Chemistry

Scarsdale High School

Electron Probability

Objective:
Determine the probability of finding an electron near the nucleus of an atom.

Task:
Perform the attached lab:
    Electron Probability

Materials:
1. See lab procedure

Lab Report:

Share your report with google docs (jwilliams@scarsdaleschools.org) with the following file name:

File Name: SHS_HC_LB_*sec#*_ElecProb_Lname

1. Abstract
2. Specified graphs and tables
3. Complete the questions included in the procedure
4. References (MLA Format)

Due Date: One week after the completion of the lab

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Problem
How well can we model an orbital with a dartboard and a dart?

Introduction
According to modern atomic theory, we cannot be sure of the exact location of electrons in an atom. We predict that electrons will be relatively close to the nucleus (because the electrons are negatively charged and the nucleus is positively charged). However, we discuss the "locations" of an electron in terms of probability instead of an exact position.

In this activity you will construct and analyze a probability map using a dart and dartboard.

Materials
Grease pencil (dart)
Target
Ruler

Procedure
1. Attach "fins" the shaft of the grease pencil so that it will strike the ground with the tip first
2. Tape the target to the floor
3. Hold the grease pen at shoulder height with your arm completely extended. Drop the dart so that it will strike the target
4. Mark the location of the strike
5. Repeat this procedure for a total of 100 drops
6. Count the number of "hits" within the rings and record this value

Data Organization
1. Create a table to record the following information for each ring of the target, the radius of each ring, the area of each ring, the number of "hits" and the number of "hits" per unit area ($hits/cm^2$)

Data Analysis
1. Which ring had the highest probability of finding a hit?
2. Which ring had the lowest probability of finding a hit?
3. Using LoggerPro, construct a graph of the following information
   a. Number of hits vs average distance from the center of the target
   b. Hits per unit area vs average distance from the center of the target
4. What does graph "a" represent? Can you explain or account for its shape?
5. What does graph "b" represent? Can you explain or account for its shape?
6. Is the maximum of each graph the same? Explain your answer.
7. How well can we model an orbital with a dartboard and a dart? Specifically, focus on the following:

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      a. Compare your target to Figure 11.19 in the textbook. How is it similar? How is it different?

      b. Why do we predict an electron should be near the nucleus? Why do we expect the dart to land in the center of the target?

8. How would changing the number of drops affect your results? What would you see if you did 10 drops? Or if you did 1000 drops? How would the results compare?

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