05/31/24

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

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

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

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

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

$83.4\ g\ Cl_2 \times \frac{1\ mol\ Cl_2}{2 \times 35.45\ g} = 1.18\ mol\ Cl_2$

What is the molar mass of glucose ($C_6H_{12}O_6$)?

$6 \times 12.01\ g/mol = 72.06\ g$

$12 \times 1.008\ g/mol = 12.096\ g$

$6 \times 16.00\ g/mol = 96.00\ g$

$180.16\ g/mol$ of $C_6H_{12}O_6$

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

$$7.85\times10^{25}\ \text{atoms H} \times \frac{1\ \text{molecule } C_6H_{12}O_6}{12\ \text{atoms H}} \times \frac{1\ \text{mol } C_6H_{12}O_6}{6.02\times10^{23}\ \text{molecules}} \times \frac{180.16\ \text{g}}{\text{mol}}$$

$$= 1957.7\ \text{g}$$

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?

$$Ca^{2+},\ PO_4^{3-} \longrightarrow Ca_3(PO_4)_2$$

$$(3\times40.08)+(2\times30.97)+(8\times16) = 310.18\ \text{g/mol}$$

$$133.5\ \text{g } Ca_3(PO_4)_2 \times \frac{1\ \text{mol}}{310.18\ \text{g}} \times \frac{8\ \text{mol O}}{1\ \text{mol } Ca_3(PO_4)_2} \times \frac{6.02\times10^{23}\ \text{O}}{1\ \text{mole}} = 2.07\times10^{24}\ \text{atoms O}$$

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

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

the carbon is 72.06 g of that 78.11 g

so $\frac{72.06}{78.11} \times 100 = 92.2\%$ 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?

In 100 g

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

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

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

C : H : N is 6.32 : 6.32 : 1.26 divide by 1.26

to get 5 : 5 : 1 → C_5H_5N

Combustion is when your 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 **and/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 mol C → 26.06 g C } not equal to 50.0 g

6.56 mol H → 6.61 g H

17.33 g O in original → 1.08 moles O in original

C : H : O 2.17 : 6.56 : 1.08 or 2 : 6 : 1

C_2H_6O