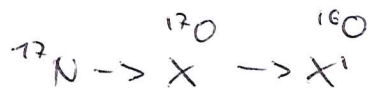


# Problem 21



a)  $Q = 8.68 \text{ MeV}$

b)  $E_x = E_{x'} + T_n + T_R + S_n$   
          |          |          |          |          |  
           ${}^{17}\text{O}$        ${}^{16}\text{O}$       neutron      recoil      neutron separation energy in  ${}^{17}\text{O}$

Momentum conservation yields  $T_R = T_n \left( \frac{m_n}{m_R} \right) \approx T_n \frac{1}{A-1}$

$$\Rightarrow \bar{E}_x = \bar{E}_{x'} + \frac{A}{A-1} T_n + S_n \quad \left| \begin{array}{l} T_n \left( 1 + \frac{1}{A-1} \right) \\ = T_n \left( \frac{A-1+1}{A-1} \right) \end{array} \right.$$

With  $T_n = 383, 1171$  and  $1700 \text{ keV}$

$$\Rightarrow E_x = 4.551, 5.388, 5.990 \text{ MeV}$$

(compare to level scheme)

c)  $E_{x'} \geq 6.049 \text{ MeV}$ , 1<sup>st</sup> excited state in  ${}^{16}\text{O}$

${}^{16}\text{O} \Rightarrow \bar{E}_x = 10.6 \text{ MeV}$   
           $> Q$   
          ↑  
          if it were in  ${}^{17}\text{O}$