897.

Problem 55.55 (RHK)

We have to find how the reaction energy Q in the deuteron-triton fusion reaction is shared between the α particle and the neutron (*that is, we have to calculate the kinetic energies K_α and $K_{\rm n}$*). *We may neglect the small kinetic energies of the two combining particles*.

Solution:

We have to find how the reaction energy Q in the reaction

$$^2{\rm H} + {}^3{\rm H} \rightarrow {}^4{\rm He} + {\rm n}, \qquad Q = 17.59 \text{ MeV}$$

is shared between the α particle and the neutron, n.

As $^4{\rm He}$ has nearly four times the mass of n, we have

$$\frac{p^2}{2\times 4m_{\rm n}} + \frac{p^2}{2m_{\rm n}} = Q,$$

or

$$\frac{p^2}{8m_{\rm n}} = \frac{Q}{5} = \frac{17.59}{5} \text{ MeV}$$

$$= 3.52 \text{ MeV}.$$

Therefore, the kinetic energy of the α particle $K_\alpha = 3.52$ MeV, and, the kinetic energy of the neutron will be $K_{\mathrm{n}} = (17.59 - 3.52)$ MeV $= 14.07$ MeV.