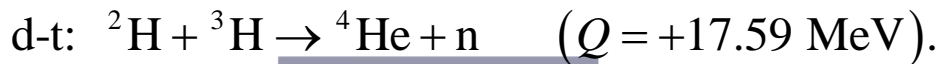
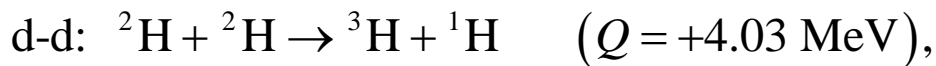
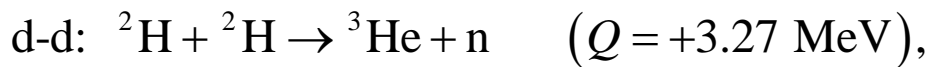


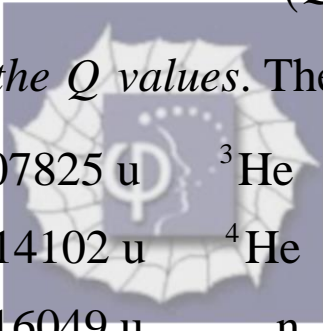
894.

Problem 55.52 (RHK)

The most attractive fusion reactions for terrestrial use appear to be deuteron-deuteron (d-d) and the deuteron-triton (d-t) reactions:



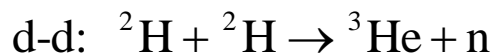
We have to verify the Q values. The needed masses are



${}^1\text{H}$	1.007825 u	${}^3\text{He}$	3.016029 u
${}^2\text{H}$	2.014102 u	${}^4\text{He}$	4.002603 u
${}^3\text{H}$	3.016049 u	n	1.008665 u.

Solution:

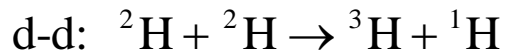
The Q value for the reaction



will be

$$\begin{aligned} &= (2m_{{}^2\text{H}} - m_{{}^3\text{He}} - m_{\text{n}}) \text{uc}^2 \\ &= (2 \times 2.014102 - 3.016029 - 1.008665) \text{uc}^2 \\ &= 0.00351 \text{uc}^2 = 0.00351 \times 931.5 \text{ MeV} \\ &= 3.269 \text{ MeV}. \end{aligned}$$

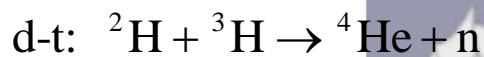
The Q value for the reaction



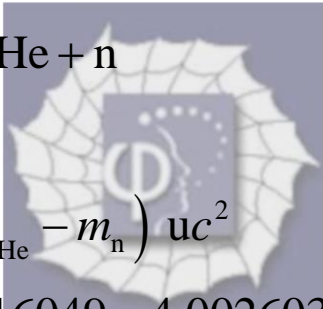
will be

$$\begin{aligned} &= \left(2m_{{}^2\text{H}} - m_{{}^3\text{H}} - m_{{}^1\text{H}} \right) \text{uc}^2 \\ &= \left(2 \times 2.014102 - 3.016049 - 1.007825 \right) \text{uc}^2 \\ &= 0.00433 \text{uc}^2 = 0.00433 \times 931.5 \text{ MeV} \\ &= 4.03 \text{ MeV}. \end{aligned}$$

The Q value for the reaction



will be


$$\begin{aligned} &= \left(m_{{}^2\text{H}} + m_{{}^3\text{H}} - m_{{}^4\text{He}} - m_{\text{n}} \right) \text{uc}^2 \\ &= \left(2.014102 + 3.016049 - 4.002603 - 1.008665 \right) \text{uc}^2 \\ &= 0.018883 \text{uc}^2 = 0.018883 \times 931.5 \text{ MeV} \\ &= 17.589 \text{ MeV}. \end{aligned}$$