

The Sun and Solar Wind: A Search for the Beginning

Where Did This Come From? Where Does It Fit?

TEACHER GUIDE

Model Development Assessment Activity

BACKGROUND INFORMATION

After completing all of the activities, students should review once again the student texts and the appendices to ensure that they have developed a comprehensive mental model of the sun and solar wind. Enough background information has been provided in the activities to allow you and your students to address questions centered around the fact that evidence for heavy elements such as iron, sodium, and magnesium has been found in the sun and the solar wind.

The fundamental questions are:

1. Is there any evidence that heavy elements such as sodium, iron, and magnesium are generated by processes occurring within the interior of the sun?
2. Is it conceivable that these heavy elements are currently being created within the interior of the sun?
3. Is the success of the Standard Solar Model dependent on the presence of these heavy elements?



After students formulate and defend their answers to the first question, they will then answer questions two and three by developing an explanation of how and where these elements were produced. Then they will formally communicate their explanation in terms of a model.

This activity may be assigned to individuals, or students may be allowed to form teams with partners who have similar answers and explanations. The development of a model can also be individually or in teams.

STANDARDS ADDRESSED

Grades 5-8

Science as Inquiry

Understandings about scientific inquiry

Science and Technology

Understandings about science and technology

Physical Science

Structure and changes in properties of matter

Transfer of energy

History and Nature of Science

Science as a human endeavor

Nature of science and scientific knowledge

Grades 9-12

Science as Inquiry

Understandings about scientific inquiry

Science and Technology

Understandings about science and technology

Earth and Space Science

The origin and evolution of the Earth System

The origin and evolution of the universe

Physical Science

Structure and changes in properties of matter

Transfer of energy
Structure of atoms

History and Nature of Science

Science as a human endeavor
Nature of science and scientific knowledge

Assessment Standard B

Achievement and Opportunity to Learn Science Must Be Assessed

Assessment Standard C

Assessment Tasks Are Authentic

MATERIALS

For each student

Copy of the Student Activity "[Where Did This Come From?](#)"

PROCEDURES

1. Make copies of the Student Activity, "Where Did This Come From?"
2. Review previous module work by asking questions similar to the following to introduce the fact that they found evidence for heavy elements such as iron, sodium, and magnesium in the sun and the solar wind, but nothing in the Standard Solar Model that accounts for how they came to be there:
 - a. What are some things you have learned regarding the Standard Solar Model and about the solar wind as you completed the previous activities? Record their responses on the board, on newsprint, or on the overhead projector.
 - b. Do you see any inconsistencies or apparent contradictions among any of these responses?
3. When students are satisfied that they have identified all the inconsistencies or apparent contradictions, hand out copies of the Student Activity so that students will have copies of the fundamental questions for this assignment:
 - a. Is there any evidence that heavy elements such as sodium, iron, and magnesium were generated by processes occurring within the interior of the sun?
 - b. Is it conceivable that these heavy elements are currently being created within the interior of the sun?
 - c. Is the success of the Standard Solar Model dependent on the presence of these heavy elements?
4. After you have read the questions aloud, ask the class to brainstorm answers to all three of the questions. Record their ideas on the board, on newsprint, or on the overhead projector. Take a straw poll that will reflect the view of the students on each question. Record their individual votes on the board.
5. Introduce the culminating assignment of this activity and this module by reminding students that they have learned about:
 - a. Scientific models, the Standard Solar Model in particular; and,
 - b. The role of technology in the design of scientific models.

Read aloud the assignment for this activity: items 3, 4, and 5 on the Student Activity Sheet.

6. Ask the class to review the characteristics of good scientific models and the criteria that they developed for assessing student models assigned in the first two activities. Develop a set of evaluative criteria for this model assignment based on class input.
7. Either assign students into teams or allow them to select their own team members. Remember that there must be a consensus among team members as to their answers to the fundamental questions. If there are students whose ideas differ from all others in the class, allow those students to complete the assignment as individuals.

8. Give the teams ample time to further discuss, enlarge, and refine their answers to the questions. Strongly encourage them to conduct on-line or library research in order to develop their answers fully. You may wish to give them full class periods for a period of time or devote half of a class period every day for a week to team discussions.
9. Have each team make an illustrated oral presentation of their model. The presentations can either be evaluated by other class members or by you, using the criteria developed by the class.



It is important that you use the same procedure used in previous activities of this module, since this is the assessment activity for the module.

10. Collect the written assessments regarding question #3 from each team and post them at a convenient location in the classroom. Give students the opportunity to review all of the assessments.
11. Bring the class together and ask them if any new facts or viewpoints presented either in the written assignments or the oral presentations have caused them to reconsider their original answers. Have the class develop an assessment of the impact of heavy elements on the Standard Solar Model.