

# Notes 3

## Moles to Mass Calculations



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# Molar Mass Factors

## Molar mass conversion factors

- are written from molar mass.
- relate grams and moles of an element or compound.

*Example:* Write molar mass factors for methane, CH<sub>4</sub>, used in gas stoves and gas heaters.

Molar mass:

$$1 \text{ mol CH}_4 = 16.042 \text{ g}$$

Conversion factors:

$$\frac{16.042 \text{ g CH}_4}{1 \text{ mole CH}_4} \quad \text{and} \quad \frac{1 \text{ mole CH}_4}{16.042 \text{ g CH}_4}$$

# Learning Check

Acetic acid  $C_2H_4O_2$  gives the sour taste to vinegar. Write two molar mass conversion factors for acetic acid.



Timberlake, *General, Organic, and Biological Chemistry*. Copyright © Pearson Education Inc., publishing as Benjamin Cummings

# Solution

Acetic acid  $\text{C}_2\text{H}_4\text{O}_2$  gives the sour taste to vinegar.  
Write two molar mass factors for acetic acid.

Calculate molar mass:

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Calculate molar mass:

$$24.022 + 4.032 + 31.998 = 60.052 \text{ g/mole}$$

$$1 \text{ mole of acetic acid} = 60.052 \text{ g acetic acid}$$

Molar mass factors

# Solution

Acetic acid  $\text{C}_2\text{H}_4\text{O}_2$  gives the sour taste to vinegar.  
Write two molar mass factors for acetic acid.

Calculate molar mass:

$$24.0 + 4.04 + 32.0 = 60.0 \text{ g/mole}$$

$$1 \text{ mole of acetic acid} = 60.0 \text{ g acetic acid}$$

Molar mass factors

$$\frac{1 \text{ mole acetic acid}}{60.052 \text{ g acetic acid}} \quad \text{and} \quad \frac{60.052 \text{ g acetic acid}}{1 \text{ mole acetic acid}}$$

# Calculations Using Molar Mass

Molar mass factors are used to convert between the grams of a substance and the number of moles.



# Moles to Grams

Aluminum is often used to build lightweight bicycle frames. How many grams of Al are in 3.00 mole Al?

Molar mass equality:



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Molar mass equality: 1 mole Al = 26.982 g Al

Setup with molar mass as a factor:

# Moles to Grams

Aluminum is often used to build lightweight bicycle frames. How many grams of Al are in 3.00 mole Al?

Molar mass equality: 1 mole Al = 27.0 g Al

Setup with molar mass as a factor:

$$3.00 \text{ mole Al} \times \frac{26.982 \text{ g Al}}{1 \text{ mole Al}} = 80.946 \text{ g Al}$$

*molar mass factor for Al*

# Learning Check

Allyl sulfide  $C_6H_{10}S$  is a compound that has the odor of garlic. How many moles of  $C_6H_{10}S$  are in 225 g?



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# Solution

Calculate the molar mass of  $\text{C}_6\text{H}_{10}\text{S}$ .

# Solution

Calculate the molar mass of  $C_6H_{10}S$ .

$$(6 \times 12.011) + (10 \times 1.008) + (1 \times 32.066) = 114.212 \text{ g/mole}$$

Set up the calculation using a mole factor.

# Solution

Calculate the molar mass of  $C_6H_{10}S$ .

$$(6 \times 12.0) + (10 \times 1.01) + (1 \times 32.1) = 114.2 \text{ g/mole}$$

Set up the calculation using a mole factor.

$$225 \text{ g } \cancel{C_6H_{10}S} \times \frac{1 \text{ mole } \cancel{C_6H_{10}S}}{72.066 \text{ g } \cancel{C_6H_{10}S}}$$

*molar mass factor (inverted)*

# Solution

Calculate the molar mass of  $C_6H_{10}S$ .

$$(6 \times 12.0) + (10 \times 1.01) + (1 \times 32.1) = 114.2 \text{ g/mole}$$

Set up the calculation using a mole factor.

$$225 \text{ g } \cancel{C_6H_{10}S} \times \frac{1 \text{ mole } \cancel{C_6H_{10}S}}{72.066 \text{ g } \cancel{C_6H_{10}S}}$$

*molar mass factor (inverted)*

$$= 1.97 \text{ mole } C_6H_{10}S$$