(19.14) The net efficiency of a 1000 MW_e BWR is 34.1%. Estimate the amount of ^{235}U consumed during its first day of full power operation with a completely fresh load of fuel.

Data and constants:

$N_A := 6.022137 \cdot 10^{23} \cdot mole^{-1}$ $M_U := 235 \cdot gm \cdot mole^{-1}$

$f_U := 3.1 \cdot 10^{10} \cdot sec^{-1} \cdot watt^{-1}$ See p. 519

Data given in the text:

$P_e := 1000 \cdot 10^6 \cdot watt$ $\eta := 34.1 \cdot \%$ $t_{oper} := 1 \cdot day$

Calculations:

$$P_{th} := \frac{P_e}{\eta} \qquad Rate := P_{th} \cdot f_U \cdot \frac{M_U}{N_A} \qquad Rate = 3.548 \cdot 10^{-5} \cdot kg \cdot sec^{-1}$$

or

$$Rate = 3.07 \cdot kg \cdot day^{-1}$$