Cosmic Chemistry: An Elemental Question

The Search for Critical Questions

TEACHER GUIDE

Background Information

In this introductory activity, students try to solve a jigsaw puzzle with some missing pieces. As they examine their thought processes about the missing pieces, they create a model for dealing with data sets that may have missing data points.

Standard Addressed (Grades 9-12)

Science as Inquiry

- IDENTIFY QUESTIONS AND CONCEPTS THAT GUIDE SCIENTIFIC INVESTIGATIONS

Materials

For each pair of students:

Two envelopes, **a** & **b**, containing pieces of magazine pictures
Student Activity, "The Search for Critical Questions"

Procedure

1. Before class, collect enough magazine pictures so there will be one for each pair of students. Cut one picture into a jigsaw puzzle. Put most of the pieces into one envelope and label it #1a. Put the remaining 2-3 pieces in the other envelope and label it #1b. Do the same with the rest of the pictures, giving each set of envelopes its own number so that the pieces from one picture are not separated.

2. Group the class into pairs. Hand out Student Activity, "The Search for Critical Questions." Give each pair an **a** envelope and encourage them to take out the pieces and begin to put the puzzle together. Ask one student to record the clues they are using to complete the puzzle as answers for the first question on Student Activity, "The Search for Critical Questions." Groups will soon find that the puzzle is not complete and begin to complain about it.

3. Ask them to describe in writing (second question) what they think the pieces that fit into the blank spaces will look like. Encourage them to be as specific as possible, focusing on shape, color, size, and internal design in addition to any other variables they wish to describe.

4. When this is completed, give them the  corresponding **b** envelope and allow them to compare their predictions to the actual pieces. If they were very close to correct, what characteristics of the puzzle gave them good information about the missing piece? If they were not very close to the correct description, what was missing in their analysis that threw them off? Did they fail to consider an important clue in the puzzle? Was there something in the missing piece that could not have been predicted from the original puzzle? Record as the third answer.

5. When students are finished, bring them back together for a general class discussion. As students report the clues they used to complete the puzzle, rephrase these into questions. For example, if they looked at the outside shape and tried to match it to a complementary shape on another piece, the question could be, "What shape

would match the shape on this piece?" List these questions on chart paper or the chalkboard. You should soon have a list of common questions from the class.

From this list, try to generalize a list of questions that students could ask when approaching any type of puzzle. One question that is derived from the shape clue might be, "How does this part of the puzzle match to or differ from another part?" The students should record these as the fourth answer.

6. Discdiscuss the predictions of the characteristics of the missing pieces. Focus on the clues that describe known characteristics and how they inform predictions of related objects. Discuss any feature that could not be predicted from the clues on the known objects. Tell students that this puzzle solving process is similar to how scientists begin to solve problems or make sense of a lot of data that has not been organized before.