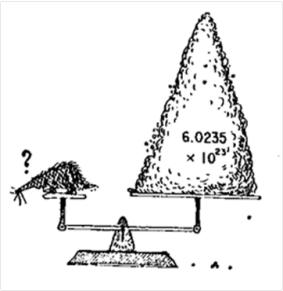
9.3 Moles of Compounds



1. Review!

A. What is the molar mass of oxygen?

16.00 g/mole

B. How about diatomic oxygen?

32.00 g/mole

Molar Mass Process

To determine a compound's molar mass:
1. Assume that you have one mole of compound.
2. Write the formula of your compound.
3. List each element in the compound, as well as how many moles of each element in the compound.
4. Multiply the moles of each element by that element's molar mass (in grams).
5. Add all the masses together. (Units = g/mol)

2. Molar Mass Guided Practice

Formulas tell how many moles of each element there are in on mole of compound.

How many moles of each element are there in calcium bicarbonate: $Ca(HCO_3)_2$?

Mole Inventory:
Ca = 1 mole
H = 2 moles
C = 2 moles
O = 6 moles

Stalactites in a cave

2. Molar Mass Calculation

One mole of $Ca(HCO_3)_2$

Mole inventory:

Ca: $1\,mol\,Ca \bullet \frac{40.08\,g\,Ca}{mol\,Ca} = 40.08\,g\,Ca$

H: $2\,mol\,H \bullet \frac{1.01\,g\,H}{mol\,H} = 2.02\,g\,H$

C: $2\,mol\,C \bullet \frac{12.01\,g\,C}{mol\,C} = 24.02\,g\,C$

O: $6\,mol\,O \bullet \frac{16.00\,g\,O}{mol\,O} = 96.00\,g\,O$

Sum masses to find molar mass:
162.12 g/mol $Ca(HCO_3)_2$.

3. Example

Find the molar mass of water.
Formula = H_2O
Molar inventory:

H: $2\,mol\,H \bullet \frac{1.01\,g\,H}{mol\,H} = 2.02\,g\,H$

O: $1\,mol\,O \bullet \frac{16.00\,g\,O}{mol\,O} = 16.00\,g\,O$

Sum of individual masses:
18.02 g/mole H_2O

4. Moles to Mass Application:

The molar mass of water is 18.02 g/mole. How many grams of water in 8.50 moles?

$$8.50\,\cancel{moles\ H_2O} \bullet \frac{18.02\,g\,H_2O}{1\,\cancel{mole\ H_2O}} = 153\,g\,H_2O$$

5. Mass to Moles Application:

The molar mass of water is 18.02 g/mole. How many moles of water is 2.500 kg (2,500. g)?

$$2{,}500.\,\cancel{g\ H_2O} \bullet \frac{1\,mole\,H_2O}{18.02\,\cancel{g\ H_2O}} = 138.7\,mol\,H_2O$$

6. Example

Find the molar mass of lithium sulfate.
Formula = Li_2SO_4
Molar inventory:

H: $2\,mol\,Li \bullet \frac{6.94\,g\,Li}{1\,mol\,Li} = 13.88\,g\,Li$

S: $1\,mol\,S \bullet \frac{32.07\,g\,S}{mol\,S} = 32.07\,g\,S$

O: $4\,mol\,O \bullet \frac{16.00\,g\,O}{mol\,O} = 64.00\,g\,O$

Sum of individual masses:
109.95 g/mole Li_2SO_4

Moles of Elements in Compounds

Ratios of elements (atoms or moles) in formulas can be used to calculate amounts.

7. Ratio example: in lithium sulfate (Li_2SO_4), the ratios of elements in the formula are:

$\frac{2\,mol\,Li}{1\,mol\,Li_2SO_4}$ and $\frac{1\,mol\,S}{1\,mol\,Li_2SO_4}$ and $\frac{4\,mol\,O}{1\,mol\,Li_2SO_4}$

How many moles of oxygen are there in 2.16 moles of Li_2SO_4?

$$2.16\,\cancel{mol\,Li_2SO_4} \bullet \frac{4\,mol\,O}{1\,\cancel{mol\,Li_2SO_4}} = 8.64\,mol\,oxygen$$

Homework

9.3 Booklet Problems
Due: Next class