Wave-Particle Duality

1. Calculate the de Broglie wavelength for a proton moving with a speed of 1.00×10^6 m/s.

2. Calculate the de Broglie wavelength for an electron that has kinetic energy (a) 50.0 eV and (b) 50.0 keV.

3. (a) An electron has kinetic energy 3.00 eV. Find its wavelength. (b) What If? A photon has energy 3.00 eV. Find its wavelength.

4. Neutrons traveling at 0.400 m/s are directed through a pair of slits having a 1.00-mm separation. An array of detectors is placed 10.0 m from the slits. (a) What is the de Broglie wavelength of the neutrons? (b) How far off axis is the first zero-intensity point on the detector array? (c) When a neutron reaches a detector, can we say which slit the neutron passed through? Explain.

Answers

1. 3.97×10^{-13} m

2. (a) 0.174 nm (b) 5.37×10^{-12} m

3. (a) 0.709 nm (b) 414 nm

4. (a) 9.92×10^{-7} m (b) 4.96 mm
   (c) We cannot say the neutron passed through one slit. We can only say it passed through the slits.