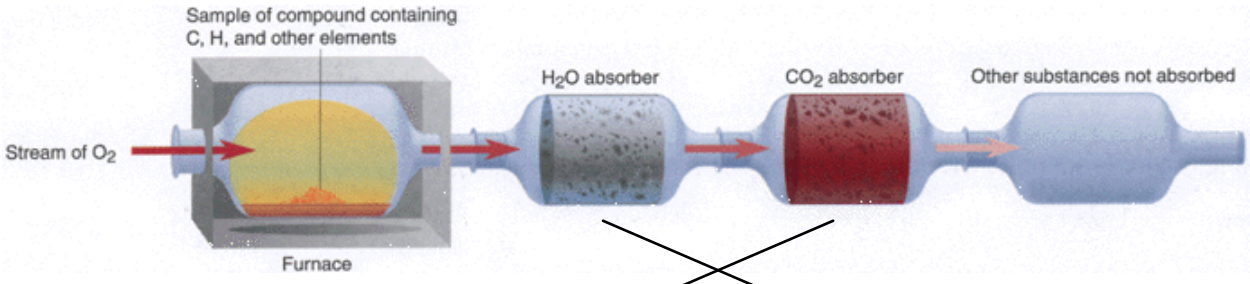
SCH 3U

FINDING EMPIRICAL & MOLECULAR FORMULAS BY EXPERIMENT

PART A: CARBON-HYDROGEN ANALYZER



$C_xH_yX_z$
combusts in excess O_2

m_{CO_2} m_{H_2O} m_X

n_{CO_2} n_{H_2O}

$\times 2$

n_C n_H n_X

$\div$ smallest n

State $C_xH_yX_z$
with whole number ratio.

EXAMPLES:

① A compound containing carbon, hydrogen and lead is burned in a C-H analyzer. If 37.8 g of CO_2, 23.2 g of H_2O and 44.5 g of Pb are recovered, what is the empirical formula?

② When a sample of a compound containing only carbon and hydrogen is burned in a C-H analyzer, 3.98 g of H_2O and 9.62 g of CO_2 are produced. If the molar mass of the compound is 84.0 g/mol what is the molecular formula?

③ A sample of a compound containing carbon, hydrogen and oxygen with a mass of 8.00 g was analyzed in a C-H analyzer. 14.06 g CO_2 and 6.72 g of H_2O were recovered. What is the empirical formula of the compound?

PART B: HYDRATED SALTS

Ionic compounds have a set number of loosely bound water molecules weakly bonded to them.

Gentle heat removes the water through evaporation.

NAMING/WRITING FORMULAS: | ionic compound name • ***prefix*** *hydrate*

Prefix -- mono, di, tri, tetra, penta, hexa, hepta, octa, nona, deca

Eg. $MgCl_2 \bullet 3H_2O$

Eg. $PbSO_4 \bullet 6H_2O$

Eg. copper (II) sulfate pentahydrate

$$\text{IONIC} \bullet x\text{H}_2\text{O} \xrightarrow{\Delta} \text{IONIC} + x\text{H}_2\text{O}$$

Hydrated salt → anhydrous salt

$$m_{hydrate} = m_{anhydrate} + m_{H_2O}$$

$$n_{anhydrate} + n_{H_2O}$$

smaller

$$1 : x$$

EXAMPLES:

① If 4.79 g of hydrated calcium chloride is heated, 1.17 g of water evaporates. What is the formula of the hydrated salt?

② If 5.742 g of hydrated magnesium sulfate (Epsom salts) is heated until all the water has been released, 2.801 g of anhydrous magnesium sulfate remains. What is the formula of hydrated magnesium sulfate?