

# Further Application of the Ideal-Gas Equation (Stoichiometry)

Advanced Chemistry

# Introduction

$^{\circ}\text{C} + 273.15$

atm  
L  
mol  
K

- ▶ Ideal Gas Law:  $PV = nRT$ , where  $R = 0.08206 \text{ L-atm/mol-K}$
- ▶ In this section, we will connect the ideal gas law to the concept of the stoichiometry

# Using Ideal Gas Law & Stoichiometry

- ▶ We can use both ideal gas law & stoichiometry to find values for compounds.
- ▶ If given moles/grams: *Start stoic*
  - ▶ Use mole ratio to determine moles of the other compound
  - ▶ From there, use ideal-gas law & information in problem to determine what you are trying to find
- ▶ If not given moles/grams: *Start ideal*
  - ▶ Use information from the problem and ideal-gas law to determine moles of one compound
  - ▶ Then determine what you are trying to find and use stoichiometry to get there.

# Example

- If an air bag has a volume of 36.0 L and is to be filled with nitrogen gas at 1.15 atm and 26.0°C, how many grams of NaN<sub>3</sub>, must be decomposed?

$P = 1.15 \text{ atm}$

$V = 36 \text{ L}$

$n = x$

$R = .08206$

$T = 299.15$



$$(1.15)(36) = (x)(.08206)(299.15)$$

$$\frac{41.4 = 24.548249x}{24.548249}$$

$x = 1.686474665$   
mol N<sub>2</sub>

$$1.686474665 \text{ mol N}_2 \times \frac{2 \text{ mol NaN}_3}{3 \text{ mol N}_2} \times \frac{65.01 \text{ g NaN}_3}{1 \text{ mol NaN}_3} = 73.1 \text{ g NaN}_3$$

N<sub>2</sub>

N<sub>2</sub>

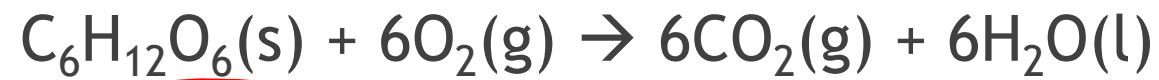
## More Practice

- ▶ How many grams of  $\text{CaH}_2$  are needed to generate 145.0 L of  $\text{H}_2$  gas if the pressure of  $\text{H}_2$  is 825.0 torr at  $21.00^\circ\text{C}$ ?



## Example

- ▶ Calculate the volume of dry  $\text{CO}_2$  produced at body temperature ( $37.0^\circ\text{C}$ ) and  $0.970\text{ atm}$  when  $24.5\text{ g}$  of glucose is consumed in the reaction.



$$24.5\text{ g glucose} \times \frac{1\text{ mol glucose}}{180.1548\text{ g glucose}} \times \frac{6\text{ mol CO}_2}{1\text{ mol glucose}} = 0.8159649368\text{ mol CO}_2$$

$$(.970)(x) = (.8159649368)(.08206)(310.15)$$

$$.97x = 20.76704935$$

$$\frac{20.76704935}{.97}$$

$$x = 21.4\text{ L CO}_2$$

## More Practice

- ▶ How many liters of  $\text{NH}_3(\text{g})$  at  $850.0^\circ\text{C}$  and  $5.00\text{ atm}$  are required to react with  $1.00\text{ mol}$  of  $\text{O}_2(\text{g})$  in this reaction?

