

RELATING ELECTRONS AND PROBABILITY

BACKGROUND: Early theories of the structure of the atom described the movement of electrons around the nucleus as similar to the movement of the planets around the sun. Today scientists know this is not the case. Electrons do not travel around the nucleus in fixed orbits. Electrons move in an area known as the electron cloud. Within the electron cloud, electrons are arranged in energy levels. Energy levels represent the most probable location in which an electron can be found. An energy level should not be confused with a specific path. For electrons do not have a path. In fact, scientists can speak only of the chances, or probability, of finding electrons at various locations-not of their exact position. In this investigation, you will get a better understanding of probability and how it relates to electrons.

PROBLEM: How can the movement of electrons outside the nucleus be described?

MATERIALS:

- 1 Die
- 1 Ruler
- 1 Sheet of Graph paper
- 4 Different Colored Pencils

PROCEDURES:

1. **Select a square near the center of the graph paper and color it using one of your colored pencils. This square represents the nucleus.**
2. **Draw three rings/squares on the graph paper. One 3 cm from the nucleus, one 5 cm from the nucleus and one 7 cm from the nucleus.**
3. Roll the die and with each roll pencil in a square according to the following rules:
 - a. If a **1, 2, or 3 is rolled**, pencil in any square that is between 0-3 cm from the nucleus.
 - b. If a **4 or 5 is rolled**, pencil in any square that is between 3-5 cm from the nucleus.
 - c. If a **6 is rolled**, pencil in any square that is between 5-7 cm from the nucleus.
4. Repeat this procedure of rolling the die and marking the graph for 50 rolls. Record your results in the Data Table

DATA:

Energy Level	Number of squares penciled in - use hash marks to keep track	Total Squares Rolled
First Energy Level (0-3 cm) 1,2, or 3 rolled		
Second Energy Level (3-5 cm) 4 or 5 rolled		
Third Energy Level (5-7 cm) 6 rolled		

QUESTIONS:

1. In your own words, explain what the term probability means.

2. Which energy level had the most "electrons", colored squares?

3. Why do you think that energy level had the most?
4. Compare your diagram to another classmate. Are they identical? Explain in what ways they are similar and in what ways they are different.
5. How does probability relate to the location of electrons?

