

# Solar Plasma Collage

Explore the Sun's plasma, variable temperature and density through art!



**Materials Needed:** *Mind Melting Facts About the Sun* poster\*, *Mind Melting Facts* worksheet, black construction paper, tissue paper in a variety of colors and patterns, glue, scissors, pencil or white chalk.

*Optional:* Compass.

\*Poster is available online at:

[www.jpl.nasa.gov/infographics/mind-melting-facts-about-the-sun](http://www.jpl.nasa.gov/infographics/mind-melting-facts-about-the-sun)

**Review the information** on the *Mind Melting Facts About the Sun* poster. You can use the questions on the worksheet as a guide for classroom discussion, or assign it as an individual or group activity.

## Key Concepts:

- The density of the Sun's plasma is highest in the core and progressively decreases towards the corona.
- The temperature is highest in the core, decreases towards the surface and increases again in the corona (one of the major puzzles heliophysicists are trying to solve!).
- Temperature measures how fast particles are moving, while heat measures how much energy is transferred (if there are more particles around, they will transfer more energy).

## Instructions:

### Step 1: Plan your materials.

*Students have creative flexibility! Colors and textures are up to the students' artistic interpretation of the Sun. Adapt the activity for different ages; for example, younger children can work together to create a collaborative collage.*

**Showing Temperature:** Choose colors to represent temperature variation inside the Sun. Decide how to represent the hottest and coolest (but still very hot!) parts within the Sun. Combine colors and include patterned or shiny paper. Choose colors that are neighbors on the color wheel to show a progressive transition.



**Showing Density:** There are various ways to show density, including packed or thickly layered pieces, as well size, shape, color, and texture. Showing density is up to the artist's creative interpretation.



**Showing Layers:** Plasma is not solid, and therefore the layers of the Sun don't have hard transitions between them. Layers can shift and blend into each other. You can represent this by blending tissue paper colors between layers.

**Show Unique Properties** for the Sun's layers. For example, the photosphere is the "surface" of the Sun. We can see it with the naked eye because it creates the most light. Highlight this layer in your collage with extra bright or shiny tissue paper.

*Optional:* Older children can outline the layers of the Sun, from the core to the corona, on the black construction paper using a pencil, white chalk, or a compass. As an applied math activity, they can also calculate and draw a scale model, based on the distances provided on the poster.

**Step 2:** Cut, tear, or crumple tissue paper. Arrange your design on the black construction paper.

**Step 3:** When you are satisfied with your design, glue the tissue paper on the black construction paper to create a solar plasma collage!



**Step 4: Discuss** the intersection of science and art. How can artists and scientists work together? How can each contribute to a better understanding of our Sun?

**Optional: Create a collaborative art exhibit.** Write a short artist's statement about your interpretation of solar plasma and the methods you used to represent scientific concepts about the Sun in your collage.

### **Extension: Kinesthetic Activity**

**Materials Needed:** Silk scarves.

#### **Instructions:**

In a gym or outdoor area, act out the solar plasma particles in each layer of the Sun, or pretend to "travel through" plasma together. Distribute a silk scarf to each student. Each student moves their silk scarf either faster or slower to show increasing or decreasing temperatures. Students move closer together to show higher density, and move farther apart to show lower density.

**Worksheet:**

**Mind Melting Facts About the Sun**



Image: NASA/SDO.

Directions: Read the *Mind Melting Facts About the Sun* poster, and answer the following questions.

**Read each statement. Circle True or False.**

- Temperature measures how fast particles are moving. True   False
- The Sun’s surface is solid. That is why it is visible from Earth. True   False
- The Sun is hottest at the core and coolest at the photosphere. True   False
- Scientists understand why the corona is hotter than the surface. True   False
- The visible part of the Sun is called the photosphere. True   False
- The density of the Sun is the same from the surface to the core. True   False

**Fill in the table.**

Layer of the Sun	Temperature	Density

**Answer these questions.**

If you were in outer space, would a thousand degrees feel hot? Why or why not?

Is the photosphere the outermost layer of the Sun? Why or why not?

Describe one major puzzle about the Sun that is not yet solved.

# MIND-MELTING FACTS ABOUT THE SUN

National Aeronautics and Space Administration



MIND-MELTING FACTS

## Temperature vs. Heat

In space, the temperature can be thousands of degrees without "feeling hot." Why? *Temperature* measures how fast particles are moving, whereas *heat* measures the total amount of energy that they transfer. Since space is mostly empty, there are very few particles to transfer energy to your hand. Particles may be moving fast (high temperature), but if there are very few of them, they won't transfer much energy (low heat).

## The Solar "Surface"

The Sun does not have a solid "surface". The layer you can see, called the **photosphere**, is just the layer that emits the most light in the visible part of the electromagnetic spectrum. In fact, there are three layers on top of it, but the visible light they emit is too faint to see. Except during a total solar eclipse, when the corona can be seen by the naked eye!

## The Puzzle of Coronal Heating

As you walk away from a fire, you expect the temperature to go down. The Sun is quite different: the **corona**, the outermost layer of the Sun, is hotter than the layers immediately below it! Exactly how the corona gets so hot is a major unsolved puzzle in heliophysics.

SOLAR WIND

## Solar Core

Temperature: More than 27 million °F  
Density: 150 g/cm<sup>3</sup>  
(more than 10 times the density of lead)

## Radiative Zone

Temperature: 3.5 million °F  
Density: From 20 g/cm<sup>3</sup>  
(the density of gold)  
to 0.2 g/cm<sup>3</sup>  
(less dense than water)

## Convection Zone

Temperature: 3.5 million to 10,000 °F  
Density: 2 x 10<sup>-7</sup> g/cm<sup>3</sup>  
(.001% the density of air)

## Photosphere (VISIBLE LAYER)

Temperature: 10,000 °F  
Density: 10<sup>-9</sup> g/cm<sup>3</sup>  
(.00001% the density of air)

## Chromosphere

Temperature: 10,000 °F to 36,000 °F  
Density: 10<sup>-12</sup> g/cm<sup>3</sup>

## Transition Zone

Temperature: 40,000 °F to 1.8 million °F  
Density: 2 x 10<sup>-13</sup> g/cm<sup>3</sup>

## Corona (THE SUN'S OUTER ATMOSPHERE)

Temperature: Average 2.5 million °F  
Density: 10<sup>-16</sup> g/cm<sup>3</sup>

## THICKNESS OF EACH LAYER OF THE SUN



For more information, please visit:  
[nasa.gov/sunearth](http://nasa.gov/sunearth)

18 million miles (approximate)

60 miles

1,050 miles

250 miles

113,000 miles

233,000 miles

Solar Core  
86,000 miles

Not to Scale

[www.nasa.gov](http://www.nasa.gov)

Larger version of this poster is available online at:

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