

Problem Set 2
Due Fri, Sept 8

Background: Chapter 2

Problems: P2.1 – Boltzmann (provide answer as *Mathematica* notebook)
P2.3, P2.6 – Wave functions
P2.5, P2.7ab, P2.8cd, P2.9abc – Complex arithmetic
P2.11abc, P2.13abc, P2.17abc, P2.21, P2.23 – Operators & eigenfunctions
Extra (Wave functions): A standing wave is described by the function in

Eq. 2.10. What is the wave's amplitude at $(x, t) = (\pi, t_1)$? At (π, t_1) ? At $(x_1, \pi/2)$? At $(x_2, \pi/2)$? Which of these coordinates, if any, mark one of the wave's spatial nodes? Which, if any, mark one of the wave's temporal nodes? Do any of the spatial and temporal nodes intersect? If they do, give the coordinate for one intersection.

General instructions for problems above: Several problems require mathematical manipulations that demonstrate your understanding of algebra, calculus, and complex arithmetic. Please show your work for these problems.

Mathematica Problem

P2.1

The Ryan Challenge

How big is an electron?

Does the de Broglie wavelength tell us an object's dimensions? (Hint: compare wavelengths of "quick electron," "ave Ar atom," and "Alan" from recent lecture)

Can you find (and describe) a method that physicists have used to measure an electron's size?