INVESTIGATION 2

PURPOSE

To relate diffraction patterns to real arrays of atoms, ions and molecules.

PROCEDURE

a. Orient the Unit Cell slide provided by the instructor so that the ICE logo is on the right-hand side. With the stereoscope, look carefully at the arrays on the slide and make a sketch in the space provided in Table 1 of the Data Sheet.

b. Connect the battery snap to the red LED and place it at least a meter away from you. View the LED through the different regions of the slide and sketch the diffraction patterns that you see in the appropriate spaces in Table 2.

c. Repeat steps a and b above using the VSEPR slide provided by the instructor and record your observations in Table 3 and Table 4.

FOLLOW-UP QUESTIONS

1. Look at your sketches of arrays *a* and *b* on the Unit Cell slide. Array *a* is the two-dimensional projection of a body-centered cubic structure and *b* of a simple cubic arrangement. Now look in Table 2 at the diffraction patterns produced by each. What is the effect on the diffraction pattern of placing an identical atom at the center of each square in the array?

2. Look at your sketches of arrays *c* and *d* in Table 1. Array *c* represents two different kinds of atoms, each surrounded by four atoms of the other type. Array *d* is like that of array *b* above. Now look in Table 2 at the diffraction patterns produced by these arrays. What is the effect on the pattern of placing a different sized atom at the center of each square in the array?

3. Look at your sketches of arrays *e* and *f* in Table 1. Array *e* represents a structure in which all angles are 90°, but the sides are of unequal length (rectangle); and *f* one in which the angles are not 90° (inclined parallelograms). Now look in Table 2 at the diffraction patterns that are produced and describe what you see.

4. Look at your sketches in Table 3. Each array simulates a molecule that consists of three atoms. What shape molecule is represented by array *a*? If the entire array was rotated 90°, describe what the new diffraction pattern would look like.

5. The sequence of arrays (*b*, *d*, and *c*) represents an array of angular molecules. What happens to the angle as you proceed through this sequence? Why is the diffraction pattern produced by *c* similar to that produced by *a*?

6. A close look at your sketches for diffraction from arrays *e* and *f* in Table 4 reveals that these diffraction patterns are mirror images of each other. Explain why this is not surprising.

7. What molecular shapes are simulated by arrays *g* and *h* in Table 3?

Name _____
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INVESTIGATION 2
DATA SHEET

Table 1

a	**b**
c	**d**
e	**f**
g	**h**

Table 2

a	**b**
c	**d**
e	**f**
g	**h**

Name _____
Date_____Period_____

INVESTIGATION 2
DATA SHEET (continued)

Table 3

a	**b**
c	**d**
e	**f**
g	**h**

Table 4

a	**b**
c	**d**
e	**f**
g	**h**