Modern Physics Problem Set 8

Due: Nov 11, 2025

Problem 1

For a 50 eV electron, determine the deBroglie wavelength using,

a) eV units

b) SI units (Joules)

Problem 2

An electron microscope typically uses electrons that are accelerated through 100 kV.

a) What is the deBroglie wavelength of these electrons?

b) Compare this with the wavelength of blue light. Given that the size of SARS-CoV-2 virus is about 100 nm, comment on the appropriateness of using an optical or electron microscope to study the structure of the virus.

Problem 3

An electron is accelerated from rest through a potential difference of 500 kV.

a) Show clearly whether the problem is relativistic or not.

b) Calculate its de Broglie wavelength using (a) the nonrelativistic and (b) the relativistic formula for momentum.

c) Compute the percent error between the two results.

d) Finish the problem we started in class: find v, v_{ph} , and v_{gr} for this electron.

Problem 4

Determine the de Broglie wavelength of a particle of mass m and kinetic energy K. Do this for both

a) a relativistic particle, and

b) a nonrelativistic particle