1. In order for the α particle to penetrate the gold nucleus, the separation between the centers of mass of the two particles must be no greater than $r = r_{\rm Cu} + r_\alpha = 6.23\,{\rm fm} + 1.80\,{\rm fm} = 8.03\,{\rm fm}$. Thus, the minimum energy K_α is given by

$$\begin{aligned} K_\alpha &= U = \frac{1}{4\pi\varepsilon_0}\frac{q_\alpha q_{\rm Au}}{r} = \frac{k q_\alpha q_{\rm Au}}{r} \\ &= \frac{(8.99\times 10^9\,{\rm V\cdot m/C})(2e)(79)(1.60\times 10^{-19}\,{\rm C})}{8.03\times 10^{-15}\,{\rm m}} = 28.3\times 10^6\ {\rm eV}\ . \end{aligned}$$

We note that the factor of e in $q_\alpha = 2e$ was not set equal to $1.60\times 10^{-19}\,{\rm C}$, but was instead carried through to become part of the final units.