

“The Nature of Science”

Introduction: The purpose of this activity is to get the students to think about the nature of science, and also, to show the importance of being an active participant in the learning process. Students have been given the definition of science in the past, but students should realize that science is dynamic, it is hands-on, and it changes as our knowledge of the world increases.

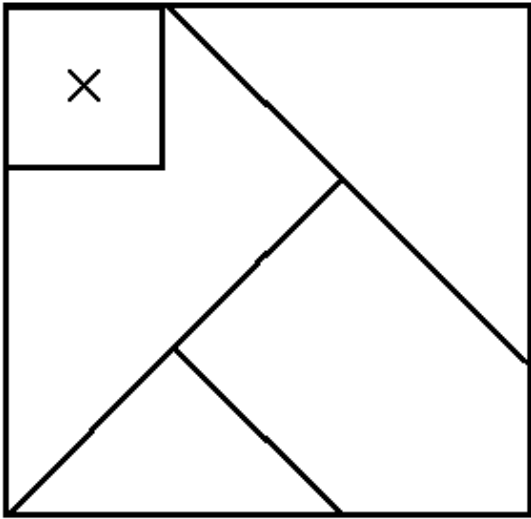


Figure 1

Materials: Print the following pattern on cardstock paper and cut out the individual pieces. Make enough for each student to work individually.

Procedure: Hand out all the pieces except the small square marked X. Each piece represents current scientific data. Once the students are given the pieces, no further instruction is given, most students will begin to arrange the pieces on their own. In a short amount of time, the students will put the pieces together to make a square as seen below in figure 2.

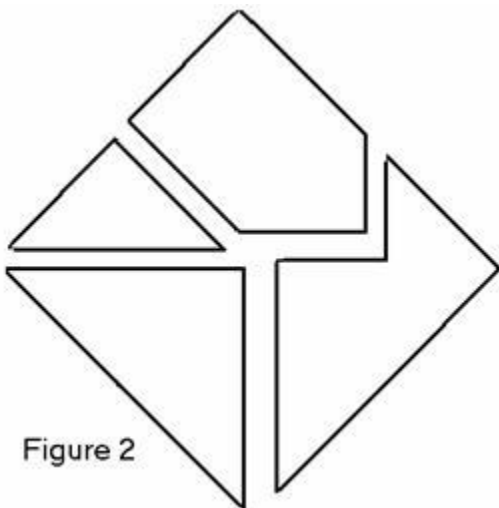


Figure 2

Once all the students have arranged the pieces to produce figure 2, hand out the small square marked X to each student and explain that a new scientific discovery has been made. Students must somehow incorporate this new information to their puzzle.

Encourage students to work individually at first, and then, to work in groups if the frustration level rises. There may be some degree of “cheating” and peeking at other student’s progress. If one student gets the correct arrangement, have that student cover up the answer.

Hints may be given to help the students along. I generally tell my students to make the Superman logo shape first.

Follow-Up Questions: Once all or most of the students have arranged the pieces correctly, I ask them to brainstorm and share how this activity is similar to “doing” science. Some similarities include, but are not excluded to: 1) Assume that the pieces fit together – nature is a puzzle that we have not yet solved; 2) Trial and error is an essential ingredient to science; 3) New information may require the old theory to be modified or discarded; 4) Our current information may be incomplete and therefore, our theories incorrect; 5) Sometimes, we get lucky and find the right answer; 6) Collaboration may be helpful; 7) Once we arrive at the answer, it makes perfect, elegant sense.

One comment I make at the end of this activity is that this activity would have been quite dull if I drew the pieces on the board and they had to figure it out in their heads. The beauty of chemistry is that ideas and concepts that may be abstract can be tested in laboratory exercises. With an advanced class, the concept of scientific paradigm and paradigm shifts i.e. germ theory, theory of evolution, and atomic theory can be discussed.

Some Additional Thoughts and Ideas: This activity always seems to validate my belief that human beings are inherently curious. I follow this activity with other activities or games in which students must discover a pattern. For homework I have them visit the Flash Mind Reader website and figure out how it works (<http://www.dslextreme.com/users/exstatica/psychic.swf>). Throughout the year, I use puzzles and mind-games as “Do Now’s” or fillers at the end of a test to exercise my students’ minds and to encourage them to think outside the box.

One of the shortcomings of our education system is that students stop asking the important questions such as: “Why, Why Not, and How”; rather these questions get replaced with mundane one such as: “What, When, and Where.” We should encourage curiosity and creativity, because these are essential ingredients in scientific progress. I try to establish an atmosphere in which students are not afraid to try, to succeed or fail, and to question. As I tell my students, if they only ask questions that I can answer completely, they are not doing their job as students. If I may alter the famous slogan of the NAACP, “An inquisitive mind is a terrible thing to waste.”

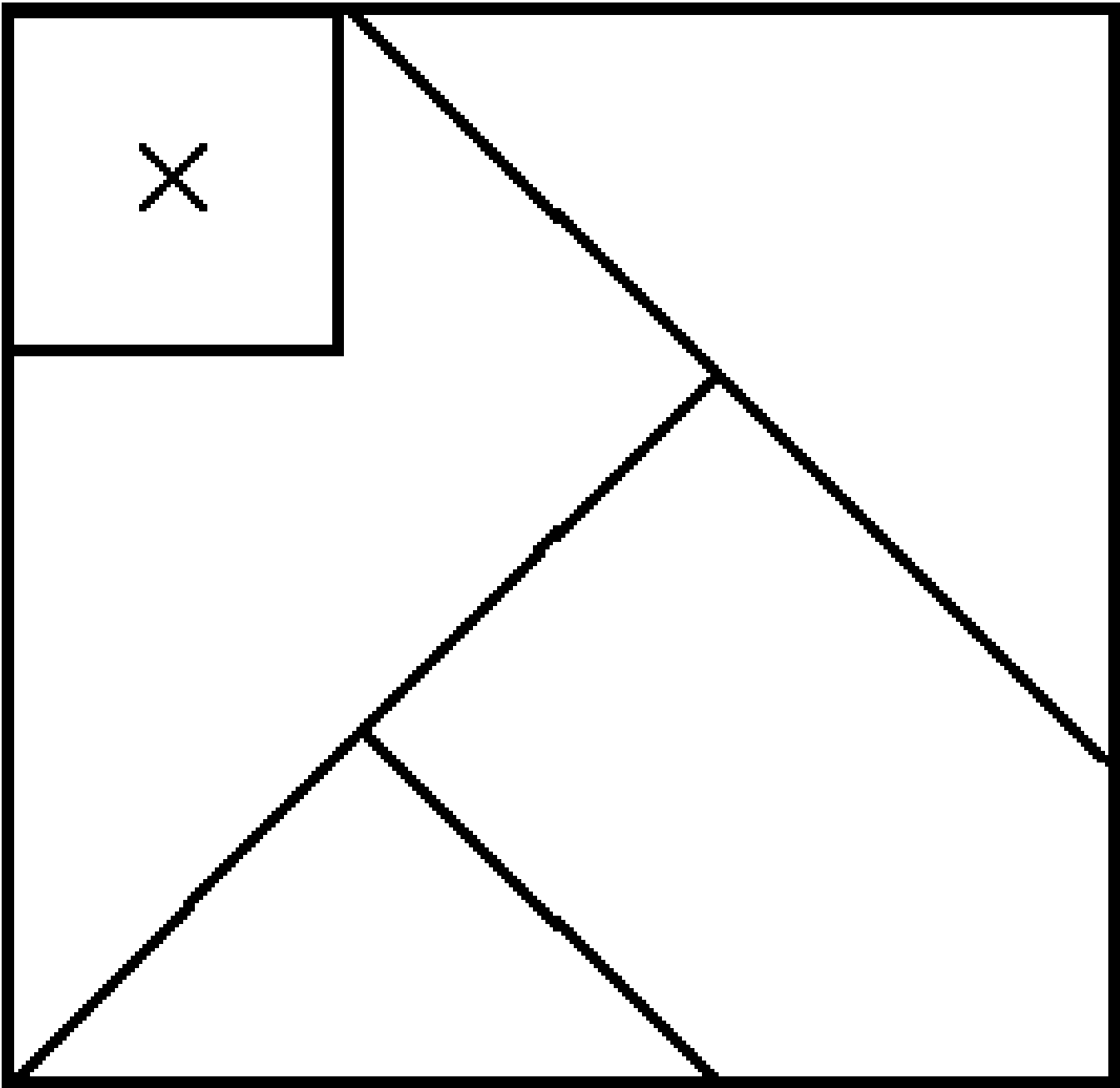


Figure 1