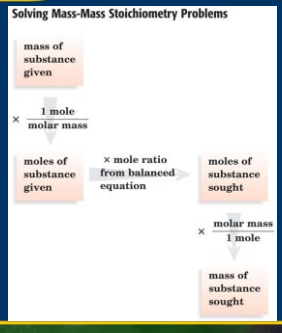
Mass to Mole and Mole to Mass Calculations



Conversions of Quantities in Moles, *continued*

Sample Problem

- In a spacecraft, the carbon dioxide exhaled by astronauts can be removed by its reaction with lithium hydroxide, LiOH, according to the following chemical equation.
- $CO_2(g) + 2LiOH(s) \rightarrow Li_2CO_3(s) + H_2O(l)$
- How many moles of lithium hydroxide are required to react with 20 mol CO_2, the average amount exhaled by a person each day?

Conversions of Quantities in Moles, *continued*

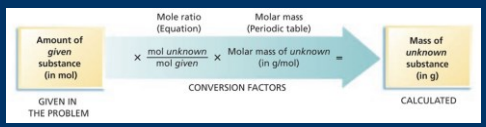
Sample Problem Solution

- $CO_2(g) + 2LiOH(s) \rightarrow Li_2CO_3(s) + H_2O(l)$
- **Given:** amount of CO_2 = 20 mol
- **Unknown:** amount of LiOH (mol)
- **Solution:**

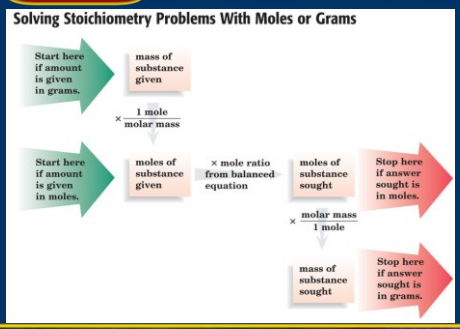
$$\text{mol } CO_2 \times \frac{\text{mol LiOH}}{\text{mol } CO_2} = \text{mol LiOH}$$

$$20 \text{ mol } CO_2 \times \frac{2 \text{ mol LiOH}}{1 \text{ mol } CO_2} = 40 \text{ mol LiOH}$$

Conversions of Amounts in Moles to Mass



Solving Stoichiometry Problems With Moles or Grams



Conversions of Amounts in Moles to Mass, *continued*

- **Sample Problem**
- In photosynthesis, plants use energy from the sun to produce glucose, $C_6H_{12}O_6$, and oxygen from the reaction of carbon dioxide and water.
- What mass, in grams, of glucose is produced when 3.00 mol of water react with carbon dioxide?

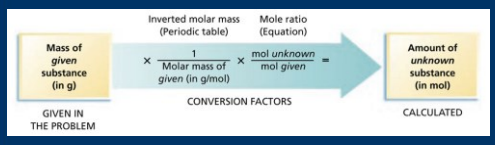
Conversions of Amounts in Moles to Mass,

- **Sample Problem Solution**
- **Given:** amount of H_2O = 3.00 mol
- **Unknown:** mass of $C_6H_{12}O_6$ produced (g)
- **Solution:**
- Balanced Equation: $6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(s) + 6O_2(g)$
- $\text{mol } H_2O \times \frac{\text{mol } C_6H_{12}O_6}{\text{mol } H_2O} \times \frac{\text{g } C_6H_{12}O_6}{\text{mol } C_6H_{12}O_6} = \text{g } C_6H_{12}O_6$

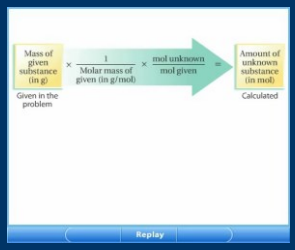
$$3.00 \text{ mol } H_2O \times \frac{1 \text{ mol } C_6H_{12}O_6}{6 \text{ mol } H_2O} \times \frac{180.18 \text{ g } C_6H_{12}O_6}{1 \text{ mol } C_6H_{12}O_6} =$$

90.1 g C6H12O6

Conversions of Mass to Amounts in Moles



Conversion of Quantities in Moles



Conversions of Mass to Amounts in Moles,

Sample Problem

- The first step in the industrial manufacture of nitric acid is the catalytic oxidation of ammonia.
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- $NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(g)$ **(unbalanced)**

- The reaction is run using 824 g NH_3 and excess oxygen.
- a. How many moles of NO are formed?
- b. How many moles of H_2O are formed?

Conversions of Mass to Amounts in Moles,

Sample Problem Solution

- **Given:** mass of NH_3 = 824 g
- **Unknown:** **a.** amount of NO produced (mol)
- **b.** amount of H_2O produced (mol)
- **Solution:**
- Balanced Equation: $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$
-

molar mass factor *mol ratio*

$$\text{g NH}_3 \times \frac{\text{mol NH}_3}{\text{g NH}_3} \times \frac{\text{mol NO}}{\text{mol NH}_3} = \text{mol NO}$$

$$\text{g NH}_3 \times \frac{\text{mol NH}_3}{\text{g NH}_3} \times \frac{\text{mol H}_2\text{O}}{\text{mol NH}_3} = \text{mol H}_2\text{O}$$

Conversions of Mass to Amounts in Moles,

Sample Problem Solution, *continued*

molar mass factor *mol ratio*

a. $824\ \text{g NH}_3 \times \frac{1\ \text{mol NH}_3}{17.04\ \text{g NH}_3} \times \frac{4\ \text{mol NO}}{4\ \text{mol NH}_3} = 48.4\ \text{mol NO}$

b. $824\ \text{g NH}_3 \times \frac{1\ \text{mol NH}_3}{17.04\ \text{g NH}_3} \times \frac{6\ \text{mol H}_2\text{O}}{4\ \text{mol NH}_3} = 72.5\ \text{mol H}_2\text{O}$