853.

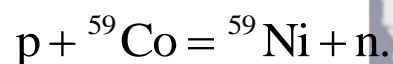## Problem 54.71 (RHK)

We have to calculate Q for the reaction $^{59}\text{Co}(p,n)^{59}\text{Ni}$. *The needed atomic masses are*

^{59}Co	58.933198 u	^{1}H	1.007825 u
^{59}Ni	58.934349 u	n	1.008665 u.

Solution:

The reaction $^{59}\text{Co}(p,n)^{59}\text{Ni}$ explicitly is

$$p + {}^{59}\text{Co} = {}^{59}\text{Ni} + n.$$

Therefore, the Q for this reaction is

$$Q = \left(\left(m\left(^{1}\text{H}\right) - m_e\right) + \left(m\left(^{59}\text{Co}\right) - 27m_e\right) - \left(m\left(^{59}\text{Ni}\right) - 28m_e\right) - m(n)\right)c^2$$

$$= (1.007825 + 58.933198 - 58.934349 - 1.008665)uc^2$$

$$= -0.001991 \, uc^2 = -0.001991 \times 931.5 \text{ MeV}$$

$$= -1.85 \text{ MeV}.$$

It is an endothermic reaction and the reaction will not take place unless threshold energy is carried by the incident proton.