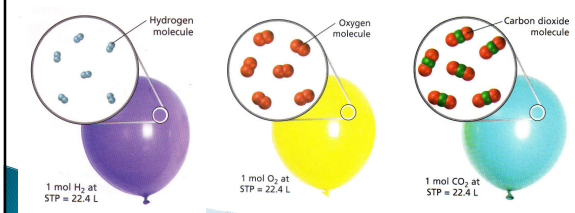
$2H_{2\,(g)} + O_{2\,(g)} \rightarrow 2H_2O_{\,(g)}$

## Remember when....

- The Mole?
  - Avogadro's Number
    - $6.022 \times 10^{23}$ atoms, particles, or molecules
  - Molar Mass
    - The mass one mole from looking on the Periodic Table.

## Avogadro's (Gas) Law

- ***Avogadro's Law*** – Equal volumes of gases at the same temperature and pressure contain the same number of molecules.




## Avogadro's Law

- Avogadro's Law indicates that the gas volume is directly proportional to the amount of gas, at a given pressure and temperature.

## Standard Molar Volume of a Gas

- The volume occupied by one mole of a gas at STP is known as the standard molar volume of a gas.
- 22.4 Liters
- This means that 1 mole of any gas has a volume of 22.4 L (@ STP: 1 atm and 0°C)

## Standard Molar Volume of a Gas

1 mole of any gas = 22.4L

## Mole-Volume Conversions

What volume does 1.75 moles of $CO_2$ occupy at STP?

## Volume Conversions

What volume will 7.4 mol of $O_2$ occupy @ STP?

## Volume Conversions

- The reaction for the combustion of methane is:

$$CH_{4(g)} + 2O_{2(g)} \rightarrow 2H_2O_{(g)} + CO_{2(g)}$$

- If you begin the reaction with 14.5 moles of methane, what volume of carbon dioxide will you form?

## Volume Conversions

- The reaction for the combustion of methane is:

$$CH_{4(g)} + 2O_{2(g)} \rightarrow 2H_2O_{(g)} + CO_{2(g)}$$

- If you begin the reaction with 40.0 L of oxygen, what volume of carbon dioxide will you form?

## The End

- 1 mole = 22.4 L @ STP