

Teacher Information

Solar Events

I. Objectives

A. Forming Concepts (Introductory) Objectives

1. Define coronal holes, solar flares, aurora, and geomagnetic storms.
2. Explain solar events' effects on radio communications.
3. Explain solar events' effects on satellites' orbits and functions.
4. Explain solar events' effects on navigation.
5. Explain solar events' effects on power grids and pipelines.

B. Interpreting Data Objectives

1. Describe the relationship between X-ray radiation and anomalies of Earth's magnetic field.
2. Describe the relationship between the sunspot number and the number of days with geomagnetic storms.
3. Interpret a graph to determine the months of most and least average geomagnetic storm activity.
4. Interpret a data set of yearly sunspot numbers to determine the year of the solar minimum with the smallest sunspot number.

Objectives 5 through 8 require a working knowledge of exponential notation. If your students have not covered exponents, skip Section III E.

5. Calculate the magnitude of the sun's gravitational pull relative to Earth's.
6. Convert the solar escape velocity to kilometers per hour.
7. Calculate the diameter of the sun.
8. Calculate the rotational speed of the sun in kilometers per hour.

C. Applying Principles Objectives

1. Explain observations of the average sunspot number.
2. Justify the cost of an early warning system for geomagnetic storms.
3. Explain the international nature of solar event problems.

II. Interdisciplinary Uses

A. Social Studies

1. Explain the adverse economic effects on people that can be caused by solar events.
2. Describe ancient cultures' use of the sun for measuring time.

B. Math

All calculations are contained in Section III E. This section requires a working knowledge of exponential notation. If your students have not covered exponents, skip Section III E.

1. Calculate the magnitude of the sun's gravitational pull relative to Earth's.
2. Convert the solar escape velocity to kilometers per hour.
3. Calculate the diameter of the sun.
4. Calculate the rotational speed of the sun in kilometers per hour.
5. Calculate by using exponential notation.

C. Language Arts

1. Write short essays about solar events effects on people.
2. Read and write poems and stories about the sun.

III. Science Standards Coordination

The Solar Events activity has been designed to incorporate science standards as specified by the National Science Education Standards (NSES) and the National Science Teachers Association (NSTA) Scope, Sequence, and Coordination (SS&C) of Secondary School Science. Only the major topics are listed. For further explanation of each standard see the complete documents:

NSES - National Academy Press, 2101 Constitution Ave, NW,
Washington, DC 20481
NSTA - 1840 Wilson Blvd, Arlington, VA 22201-3000

NSES	SS&C
Structure of the Earth system	Thermal energy
Earth in the solar system	Earth-Moon-Sun system
Transfer of energy	Sun as an energy source
Properties and changes of properties in matter	Solar system in space

IV. Advanced Preparation

A. Materials

1. One computer per two or three students is a recommended minimum.
2. One copy of the Student Activity Book for each student or group of students.

B. Time Required for Completing the Activity

1. The *Get Info* section takes about 30 minutes
2. The *Gather Data* section takes about 30 minutes if your students are accomplished at exponential notation or if you skip Section III E.
3. The *Application* section takes about 10 minutes.

C. Teacher Familiarity

Preview these materials thoroughly. As with all these activities, before using this activity in class, review the sites and work through the activity yourself to learn about sunspots so you can answer questions or direct students to the answers.

The activity is set up so students are taken to sites containing information that will be used to answer questions regarding solar events. The sites contain either the answers or the information from which the students can infer the answers. At the end of the activity, there is a list of enrichment activities and related web sites.

D. Select Questions for Students to Answer

It would be prudent for you to read the questions students will be expected to answer. These questions are in order of ascending difficulty. Depending on grade level and ability level, you might want to assign specific questions for your students.

E. Student Grouping

These activities can be done individually or in small groups of two or three students. Students who have Internet access can also do them at home for extra credit.

F. Software Requirements and Duplication Preparation

1. Adobe Acrobat Reader is required to download the pages. Click the "Tech Info" link on the Science with NOAA Research homepage to download Acrobat Reader.
2. Download the Teacher Information, Teacher Key, and Student Activity Book PDF files from the "Teacher Info" web page.
3. Duplicate and distribute student pages. Ideally, each student should have a copy of the Student Activity Book that should be distributed and discussed the day before the exercise.