11. (a) Conservation of energy gives $Q = K_2 + K_3 = E_1 - E_2 - E_3$ where E refers here to the *rest* energies (mc^2) instead of the total energies of the particles. Writing this as $K_2 + E_2 - E_1 = -(K_3 + E_3)$ and squaring both sides yields

$$K_2^2 + 2K_2E_2 - 2K_2E_1 + (E_1 - E_2)^2 = K_3^2 + 2K_3E_3 + E_3^2 \ .$$

Next, conservation of linear momentum (in a reference frame where particle 1 was at rest) gives $|p_2| = |p_3|$ (which implies $(p_2c)^2 = (p_3c)^2$). Therefore, Eq. 38-51 leads to

$$K_2^2 + 2K_2E_2 = K_3^2 + 2K_3E_3$$

which we subtract from the above expression to obtain

$$-2K_2E_1 + (E_1 - E_2)^2 = E_3^2 \ .$$

This is now straightforward to solve for K_2 and yields the result stated in the problem.

(b) Setting $E_3 = 0$ in

$$K_2 = \frac{1}{2E_1}\left[(E_1 - E_2)^2 - E_3^2\right]$$

and using the rest energy values given in Table 45-1 readily gives the same result for K_μ as computed in Sample Problem 45-1.