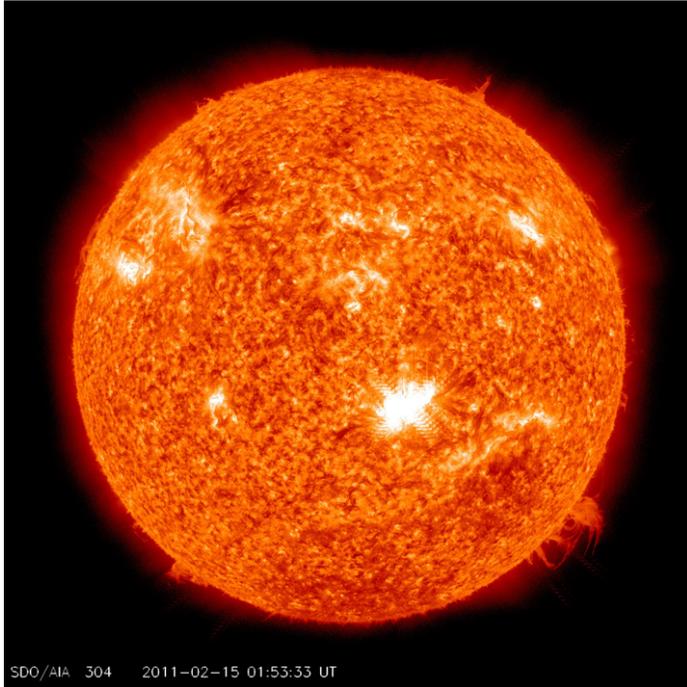




Module 1: What are the features of the Sun?

Activity A: Structure of Earth's Star

Overview



Our Sun is a star and is the closest star to planet Earth. The Sun is also the largest object in our solar system and it contains most of the mass in the entire solar system. Because the Sun has the greatest mass it also has the greatest force of gravity in the solar system. This is the reason why Earth and all the other planets, dwarf planets, asteroids, meteoroids, comets, etc. in our solar system orbit around the Sun. The Sun is the source of energy that enables and sustains life on Earth; without our nearest star we would not be here!

Image: NASA

Team Goal

Your goal is to know and understand the structure and features (parts) of the Sun.

Teacher Overview

All modules in the *SDO Project Suite* are student-led activities, which means the role of the teacher is to support student learning rather than directly lead it. This student-as-scientist method of learning incorporates active team collaboration as they research scientific concepts along with individual review and reinforcement of the concepts learned. The objective of Solar Module 1 is to provide students with a fundamental understanding of NASA's Solar Dynamic Observatory (SDO) and the Sun's structure and function. The focus of Module 1A is to engage students in developing their fundamental knowledge of the Sun's structure. This foundational knowledge will be further explored and developed in Solar Modules 2 & 3 and presented in the performance-based Module 4 SDO Exploration Museum 3-D Solar Exhibit.

Objectives

Students will be able to:

- Understand and demonstrate knowledge of the structure of the Sun.
- Understand and demonstrate knowledge of the features of the Sun.

Essential Vocabulary

- Chromosphere
- Convection Zone
- Corona
- Core
- Prominence
- Photosphere
- Radiative Zone
- Solar Flare
- Solar Granule
- Sunspot



Materials

- Computer with Internet access
- “Solar K-W-L Chart”
- “Sun Primer” data sheet
- “Origami Sun Model” pages
- Yellow & orange highlighters or colored pencils
- Fine tip black pen (Sharpie)
- Scissors
- Ruler
- Pencil

Engage & Explore!

1. BUILD Knowledge:

Activate prior knowledge about the Sun

First complete the “Solar K-W-L Chart” as a team to see what you already know (K) about the Sun and what (W) you’d like to know about the Sun. Next, watch the following NASA and NOVA Sun Lab videos to get an introduction to NASA’s Solar Dynamic Observatory (SDO) and learn about the Sun’s structure (parts) and how the Sun functions (works). Afterward, write down what your team has learned (L) about the Sun on your “Solar K-W-L Chart”.

[Intro to SDO Video](#)

[SDO Science Overview Video](#)

[Sun 101 Video](#)

[The Sun's Energy Video](#)

Module Lesson

Time: 1 block period/2 class periods

Materials: per team

- Computer with Internet access
- “K-W-L Chart”
- “Sun Primer” data sheet
- “Origami Sun Model” pages
- Classroom set of yellow & orange highlighters or colored pencil
- Fine tip black pens (Sharpies)
- Scissors
- Ruler
- Pencil

Teacher Prep:

- Bookmark “NOVA Labs: Sun 101 video” and “Stanford Solar Center Comparison Activities” Internet links on computer(s)/Smart Board
- Make team copies of “Solar K-W-L Charts”, “Sun Primer”, and “Origami Sun Model” pages
- Prepare remaining materials

Student Engage & Explore Activities

1. BUILD Knowledge:

Activate prior knowledge about the Sun

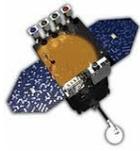
Provide each team with a “Solar K-W-L Chart” to brainstorm a list of things they already know about the Sun and write their ideas in the “Know” column. Next, students write a list of questions they want to learn about the Sun in the “Want to Know” column. After watching the videos and discussion questions, students work together to summarize what their team learned about the Sun in the final “Learned” column of the K-W-L chart.

[Intro to SDO Video](#)

[SDO Science Overview Video](#)

[Sun 101 Video](#)

[The Sun's Energy Video](#)



2. APPLY Learning:

Research information about the Sun

Watch Stanford Solar Center's "Colors of the Sun" video for an introduction to our nearest star. How big is the Sun? How hot is the Sun? How far is the Sun? Navigate through each of the three Sun comparison sections to compare measurements of familiar objects to learn about the Sun's size, structure, and constantly changing features. Use a pencil to complete the "Sun Primer" data sheet. Click on the link below to get started and enjoy your solar journey!

[Colors of the Sun Video](#)

[Sun Comparison Activities](#)

Student Engage & Explore Activities

2. APPLY Learning:

Research information about the Sun

Provide each team with a "Sun Primer" data sheet. Teams then navigate to the website below and collectively learn about the structure of the Sun and collaborate to research answers to questions in the "Diameter", "Sun's Vital Statistics", "Outer Layers", "Mass", "Photosphere", "Core", and "Distance" sections of the data sheet. Once the team has consensus on an answer to a research question, students take turns writing the agreed response on their team's data sheet. Teams continue the process until their data sheet is complete.

[Sun Comparison Activities](#)



SDO Lesson Suite

Student Guide

Names: _____ Date: _____

Module 1A: Sun Primer

Instructions: Navigate to the Stanford Solar Center Comparison Activity webpage (<http://solar-center.stanford.edu/compare/>). As a team, research answers to the activity questions and write down the correct responses. Shine on!

A) How BIG is the Sun? Click on the "Diameter", "Outer Layers", and "Mass" links to learn about and compare the size of the Sun and its features.

Diameter:

- Using a ruler, draw a diameter across the false-color image of the Sun. Next, label your prediction of the width of the Sun in miles and kilometers on the diameter line, don't forget units (mi. and km).

We predict the Sun's diameter is...



Image: NASA

- Draw a box around the feature found on the Sun's surface:
Corona Prominence Sunspot
- Circle the choices that correctly complete the statement:
Sunspots are *hotter / cooler* than the surrounding surface of the Sun so they appear as *darker / lighter* areas on the Sun's surface.



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3. DEMONSTRATE Ability:
Make a 3-D model of the Sun

Scientists use models to study objects that are too big, too small, too far, or too difficult to observe directly. Create an origami model of the Sun by using the resources and following the instructions below. Click on the “Sun|Trek Fact-ary” link below to locate and read the vocabulary definitions for the features of the Sun. Next, using a black pen, correctly label the terms in the correct location on your team’s 3-D “Origami Sun Model”. Feel free to add creative detail to your origami Sun model artifact, which is part of your team’s Module 4 SDO Exploration Museum 3-D Solar Exhibit.

[Sun|Trek Fact-ary](#)
[Sun Origami Model](#) (see attached file)

Solar Vocabulary:

- Chromosphere
- Convective Zone
- Core

- Corona
- Photosphere
- Radiative Zone
- Sunspot

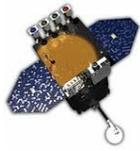
Student Engage & Explore Activities

3. DEMONSTRATE Ability:
Make a 3-D model of the Sun

Distribute copies of instructions and materials for teams to build the 3-D “Origami Sun Model”. Teams use their “Sun Primer” data sheet and the “Sun|Trek Fact-ary” link to locate and read definitions for the Solar Vocabulary list. These terms are then accurately labeled for each feature of the Sun’s structure on the 3-D Sun model. Teams display their 3-D “Origami Sun Model” as part of their Module 4 SDO 3-D Solar Exploration Exhibit.

[Sun|Trek Fact-ary](#) & [Sun Origami Model](#) (see attached file)

The image contains two pages of instructions for creating a 3-D origami Sun model. The left page shows a series of 14 numbered diagrams (1-14) illustrating the steps of the origami process, from a flat square to a complex 3-D structure. The right page shows a circular template for the Sun model, labeled 'OUR SUN' in the center. The template is divided into several concentric regions, each with a lettered label (A through H) corresponding to the solar vocabulary list. The regions are: A (outermost), B, C, D, E, F, G, and H (innermost). The template also includes dashed lines for cutting and solid lines for folding. Instructions at the top of the right page read: 'Color between the lines on the other side with a highlighter or light-colored marker. Cut out the Square along the dashed line on this side. Fold according to the directions on the opposite page. Press the final Sun in a book to flatten.'



***Congratulations, you have completed
your first SDO Solar Module!
You're on your way to becoming
solar student-scientists!***

Differentiation/Extension

- Students write and illustrate a mini-book based on the solar science information they researched and recorded in their "Sun Primer" data sheets and the Solar Vocabulary list.
- Teams record a "documentary" program that explains the structure of the Sun using information from their "Sun Primer" data sheets and the Solar Vocabulary list.
- Teams create a 2-D puzzle or quiz game on the structure of the Sun based on their research findings in their "Sun Primer" data sheets and the Solar Vocabulary list.

[NASA Solar Math](#)

Grade Level 3-5, p. 14

Grade Level 6-8, p. 32

Grade Level 9-12, p. 86

Internet Resources

[NOVA Labs: The Sun Lab Website](#)

[Our Star the Sun Images](#)

[Sun|Trek Structure of the Sun Tour](#)

[Sun|Trek Solar Atmosphere Videos](#)

[Stanford Solar Center Exploring the Sun](#)

[Sun|Trek Gallery](#)

[NASA Solar Glossary](#)

[NASA Space Weather Media Viewer:](#)

["The Sun" Videos #1-2](#)

[NASA Space Weather Media Viewer:](#)

[Illustrations "The Dynamic Sun"](#)