

CH301H – Principles of Chemistry I: Honors

Fall 2011, Unique 51040

Quiz 1

Draw a potential energy diagram ($V(r)$ vs. r) for an alpha particle (He nucleus) with initial kinetic energy of 2.0 MeV approaching a sheet of silver foil. Label your axis with realistic estimates of potential energy and distance between the two nuclei (r), in appropriate units. Use this information to determine the radius of the silver atom.

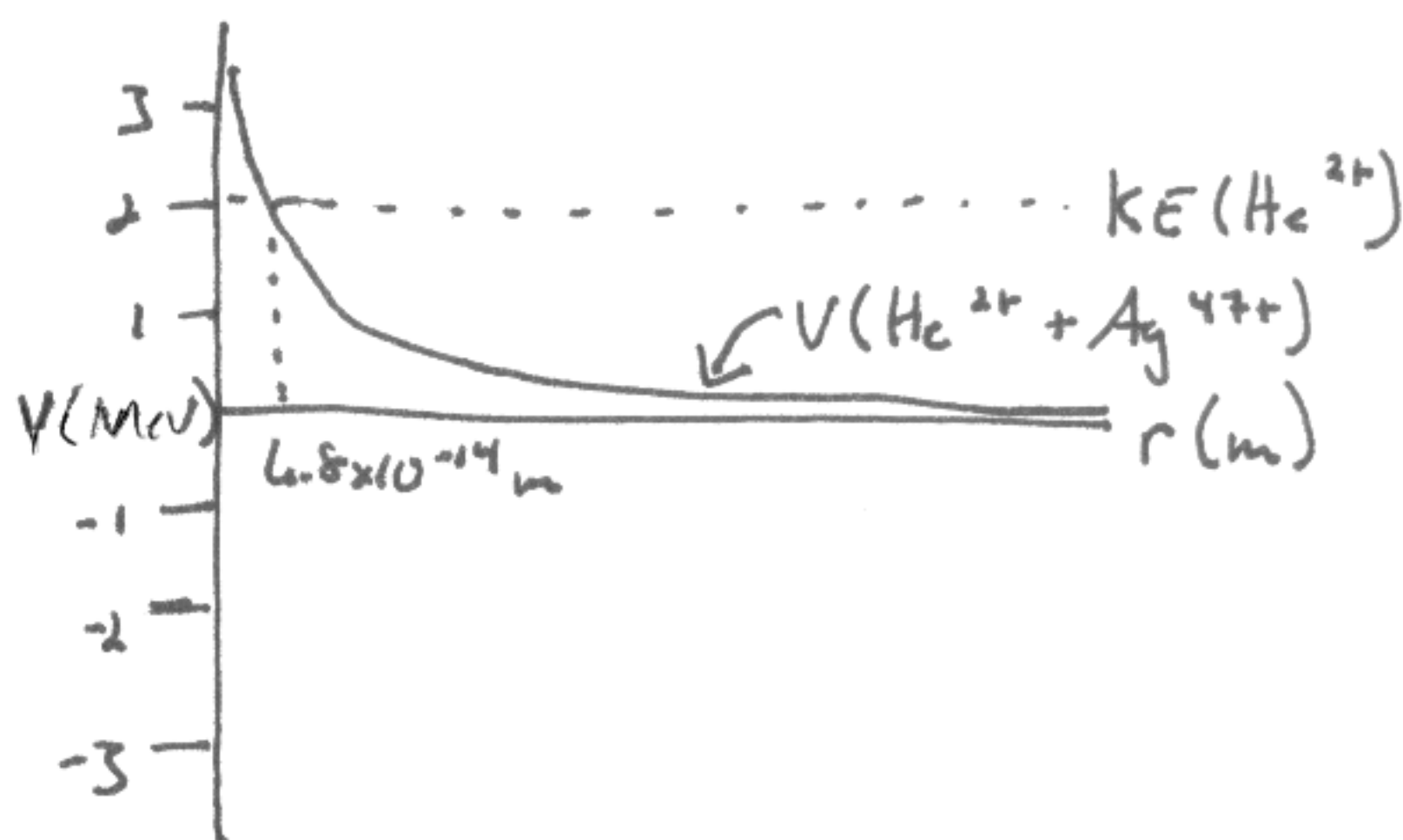
$$q = 1.602 \times 10^{-19} \text{ C}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ J}^{-1} \text{ m}^{-1}$$

$$Z_{\text{He}^{2+}} = +2$$

$$Z_{\text{Ag}} = +47$$

$$KE = V = 2.0 \times 10^6 \text{ eV}$$



$$V = \frac{q_1 q_2}{4\pi\epsilon_0 r} ; r = \frac{q_1 q_2}{4\pi\epsilon_0 V} = \frac{(+2)(+47)(1.602 \times 10^{-19} \text{ C})^2}{4\pi(8.854 \times 10^{-12} \text{ F}^2/\text{Jm})(2.0 \times 10^6 \text{ eV})}$$

$$r = 1.08 \times 10^{-32} \frac{\text{Jm}}{\text{eV}} \left(\frac{\text{eV}}{1.602 \times 10^{-19} \text{ C}} \right)$$

$$r = 6.8 \times 10^{-14} \text{ m}$$

Same order of magnitude that we have seen for Au and Al, so we are probably ok.