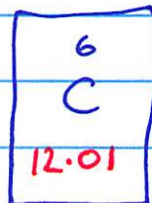


9/24/2018

Formula Mass + Mole Concept for Compounds

Earlier: av'g mass of atom = atomic mass



ex: 1 atom C = 12.01 u C

$$1 \text{ mol} = 6.022 \times 10^{23}$$

1 mol C = 12.01 g C

Average mass of a compound = formula mass.

ex: C_2Cl_6

$$2 \times \text{C} = 2 \times 12.01 \text{ u}$$

$$6 \times \text{Cl} = 6 \times 35.45 \text{ u}$$

$$\underline{\underline{236.72 \text{ u}}}$$

Just like before, we also can say:

$$1 \text{ mol } \text{C}_2\text{Cl}_6 = 236.72 \text{ g } \text{C}_2\text{Cl}_6$$

We say the molar mass of C_2Cl_6 is 236.72 g/mol

Counting by weighing !!

Q1. How many moles of C_2Cl_6 molecules are there in a 58.0 g sample?

Q2. How many molecules is this?

$$\text{A1. } 58.0 \text{ g } \cancel{\text{C}_2\text{Cl}_6} \times \frac{1 \text{ mol } \text{C}_2\text{Cl}_6}{236.72 \text{ g } \cancel{\text{C}_2\text{Cl}_6}} = 0.245 \text{ mol } \text{C}_2\text{Cl}_6$$

$$\text{A2. } 0.245 \text{ mol } \text{C}_2\text{Cl}_6 \times \frac{6.022 \times 10^{23} \text{ molecules } \text{C}_2\text{Cl}_6}{1 \text{ mol } \text{C}_2\text{Cl}_6} = 1.48 \times 10^{23} \text{ molecules } \text{C}_2\text{Cl}_6$$

Q1: How many mol of H_2O are there in 0.500g ?

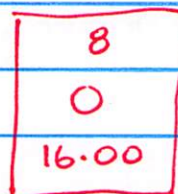
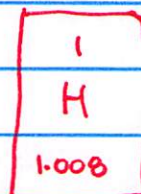
Q2: How many molecules is this?



$$2 \times H = 2 \times 1.008$$

$$1 \times O = 1 \times 16.00$$

$$\underline{18.02}$$



$$1 \text{ mol } H_2O = 18.02 \text{g } H_2O$$

$$A1. \quad 0.500 \text{g } H_2O \times \frac{1 \text{ mol } H_2O}{18.02 \text{g } H_2O} = 0.027747 \text{ mol } H_2O$$

guard digits.

$$A2. \quad 0.027747 \text{ mol } H_2O \times \frac{6.022 \times 10^{23} H_2O}{1 \text{ mol } H_2O} = 1.67 \times 10^{22} \text{ molecules } H_2O$$

Composition of compounds

- can calculate mass % of a given element in a cpd.
- can be used to ID + detⁿ purity.

Ex: Calculate mass % of elements in CCl_2F_2

$$1 \times C = 1 \times 12.01 = 12.01$$

$$2 \times Cl = 2 \times 35.45 = 70.90$$

$$2 \times F = 2 \times 19.00 = 38.00$$

$$\underline{120.91}$$

$$\%Cl = \frac{\text{mass Cl}}{\text{mass cpd}} = \frac{70.90 \text{g/mol}}{120.91 \text{g/mol}} \times 100$$

$$= 58.64\%$$

$$\%F = \frac{\text{mass F}}{\text{mass cpd}} = \frac{38.00 \text{g/mol}}{120.91 \text{g/mol}} \times 100$$

$$= 31.43\%$$

$$\%C = \frac{\text{mass of C}}{\text{mass of cpd}} \times 100 = \frac{12.01 \text{g/mol}}{120.91 \text{g/mol}} \times 100 = 9.933\%$$

Determining formulas from % data!

Plan: % elements $\xrightarrow{\times/100}$ g-elements $\xrightarrow{\text{atomic mass}}$ mol-elements

⊗ empirical formula
simplest ratio
molecular formula $\xleftarrow[\text{molar mass emp. formula.}]{\text{by molar mass cpd}}$ empirical formula

Ex: Aspirin is : $\left. \begin{array}{l} 60.00\% \text{ C} \\ 4.48\% \text{ H} \\ 35.52\% \text{ O} \end{array} \right\} \rightarrow \text{empirical formula.}$