CHEM106: Assessment 4

Wave Functions and Probability

Answer Key

1. Define the complex conjugate of the following functions.

The complex conjugate for a complex number Z = a + ib is defined as Z\* = a − ib. In general, to find the complex conjugate of any function, all we need to do is to reverse the sign of the imaginary component.

A. 

B. 

C. , noticing that for a real function, 

2. What are the requirements for an acceptable wavefunction?

Since  represents the probability density for finding the particle, the wavefunctionitself must meet the following requirements: (1) finite (or quadratically integrable); (2) single valued; and (3) continuous.

3. Which of the following is an acceptable wave function over the indicated interval?

A. 

  is not an acceptable wavefunction since it approaches infinity as x = 0.

B. 

 is an acceptable wavefunction since it meets all three requirements listed in question 2 in the specified domain.

C. 

 is not an acceptable wavefunction since it approaches infinity as  .

4. Which of the following functions are normalizable over the indicated intervals?

Normalize those functions that can be normalized. (Hint: In normalizing wavefunctions, the integration is over all space in which the wave function is defined.)

A. 

The function is finite everywhere, and thus normalizable.

Given ,

the normalization constant is .

Thus, the normalized function is .

B. 

The function  is infinite at , and thus not normalizable.

C. 

The function is finite everywhere, and thus normalizable.

Given ,

look up the integration table, and find that .

Thus, .

The normalization constant is .

Thus, the normalized function is .

5. Consider the following normalized wavefunction , for a one-dimensional system confined in the region .

1. Calculate the probability that the particle will be found in the region between x = 0 and x = L/2.



Look up the integration table, and find that .

Thus, .

1. Determine the probability that the particle will not be located in the region between x = 0 and x = L/2.

The probability in case B and that in case A above should add up to 100%.

Thus, P = 1 − 0.197 = 0.803.