(14.1) A 0.01 mm thick gold foil, 1 cm^2 in area, is irradiated with thermal neutrons. The (n,γ) cross-section is 99 b. What is the transformation rate at a n-flux of 10^{19} n m^{-2} s^{-1}?

Known data, constants, and units:

$M_{Au} := 196.97 \cdot gm \cdot mole^{-1}$ $N_A := 6.022137 \cdot 10^{23} \cdot mole^{-1}$ $\rho_{Au} := 19.3 \cdot gm \cdot cm^{-3}$

Data for the current case:

$thickness := 0.01 \cdot mm$ $area := 1 \cdot cm^2$ $\sigma_{Au} := 99 \cdot 10^{-28} \cdot m^2$ $\phi := 10^{19} \cdot m^{-2} \cdot sec^{-1}$

Calculations:

$volume := thickness \cdot area$ $m_{Au} := volume \cdot \rho_{Au}$

$$N_{Au} := \frac{m_{Au}}{M_{Au}} \cdot N_A$$

$R_{Au} := \phi \cdot \sigma_{Au} \cdot N_{Au}$ $R_{Au} = 5.842 \cdot 10^{12} \cdot \text{sec}^{-1}$

$$dm_{Au} := \frac{R_{Au}}{N_A} \cdot M_{Au} \qquad dm_{Au} = 1.911 \cdot 10^{-12} \cdot \text{kg} \cdot \text{sec}^{-1}$$

$$transrate := \frac{dm_{Au}}{m_{Au}} \qquad transrate = 9.9 \cdot 10^{-8} \cdot \text{sec}^{-1}$$