Answer on Question # 60386 - Chemistry - General Chemistry

Calculate the numbers of atoms in 100g of CO_2, and Glucose($C_6H_{12}O_6$).

Solution

The number of moles of a substance (n) is related to its mass (m) and molar mass (M) by a formula

$$n = \frac{m}{M};$$

The number of molecules (N) is bridged with number of moles with Avogadro's number (N_A):

$$N = nN_A;$$

consequently,

$$N = \frac{mN_A}{M}.$$

The molar mass of carbon dioxide is M(CO_2)=44.01 g/mol,

$$N(CO_2) = \frac{mN_A}{M} = \frac{100 \cdot 6.02 \cdot 10^{23}}{44.01} = 1.368 \cdot 10^{24} \, molecules$$

As one molecule of CO_2 contains 3 atoms, the total number of atoms is

$$N(CO_2) = 1.368 \cdot 10^{24} \cdot 3 = 4.104 \cdot 10^{24} \, atoms.$$

The molar mass of carbon dioxide is M($C_6H_{12}O_6$)=180.16 g/mol,

$$N(C_6H_{12}O_6) = \frac{mN_A}{M} = \frac{100 \cdot 6.02 \cdot 10^{23}}{180.16} = 3.341 \cdot 10^{23} \, molecules;$$

As one molecule of glucose contains 24 atoms, the total number of atoms is

$$N(C_6H_{12}O_6) = 3.341 \cdot 10^{23} \cdot 24 = 8.02 \cdot 10^{24} \, atoms.$$