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ABSTRACT

This autoinstructional program deals with experiences that will aid chemistry students at the secondary school level to determine the slope of the straight line graph relating the variables in a given set of data involving a direct relationship. Prerequisites set for this activity include three Del Mod System packets (SE 018 018, SE 018 020, and SE 018 023). Two behavioral objectives are presented. No equipment is necessary. A time allotment of 35 minutes is needed. (EB)

ED 096 125

THE DIRECT RELATIONSHIP

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SE 018 026

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TEACHER'S GUIDE

PACKET NUMBER	540.018 St
SUBJECT	Chemistry
TITLE	The Direct Relationship
PREREQUISITES	AT 540.018, AT 540.018, AT 540.018 S Sg S S1
BEHAVIORAL OBJECTIVES	1. Given data involving a direct relationship, the student will determine the slope of the straight line graph relating the variables. 2. Using the value for the slope calculated by the student, the student will write the equation for the given relationship.
EQUIPMENT	None
TIME	35 minutes
ASSESSMENTS	Four exercises found in Envelope III
SPACE REQUIRED	Carrel

SCRIPT

THE DIRECT RELATIONSHIP
CHEMISTRY

One of the goals of science is the formulation of laws and principles that govern the behavior of matter. In this course you will be discovering and using many of these laws. How are these laws and principles expressed? Quite often they take the form of mathematical equations. The equations can then be classified into different types of relationships. You have worked with many of these relationships in your math classes. In doing AT-2 several of them were briefly mentioned, the direct, linear, and inverse relationships.

It is the purpose of this AT to make a careful analysis of one of these relationships - the direct relationship. Although it is the simplest relationship that can exist between two variables a thorough understanding of it is a powerful tool in your handling of many of the calculations in this course.

Our discussion of this relationship will center around two examples. One is the relationship between length measured in centimeters, and length measured in inches. This you worked with in AT-2. The other involves a relationship between the variables X and Y. We will work with this example only because of the simplicity of the representation of the variables. Would you now go to Closet A and get the box labeled AT-4. OFF. In Envelope I you will find Figure 1, a graph showing the relationship between length in centimeters and length in inches. (PAUSE) This graph is an example of a direct relationship. How does one recognize a direct relationship? Graphically, it is a straight line passing through the origin of the coordinate system. The fact that the line passes through the origin is important. A straight-line graph having an intercept other than zero would not be a direct relationship, but rather a linear relationship. The direct relationship is actually a special form of the linear relationship, one where the two variables must be simultaneously zero.

Now that you can recognize a direct relationship, lets try to analyze it. At the heart of the analysis is the concept of slope. Look at the graph on Figure 2. The numerical value of the slope in a direct relationship actually _is_ the relationship between the variables. How is it obtained? We will begin by picking any two points on the line. Lets pick the points with the coordinates X = 2, Y = 3 and X = 4, Y = 6. Now we determine what change takes place in the two variables as we move from the first point to the second. What change takes place in X? (PAUSE) X changes from 2 to 4 - it changes by +2. At the same time what has happened to Y? It has undergone a change from 3 to 6 - it changes by +3. The slope of a line is defined as being the change in Y divided by the simultaneous change in X. Please refer to Figure 3 which can be found in Envelope 1. (PAUSE) Figure 3a gives a summary of the operations we have just discussed.

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(PAUSE) The slope is 1.3 (PAUSE) In words this says that any change in Y is 1.3 times as great as the simultaneous change taking place in X. We have looked at a specific calculation of the slope of a line, Figure 3b gives a general definition of slope. Study the diagram carefully. (PAUSE) We are now ready to write the equation for the relationship represented in Figure 3a. The general equation for a direct relationship is Y = MX where Y and X are the variables and M is a proportionality constant which relates the two variables. The proportionality constant is the slope of the line. If we know the slope and are given one of the two variables, life takes on a rosy hue. Calculation of the other one is easy. What is the equation for the relationship in Figure 3a? (PAUSE) Substitution of 1.3 for M in the general equation gives 4 = 1.3X.

Let's go back to Figures 1 and determine the slope and the equation for the relationship. Why don't you take a crack at it? Use the example as a guide. When you finish or if you have trouble, look at Figure 4 in Envelope II.

One final point must be made before you complete this lesson. That is we must distinguish between physical and geometric slope. To illustrate we will compare Figure 2 with Figure 3a. How do the slopes of these two graphs compare? (PAUSE) There are two right answers because there are two different kinds of slope. In this course we are concerned with what is called physical slope. It was physical slope that was defined in the lesson. The numerical value of the physical slope is independent of scale selection. The other type of slope which by the way we are not concerned with at all, is a measure of the steepness of the line or more specifically depends on the angle that the line makes with the abscissa. This slope is called the geometric slope of the line. Let's return now to the question. How do the slopes of Figure 2 and Figure 3a compare? (PAUSE) The physical slopes are identical while the geometric slope in Figure 2 is greater. (PAUSE)

STUDENT GUIDE

THE DIRECT RELATIONSHIP
CHEMISTRY

OBJECTIVE 1

Given data involving a direct relationship, the student will determine the slope of the straight-line graph relating the variables.

OBJECTIVE 2

Using the value for the slope calculated by the student, the student will write the equation for the given relationship.