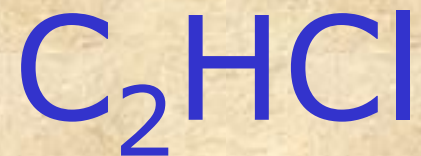# Empirical and Molecular Formulas

Other kinds of chemical formulas are **empirical** and **molecular** formulas.
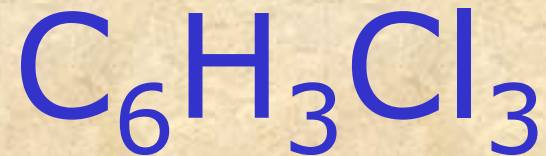
Empirical Formulas

Empirical formulas give the *lowest whole number ratio* of the atoms in a compound.

C_2HCl

True or Molecular Formulas

The true or molecular formula gives the *exact composition* of one molecule.

$$C_6H_3Cl_3$$

Empirical	Molecular
HO	H_2O_2
CH	C_6H_6
CH	C_2H_2
NO_2	N_2O_4
H_2O	H_2O

Steps to determine Empirical Formula

- 1. Assume 100 gram sample
- 2. Convert % (if given to grams)
- 3. Change each mass to moles
- 4. Divide ALL moles by the smallest # of moles
- *5. Do not round: if 1.5 moles then double everything to obtain a whole # (3)

Empirical formulas can be calculated using experimental data:

- Given that a certain compound is 69.58% Ba, 6.090% C and 24.32% O, calculate the empirical formula of this compound.

Assume that you have 100.00 g of the compound:

 69.58% Ba = 69.58 g Ba

 6.090% C = 6.090 g C

24.32% O = 24.32 g O

Convert the mass of each element to moles of that element:

- Ba = (69.58 g Ba)(1 mol/137.3 g)
      = 0.5068 mol Ba

C = (6.090 g C)(1 mol/12.01)
    =   0.5071 mol C

O =   (24.32 g O)(1 mol/16.00 g)
       =   1.520 mol O

Empirical Formula

- Divide through each value by the smallest number of moles to get a 1 : 1.001 : 2.999 ratio, which rounds of nicely to give the formula $BaCO_3$

Try the quiz

1. Honors Chem:

http://www.quia.com/quiz/618428.html

2. Academic Chem:

http://www.quia.com/quiz/363518.html

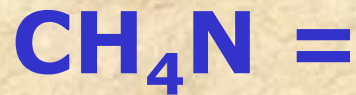# Use the empirical formula to determine the molecular formula

- Empirical Formula is

$$CH_4N$$

- Molecular Formula
  - Has a mass of 60 g/m

Use the empirical formula to determine the molecular formula

- Empirical Formula is

  CH$_4$N =

  30 g/m

60 g/m
_____ =

30 g/m

2

Molecula Formula

- 2 (CH_4N) or

$$C_2H_8N_2$$