Empirical Formula HW

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9. The molecular formula tells you the actual number of atoms that make up the molecule or formula unit

11. It is important to know the molecular formula because even if two compounds have the same empirical formula they can have different chemical properties & applications.

12. $N_2O_4 \div 2 = NO_2$

molecular → empirical

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31. Assume 100g sample

$m_C = 80.04\ g$ $\qquad$ $m_H = 19.96\ g$

$n_C = 80.04\ g \times \frac{1\ mol}{12.011\ g}$ $\qquad$ $n_H = 19.96\ g \times \frac{1\ mol}{1.008\ g}$

$= 6.6639\ mol$ $\qquad$ $= 19.802\ mol$

C : H

$\frac{6.6639}{6.6639} : \frac{19.802}{6.6639}$

1 : 3

∴ the empirical formula is CH_3

32. $m_{Mg} = 58.2\,g$ $\quad m_{Cl} = 41.8\,g$

$n_{Mg} = 58.2\,g \times \frac{1\,mol}{24.305\,g}$ $\quad n_{Cl} = 41.8\,g \times \frac{1\,mol}{35.453\,g}$

$= 2.395\,mol$ $\quad = 1.179\,mol$

Mg : Cl

$\frac{2.395\,mol}{1.179\,mol} : \frac{1.179\,mol}{1.179\,mol}$

2 : 1

∴ the empirical formula is Mg_2Cl

33. Assume a 100g sample

$m_{Cu} = 40.0\,g$ $\quad m_S = 20.0\,g$ $\quad m_O = 40.0\,g$

$n_{Cu} = 40.0\,g \times \frac{1\,mol}{63.546\,g}$ $\quad n_S = 20.0\,g \times \frac{1\,mol}{32.065\,g}$ $\quad n_O = 40.0\,g \times \frac{1\,mol}{15.999\,g}$

$= 0.629\,mol$ $\quad = 0.624\,mol$ $\quad = 2.500\,mol$

Cu : S : O

$\frac{0.629}{0.624} : \frac{0.624}{0.624} : \frac{2.500}{0.624}$

1 : 1 : 4

∴ the empirical formula is $CuSO_4$

35. $m_H = 17.6\,g$ $\quad$ $m_N = 82.4\,g$

$n_H = 17.6\,g \times \frac{1\,mol}{1.008\,g}$ $\quad$ $n_N = 82.4\,g \times \frac{1\,mol}{14.007\,g}$

$= 17.46\,mol$ $\quad$ $= 5.883\,mol$

H : N

$\frac{17.46}{5.883} : \frac{5.883}{5.883}$

3 : 1

H_3N

∴ the empirical formula is H_3N or NH_3