

Moles - Mass Relationship

- One mole (6.02×10^{23} particles) has a specific mass, called the molar mass.

molar mass: the sum of the atomic masses of all the atoms of each element in a compound

1 mole = molar mass (g)

to make this into a ratio we can use to solve problems:

$$\frac{1 \text{ mol}}{\text{molar mass}}$$

or

$$\frac{\text{Molar mass}}{1 \text{ mol}}$$

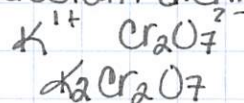
- calculating molar mass - get out your Periodic Table!

Examples

1. water - H_2O

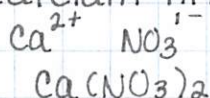
$$\begin{aligned} 2 \text{H} \times 1.01 \text{g} &= 2.02 \text{g} \\ 1 \text{O} \times 16.00 \text{g} &= +16.00 \text{g} \\ \hline &18.02 \text{g} \end{aligned}$$

2. potassium dichromate



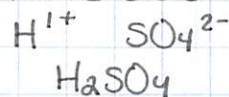
$$\begin{aligned} 2 \text{K} \times 39.10 \text{g} &= 78.20 \text{g} \\ 2 \text{Cr} \times 52.00 \text{g} &= 104.00 \text{g} \\ 7 \text{O} \times 16.00 \text{g} &= +112.00 \text{g} \\ \hline &294.20 \text{g} \end{aligned}$$

3. calcium nitrate



$$\begin{aligned} 1 \text{Ca} \times 40.08 \text{g} &= 40.08 \text{g} \\ 2 \text{N} \times 14.01 \text{g} &= 28.02 \text{g} \\ 6 \text{O} \times 16.00 \text{g} &= +96.00 \text{g} \\ \hline &164.10 \text{g} \end{aligned}$$

4. sulfuric acid



$$\begin{aligned} 2 \text{H} \times 1.01 \text{g} &= 2.02 \text{g} \\ 1 \text{S} \times 32.07 \text{g} &= 32.07 \text{g} \\ 4 \text{O} \times 16.00 \text{g} &= +64.00 \text{g} \\ \hline &98.09 \text{g} \end{aligned}$$

- Solving problems.

1st determine the unknown & the given

2nd write the formula $\text{Au}^{3+} \text{CN}^{-}$
 $\text{Au}(\text{CN})_3$

examples

1. How many moles are in 25.00g of gold (III) cyanide?
unknown given.

We will be using dimensional analysis & molar mass to solve these problems.

4th solve the problem!

$$\frac{25.00\text{g Au}(\text{CN})_3}{275.03\text{g}} \times \frac{1\text{mol}}{1} = .0908991746 = .09090\text{ mol Au}(\text{CN})_3$$

Molar Mass - Au(CN)₃

$$1 \text{ Au} \times 196.97\text{g} = 196.97\text{g}$$

$$3 \text{ C} \times 12.01\text{g} = 36.03\text{g}$$

$$3 \text{ N} \times 14.01\text{g} = +42.03\text{g}$$

$$\underline{275.03\text{g}}$$

3rd calculate the molar mass of the formula

2. What is the mass of 0.295 moles of carbon tetrachloride?
unknown given

$$\frac{0.295\text{mol CCl}_4}{1\text{mol}} \times \frac{153.81\text{g}}{1} = 45.37395 = 45.4\text{g CCl}_4$$

Molar Mass - CCl₄

$$1 \text{ C} \times 12.01\text{g} = 12.01\text{g}$$

$$4 \text{ Cl} \times 35.45\text{g} = +141.80\text{g}$$

$$\underline{153.81\text{g}}$$

$\text{Na}^+ \text{Cl}^-$
 NaCl

3. How many moles are in 200.0g of sodium chloride?
unknown given

$$\frac{200.0\text{g NaCl}}{58.44\text{g}} \times \frac{1\text{mol}}{1} = 3.422313484 = 3.422\text{ mol NaCl}$$

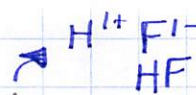
Molar Mass - NaCl

$$1 \text{ Na} \times 22.99\text{g} = 22.99\text{g}$$

$$1 \text{ Cl} \times 35.45\text{g} = +35.45\text{g}$$

$$\underline{58.44\text{g}}$$

4. what is the mass of 6.50×10^{-4} moles of hydrofluoric acid?



$$\frac{6.50 \times 10^{-4} \text{ mol HF}}{1 \text{ mol}} \times \frac{20.01 \text{ g}}{1 \text{ mol}} = .0130065 = .0130 \text{ g HF}$$

Molar Mass - HF

$$1 \text{ H} \times 1.01 \text{ g} = 1.01 \text{ g}$$

$$1 \text{ F} \times 19.00 \text{ g} = +19.00 \text{ g}$$

$$20.01 \text{ g}$$