

(3.1) How many atoms of ^{235}U exist in 1 kg of uranium oxide, U_3O_8 , made of natural uranium?

First we must define the Avogadro number, N_A

$$N_A := 6.022 \cdot 10^{23} \cdot \text{mole}^{-1}$$

Then we have to define the molecular weights of U, O, and U_3O_8

$$Mw_U := 238.03 \cdot \frac{\text{gm}}{\text{mole}} \quad Mw_O := 16.00 \cdot \frac{\text{gm}}{\text{mole}} \quad Mw_{\text{U}_3\text{O}_8} := 3 \cdot Mw_U + 8 \cdot Mw_O$$

In natural uranium, the atomic fraction of ^{235}U (x) is 0.724%, i.e.:

$$x := \frac{0.724}{100}$$

The total amount of uranium oxide (U_3O_8), m_U , is 1 kg:

$$m_U := 1 \cdot \text{kg}$$

Now we can calculate the number of ^{235}U atoms, N_U , in this amount of uranium oxide (remember 3 U per U_3O_8):

$$N_U := 3 \cdot \frac{m_U}{Mw_{\text{U}_3\text{O}_8}} \cdot x \cdot N_A \quad N_U = 1.553 \cdot 10^{22} \quad \text{atoms}$$