

65. The same resolution requires the same wavelength, and since the wavelength and particle momentum are related by $p = h/\lambda$, we see that the same particle momentum is required. The momentum of a 100 keV photon is $p = E/c = (100 \times 10^3 \text{ eV})(1.60 \times 10^{-19} \text{ J/eV})/(3.00 \times 10^8 \text{ m/s}) = 5.33 \times 10^{-23} \text{ kg} \cdot \text{m/s}$. This is also the magnitude of the momentum of the electron. The kinetic energy of the electron is

$$K = \frac{p^2}{2m} = \frac{(5.33 \times 10^{-23} \text{ kg} \cdot \text{m/s})^2}{2(9.11 \times 10^{-31} \text{ kg})} = 1.56 \times 10^{-15} \text{ J} .$$

The accelerating potential is

$$V = \frac{K}{e} = \frac{1.56 \times 10^{-15} \text{ J}}{1.60 \times 10^{-19} \text{ C}} = 9.76 \times 10^3 \text{ V} .$$