

06/03/22

How many lithium (Li) atoms are there in 23.55 grams of Li?

$$23.55 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.94 \text{ g Li}} \times \frac{6.02 \times 10^{23} \text{ atoms}}{\text{mol}} = 2.04 \times 10^{24} \text{ atoms Li}$$

How many grams of silicon (Si) do you have if you have 11.54 moles of Si?

$$11.54 \text{ mol Si} \times \frac{28.09 \text{ g}}{\text{mol}} = 324.16 \text{ g Si}$$

How many moles of chlorine gas (Cl_2) are there in 83.4 grams of chlorine gas?

$$83.4 \text{ g Cl}_2 \times \frac{1 \text{ mol Cl}_2}{2 \times 35.45 \text{ g}} = 1.18 \text{ mol Cl}_2$$

What is the molar mass of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)?

$$\begin{aligned} 6 \times 12.01 \text{ g/mol} &= 72.06 \text{ g} \\ 12 \times 1.008 \text{ g/mol} &= 12.096 \text{ g} \\ 6 \times 16.00 \text{ g/mol} &= 96.00 \text{ g} \\ \hline 180.16 \text{ g/mol of } \text{C}_6\text{H}_{12}\text{O}_6 \end{aligned}$$

If you have a sample of glucose that contains 7.85×10^{25} atoms of hydrogen, how many grams of glucose do you have?

$$7.85 \times 10^{25} \text{ atoms H} \times \frac{1 \text{ molecule } C_6H_{12}O_6}{12 \text{ atoms H}} \times \frac{1 \text{ mol } C_6H_{12}O_6}{6.02 \times 10^{23} \text{ molecules}} \times \frac{180.16 \text{ g}}{\text{mol}} = 1957.7 \text{ g}$$

How many moles of carbon dioxide (CO_2) do you have if you have 75.6 grams of CO_2 ?

$$75.6 \text{ g } CO_2 \times \frac{1 \text{ mol } CO_2}{44.02 \text{ g}} = 1.72 \text{ mol } CO_2$$

How many oxygen atoms are there in 133.5 grams of calcium phosphate?



$$(3 \times 40.08) + (2 \times 30.97) + (8 \times 16) = 310.18 \text{ g/mol}$$

$$133.5 \text{ g } Ca_3(PO_4)_2 \times \frac{1 \text{ mol}}{310.18 \text{ g}} \times \frac{8 \text{ mol O}}{1 \text{ mol } Ca_3(PO_4)_2} \times \frac{6.02 \times 10^{23} \text{ O}}{1 \text{ mol O}} = 2.07 \times 10^{24} \text{ atoms O}$$

What is the mass percentage of carbon in benzene (C_6H_6)?

$$6 \times 12.01 + 6 \times 1.008 = 78.11 \text{ g/mol}$$

the carbon is 72.06 g of that 78.11 g

$$\text{so } \frac{72.06}{78.11} \times 100 = 92.2\% \text{ carbon by mass}$$

What is the empirical formula of a substance that is 75.91% C, 6.38% H and 17.72% N by mass?

$$\text{In } 100 \text{ g} \quad 75.91 \text{ g C} \times \frac{1 \text{ mol}}{12.01 \text{ g}} = 6.32 \text{ mol C}$$

$$6.38 \text{ g H} \times \frac{1 \text{ mol}}{1.008 \text{ g}} = 6.33 \text{ mol H}$$

$$17.72 \text{ g N} \times \frac{1 \text{ mol}}{14.01 \text{ g}} = 1.26 \text{ mol N}$$

C: H: N is 6.32:6.33:1.26 divide by 1.26
to get 5:5:1 $\rightarrow C_5H_5N$

Combustion is when you burn a material in the presence of oxygen.

- If there is carbon in the material you will get CO_2 as a product of the combustion – and all of the carbon in the CO_2 will have come from the material that was combusted.
- If there is hydrogen in the material you will get water as a product of the combustion – and all of the hydrogen in the H_2O
- Oxygen atoms in the CO_2 and in the H_2O may have come from the original material **or** from the oxygen involved in the combustion process.

You have 50.0 grams of a material that contains carbon, hydrogen and **maybe** oxygen. You combust the material and collect the water and the carbon dioxide that results. You collect 95.6 grams of CO_2 and 59.1 grams of H_2O . Did the original material contain oxygen atoms? Prove your answer. Then determine the empirical formula of the material.

$$95.6 \text{ g } CO_2 \times \frac{1 \text{ mol } CO_2}{44.02 \text{ g } CO_2} \times \frac{1 \text{ mol C}}{1 \text{ mol } CO_2} = 2.17 \text{ mol C in original}$$

$$59.1 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.02 \text{ g}} \times \frac{2 \text{ mol H}}{1 \text{ mol } H_2O} = 6.56 \text{ mol H in original}$$

Was there O in original? $2.17 \text{ mol C} \rightarrow 26.06 \text{ g C}$ $6.56 \text{ mol H} \rightarrow 6.61 \text{ g H}$ $\rightarrow$ not equal to 50.0g

$$17.33 \text{ g O in original} \rightarrow 1.08 \text{ moles O in original}$$

$$C: H: O \quad 2.17:6.56:1.08 \quad \text{or} \quad 2:6:1$$

