Aufgabe 9

a.) $E = eU = 1\,\text{keV} = 10^3 \cdot 1.602 \cdot 10^{-19}\,\text{J} = 1.602 \cdot 10^{-16}\,\text{J}$

$E = \frac{1}{2} m v^2 \Rightarrow v = \sqrt{\frac{2E}{m}} = 1.875 \cdot 10^7 \frac{\text{m}}{\text{s}} = 6.256\,\% \cdot c$

$p = mv = 1.708 \cdot 10^{-23}\,\text{kg}\frac{\text{m}}{\text{s}}$

$\lambda = \frac{h}{p} = 3.879 \cdot 10^{-11}\,\text{m}$

$m_0 = m$ = Elektronen-Ruhemasse

b.) genauso $\rightsquigarrow$ $v = 62.56\,\% c$ $\rightarrow$ relativistisch rechnen!

$E_{kin} = E - E_0 = \gamma m_0 c^2 - m_0 c^2 = (\gamma - 1) m_0 c^2$

$\Rightarrow \gamma = \frac{E_{kin}}{m_0 c^2} + 1 = 1.1357 = \frac{1}{\sqrt{1 - \beta^2}}$

$\Rightarrow \beta = \sqrt{1 - \frac{1}{\gamma^2}} = 0.5482$

$\Rightarrow p = \gamma m_0 v = \gamma m_0 c \beta = 1.730 \cdot 10^{-22}\,\text{kg}\frac{\text{m}}{\text{s}}$

$\Rightarrow \lambda = \frac{h}{p} = 3.702 \cdot 10^{-12}\,\text{m}$