Intrumentation for Characterization of Nanomaterials (v11)

1. Transmission Electron Microscopy

Problems

1.1. Are there any advantages to using high-energy electrons instead of visible light to image nanomaterials? Explain. (Do not duplicate verbatim text given in these notes or from other sources!)

1.2. These questions involve the wavelength λ of electrons accelerated to relativistic energy E.

a) Write a formula for λ.

b) Compute λ (in nm) for the energies listed below:

i) 63 KeV ii) 6.7×10^2 KeV iii) 3.4 MeV

Express your answers with appropriate significant figures.

1.3. Express the following lengths in units of nm:

a) 4.6×10^{-6} in b) 0.108 μm c) 43 Å

d) the distance light travels in a vacuum in 0.89 fs. (1 fs $=10^{-15}$ s)

1.4. Find the angle θ (in rad) subtended by an arc of length $\ell = 0.62$ mm with radius of curvature $R = 8.4$ mm.