Answer on Question #42889, Physics, Nuclear Physics

10. For the following fission reaction

$$^{235}\text{U} + \text{n} \rightarrow {}^{140}\text{Ce} + {}^{94}\text{Zr} + 2\text{n},$$

Find the disintegration energy.

Solution:

Given:

$M_u = 235.02$ u,

$M_n = 1.0$ u,

$M_{ce} = 139.9$ u,

$M_{zr} = 93.9$ u,

$Q = ?$

The disintegration energy Q is the energy transferred from mass energy to kinetic energy of the decay products.

$$Q = m_i c^2 - m_f c^2$$

Initial mass is

$$m_i = M_u + M_n$$

The final mass is

$$m_f = M_{ce} + M_{zr} + 2M_n$$

Thus,

$$Q = (M_u - M_{ce} - M_{zr} - M_n)c^2$$

$$Q = (235.02 - 139.9 - 93.9 - 1.0\ ) \cdot 931.5\ \text{MeV/u} = 204.93\ \text{MeV} \approx 205\ \text{MeV}$$

Answer: $Q = 205$ MeV.