9/26/2018

Aspirin: 60.00% C
4.48% H
35.52% O
→ emp. formula ?

Assume 100-g sample

$60.00\,g\ C \times \frac{1\,mol\ C}{12.01\,g\ C} = 4.9958\,mol\ C$

$4.48\,g\ H \times \frac{1\,mol\ H}{1.008\,g\ H} = 4.444\,mol\ H$

$35.52\,g\ O \times \frac{1\,mol\ O}{16.00\,g\ O} = 2.220\,mol\ O$

÷ 2.220 mol

2.2504 C ≈ 2.25

2.0018 H ≈ 2

1.000 'O' ≈ 1

$C_{4.996}H_{4.44}O_{2.220}$

"pseudoformula"

× 4

≈ 9 C, ≈ 8 H, ≈ 4 'O'

empirical formula of aspirin → $C_9H_8O_4$

Sugars (carbohydrates) have an empirical formula of CH_2O

If fructose has a molar mass of 180.2 g/mol, what is its molecular formula?

$n = \frac{\text{molar mass}}{\text{emp. form. mass}} \approx 6$

Molecular formula = Empirical formula × n (1, 2, 3, 4, ...)

mol. form. $= (CH_2O)_n = C_nH_{2n}O_n$

$= (CH_2O)_6 = \boxed{C_6H_{12}O_6}$

CH_2O

1 × C = 12.01

2 × H = 2.016

1 × O = 16.00

30.03 g/mol

Writing + balancing chemical eqns

ex: $CH_4(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g)$

state symbols
(s) = solid
(l) = liquid
(g) = gas
(aq) = aqueous - dissolved in H_2O

Reactants "yields" Products

#atoms

C : 1	C : 1
H : 4	H : 2
O : 2	O : 3

not "balanced" ⇒ violates law of conservation of mass!

Need to balance this eqn by adjusting coefficients.

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

C 1	C 1
H 4	H ~~2~~ 4
O ~~2~~ 4	O ~~3~~ 4

ex: $\left(C_2H_6 + 3\frac{1}{2}O_2 \longrightarrow 2CO_2 + 3H_2O \right) \times 2$

C : 2	C : ~~*~~ 2
H : 6	H : ~~2~~ 6
O : ~~2~~ 7	O : ~~3~~ ~~5~~ 7

$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

C : 4	C : 4
H : 12	H : 12
O : 14	O : 14

$$2KClO_3 \longrightarrow 2KCl + 3O_2$$

Balance: $(KClO_3 \longrightarrow KCl + \frac{1}{2}O_2) \times 2$

K: 1	K: 1
Cl: 1	Cl: 1
O: 3	O: ~~2~~ 3

... practice!!! Read: pages 122-126

Chapter 4: Chemical Quantities + Aqueous Rxns

consider: $2C_2H_6(g) + 7O_2(g) \longrightarrow 4CO_2(g) + 6H_2O(g)$

can read this as, say, ...

2 molecules of C_2H_6 form 4 molecules of CO_2

or more usefully...

2 mol C_2H_6 form 4 mol CO_2

Coefficients in bal. eq give us the MOLAR RATIOS!

2 mol C_2H_6 = 4 mol CO_2
7 mol O_2 = 6 mol H_2O
2 mol C_2H_6 = 7 mol O_2

} conversion factors!

We use this info to help predict amounts used/formed.

STOICHIOMETRY