

## Empirical formula(EF) and molecular formula (MF)

**EF:**

**Simplest ratio of atoms** of each element in the compound

**Example:**



**MF:**

**Actual ratio of atoms** of each element in the compound

**Example:**



molar mass                      molar mass  
molecular formula =  $n(\text{Empirical formula})$

 **LIVEWORKSHEETS**

An organic compound M contains only carbon, hydrogen and oxygen. A sample of 2.40 g of M is combusted completely in excess oxygen to produce 5.28 g of  $\text{CO}_2$  and 2.88 g of  $\text{H}_2\text{O}$ .

Based on the combustion data, determine the empirical formula of M.

If it is **burning or combustion**, the reaction will involve Oxygen gas



Mass of the C in  $\text{CO}_2$  is the mass of C in the P. Use molar mass ratio method to determine the mass of C in  $\text{CO}_2$

Mass of the H in  $\text{H}_2\text{O}$  is the mass of H in the P. Use molar mass ratio method to determine the mass of H in  $\text{H}_2\text{O}$

 **LIVEWORKSHEETS**

$$\text{Mass of C in CO}_2 = \frac{\text{molar mass C}}{\text{molar mass CO}_2} \times \text{mass CO}_2$$

$$= \frac{\boxed{\phantom{000}} \text{ g/mol}}{\boxed{\phantom{000}} \text{ g/mol}} \times \boxed{\phantom{000}} \text{ g}$$

$$= \boxed{\phantom{000}}$$



Do you know why we cannot use the **same method @ molar mass ratio of O** to determine the mass of Oxygen in compound P?

LIVEWORKSHEETS

$$\text{Mass of H in H}_2\text{O} = \frac{\text{molar mass H}}{\text{molar mass H}_2\text{O}} \times \text{mass H}_2\text{O}$$

$$= \frac{\boxed{\phantom{000}} \text{ g/mol}}{\boxed{\phantom{000}} \text{ g/mol}} \times \boxed{\phantom{000}} \text{ g}$$

$$= \boxed{\phantom{000}}$$

$$\text{Mass of ibuprofen} = \text{mass C} + \text{mass H} + \text{mass O}$$

$$\text{mass O} = \boxed{\phantom{000}}$$

LIVEWORKSHEETS

Element	C	H	O
Mass, g	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mole	$\frac{\text{Mass C}}{\text{Molar mass C}} = \frac{\text{Mass C}}{\text{Molar mass C}}$ <input type="text"/> <input type="text"/>	$\frac{\text{Mass H}}{\text{Molar mass H}} = \frac{\text{Mass H}}{\text{Molar mass H}}$ <input type="text"/> <input type="text"/>	$\frac{\text{Mass O}}{\text{Molar mass O}} = \frac{\text{Mass O}}{\text{Molar mass O}}$ <input type="text"/> <input type="text"/>
Ratio of mole	$\frac{\text{Mole of C}}{\text{Smallest mole}} = \frac{\text{Mole of C}}{\text{Smallest mole}}$ <input type="text"/> <input type="text"/> $=$ <input type="text"/>	$\frac{\text{Mole of H}}{\text{Smallest mole}} = \frac{\text{Mole of H}}{\text{Smallest mole}}$ <input type="text"/> <input type="text"/> $=$ <input type="text"/>	$\frac{\text{Mole of O}}{\text{Smallest mole}} = \frac{\text{Mole of O}}{\text{Smallest mole}}$ <input type="text"/> <input type="text"/> $=$ <input type="text"/>
Simplest ratio	<input type="text"/>	<input type="text"/>	<input type="text"/>

Empirical formula ibuprofen = C  H  O

**molar mass                      molar mass**  
**molecular formula = n(Empirical formula)**

= n

n =

MF = C  H  O