

Chemistry 237 -- Quiz 2

January 27, 2010 — Tellinghuisen

Pledge and signature:

1. (8) Consider a particle in a one-dimensional box of length a .
 - (a) Sketch ψ and $|\psi|^2$ for $n = 1$ and $n = 4$.
 - (b) In problem 17.23 you derived an expression for the probability of finding the particle at $x = a/4$. Without doing any numerical calculations, and considering just the symmetry of the wavefunctions, for which levels will $P(x = a/2) = 1/2$?
 - (c) Suppose the energy difference between levels $n = 1$ and $n = 2$ is E . What is the energy separation between levels $n = 2$ and $n = 5$?
 - (d) What will be the new value of E if we (i) decrease the mass by a factor of 2; (ii) triple the length? (In each case, assume other quantities are held constant.)
2. (6) Consider the probability distribution $P(x) = Cx$ for $0 \leq x \leq 3$ and $P(x) = 0$ elsewhere. Calculate (a) the normalization constant C , (b) the mean μ and (c) the variance σ^2 .
3. (6) You want to use KG to fit data to the function, $y = a/x + bx^2 + cx^3$.
 - a. Write exactly what you must enter in the Define Fit box.
 - b. The fit is done unweighted and yields $\text{Chisq} = 29.173$ for 13 points. Calculate s_y^2 and s_y .
 - c. The fit yields $c = 4.9711$ and $\text{Error}(c) = 1.1185$. If you repeat the entire experiment and analysis, what (approximately) is the probability that you will obtain a new c differing from this value by more than 1.6? [Use the table on the second page of the Class Pak.]