Chemistry 11

The Mole V

Name:
Date:
Block:

1. **Empirical Formula**
2. **Percent Composition**

Empirical Formula

Molecular Formula:

Ex:

Empirical Formula:

Ex:

Structural Formula:

Ex:

Molecular Formula	Empirical Formula
P_4O_{10}	
$C_{10}H_{22}$	
$C_6H_{18}O_3$	
$C_5H_{12}O$	
N_2O_4	

1. Vinegar is a dilute solution of acetic acid. The molar mass of acetic acid is 60.06 g/mol and it has an empirical formula of CH_2O. What is the molecular formula of acetic acid?

2. A compound has an empirical formula of C_3H_4. Which of the following are possible molar masses of the compound? 20 g/mol, 55 g/mol, 80 g/mol, 120 g/mol.

3. A compound has an empirical formula of CH_2 and a molar mass of 42.09 g/mol. Determine its molecular formula.

4. A compound is 48.65% carbon, 8.11% hydrogen and 43.24% oxygen. Determine the empirical formula.

⇒ Think about having 100.0 g of the substance rather than as a %...

⇒ Convert % into moles…

⇒ Divide each molar quantity by the smallest one

⇒ Multiply by whatever factor is necessary to get a whole number ratio.

5. A compound contains 9.93 g C, 58.6 g Cl, and 31.4 g F. Determine its empirical formula.

6. A small sample of antifreeze was analyzed. It contained 4.51 g C, 1.13 g H and 6.01 g O. It was determined that the molar mass is 62.0 g/mol. What is the molecular formula of antifreeze?

7. A hydrocarbon is a compound containing only carbon and hydrogen. One particular hydrocarbon is 92.29% carbon by mass. If the compound's molar mass is 78.0 g/mol then what is its molecular formula?

Percent Composition

Percent Composition:

- The percent of a compound's **mass** contributed by <u>each type of atom</u> in the compound.
- Determined from the formula.

8a. Find the percent of carbon by <u>mass</u> in ethane, C_2H_6.

8b. Find the percent of hydrogen by <u>mass</u> in ethane, C_2H_6.

9. What is the percent composition of each type of a sugar with the formula $C_{12}H_{22}O_{11}$?

Practice:

10. Calculate the % composition of the following compounds:

    a. $FeCl_2$

    b. $C_2H_4O_2$

    c. $CaCl_2.2H_2O$

    d. $(NH_4)_3PO_4$

    e. $NaOH$

    f. $Ag(NH_3)_2Cl$

    g. $K_3Fe(CN)_6$

    h. $CaCO_3$

11. Calculate the % of the bold species in the following compounds:

    a. $CaCl_2.2\mathbf{H_2O}$

    b. $Al_2(SO_4)_3.18\mathbf{H_2O}$

    c. $Cr(\mathbf{NH_3})_6Cl_3.H_2O$

    d. $Fe_2(\mathbf{SO_4})_3.9H_2O$

    e. $Cu(\mathbf{C_2H_3O_2})_2.2NH_3$

    f. $NiSO_4.7\mathbf{H_2}$

1. $C_2H_4O_2$ 2. 80g/mol and 120g/mol 3. C_3H_6 4. $C_3H_6O_2$ 5. CCl_2F_2 6. $C_2H_6O_2$ 7. C_6H_6 8a. 79.85% b. 20.15%
9. 42.098% C, 6.491% H, 51.411% O 10a. Fe: 44.06% Cl: 55.94% b. C: 39.99% H: 6.73% O: 53.28%
c. Ca:27.26% Cl: 48.22% H: 2.75% O: 21.77% d. N: 28.19% H: 8.13% P: 20.77% O: 42.92%
e. Na: 57.48% O: 40.00% H: 2.53% f. Ag: 60.81% N: 15.79% H: 3.42% Cl: 19.98%
g. K: 35.62% Fe: 16.96% C: 21.88% N: 25.53% h. Ca: 40.04% C: 12.00% O: 47.96%
11a. 24.51% b. 48.66% c. 36.70% d. 51.27% e. 54.74% f. 8.37%