Name: _____ Date: _____ Period: _____

Probability Analogy for an Electron

12 Point Lab

Background

An electron cloud is the region of negative charge surrounding an atomic nucleus that is associated with an electron orbital (or atomic orbital). It is defined mathematically, describing a region with a high probability of containing electrons.

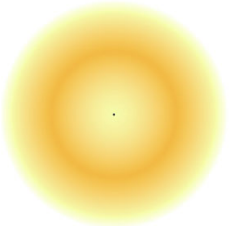
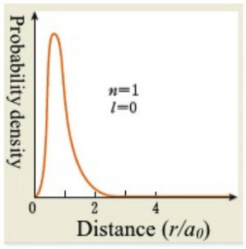


Figure 1: Cloud Model

The phrase "electron cloud" first came into use around 1925, when Erwin Schrödinger and Werner Heisenberg were seeking for a way to describe the uncertainty of the position of electrons in an atom.



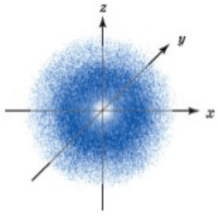


Figure 2: Probability density function of an electron in an atom of hydrogen

The electron cloud model differs from the more simplistic Bohr model, in which electrons orbit the nucleus in much the same way as planets orbit the sun. In the cloud model, there are regions where an electron may likely be found, but it's theoretically possible for it to be located anywhere.

In this lab you will predict and then observe the probability of randomness in the distribution of student generated data points.

NAME: _____ **DATE:** _____ **PERIOD:** _____

PRELAB

IMPORTANT: All answers must be clear, coherent, and complete sentences. *Answers written below high school level will not receive credit.*

1. What is an electron orbital? *(1 pt)*

2. Test subjects will try to hit the bull's-eye of a target. Radial distance is simply the distance away from the center of the target. Assuming the test subjects are trying their best, what trend do you predict to see in the radial distance from the center verse the densitry of attempts? *(1 pt)*

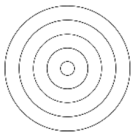


Figure 3: Example Target

3. The center circle of the target has a smaller area than the area of the outer rings. Ring #1 is the center circle, and the rings increase in number until the outermost ring which is ring #5. Analysis the area of the rings that will be used in this lab in the table below.

Ring Number	Area (cm^2)
1	3.15
2	25.1
3	50.3
4	75.4
5	101

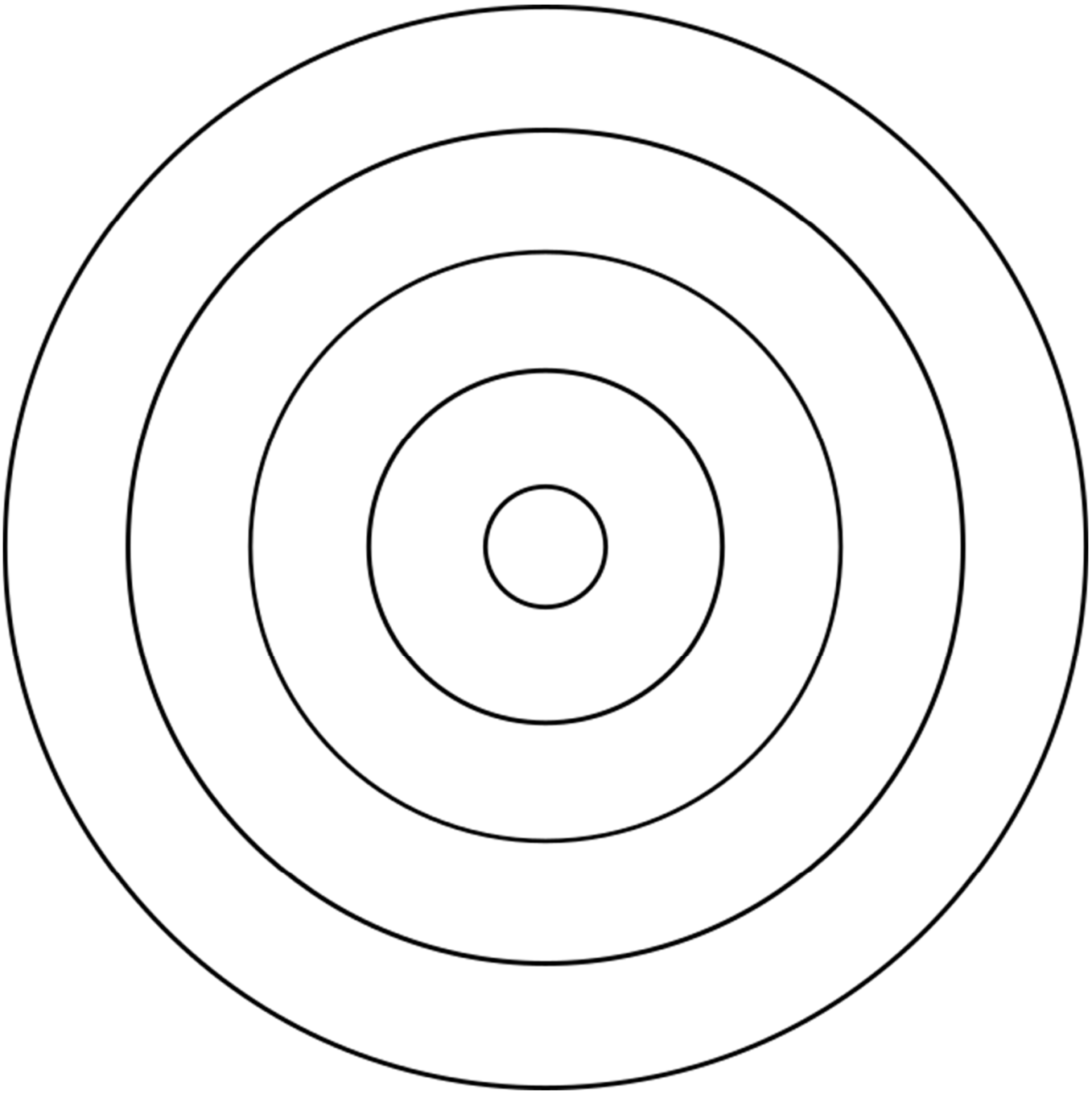
Considering that the test subjects are trying to hit the center BUT it has the smallest area, which ring do you predict will have the most data points in it? *(1 pt)*

PROCEDURE

1. Hold a pencil at arm's length over the target and try to hit the bull's eye.
2. Repeat pencil drops until you have at least 100 marks inside the rings. If a mark goes outside of the rings, do not count that attempts and try again.
3. Count the number of marks in each ring.

Name: _____ **Date:** _____ **Period:** _____

Target



Data

1. Count and write the number of marks for each ring, in the appropriate ring. *(1 pt)*

NAME: _____ DATE: _____ PERIOD: _____

DATA

Share the class data and record the class totals in the table below: *(1 pt)*

Ring Number	Number of Marks
1	
2	
3	
4	
5	

CALCULATIONS

Determine the analogue probability density by dividing the number of marks by the area of the ring. Show your work. *(5 pts)*

Ring Number	Analogue Probability of Density
1	
2	
3	
4	
5	

ANALYSIS

1. Summarize your results and your prelab predictions. Writing must be clear, coherent, and in complete sentences. *Answers written below high school level will not receive credit. (2 pts)*