The Sun

Source: NASA

Challenger CENTER

Our Solar System: The Sun

Activity 1: True or False

Facilitator Notes

Objective:

Students will answer TRUE or FALSE questions to identify interesting facts about the Sun and address common misconceptions.

Materials Needed:

- ☐ Statements about the Sun
- ☐ OPTIONAL: TRUE/FALSE cards

Summary of Student Action:

Students will read a statement about the Sun and indicate if they believe the statement is true or false. After revealing the answer, they will read a short statement with additional information.

Setup Instructions:

- Print the statements and cut them out, keeping the statements and answers attached.
- Fold the cards in half, along the line between the statement and the answer.
- Place the cards on a table with the answers down and the statements standing up.
- Students can direct themselves and lift the cards to find the answer, or this activity can be done as a group by giving each student a TRUE/FALSE card to hold up when each statement is read.
- Cards can be added or removed to adjust the level of difficulty.

Delivery:

- This activity is intended to be delivered in person but can be done virtually.
- If delivered virtually, the facilitator can read the statement and ask students to use a thumbs up/down feature in the video call or physically hold their thumbs up or down.

Additional Notes:

- If running the activity as a group, students can simply hold a thumb up or down instead of using the TRUE/FALSE answer cards.

Our Solar System: The Sun

Activity 1: True or False
Student Instructions

Activate Your Knowledge:

What do you know about the Sun? How does it compare to the stars in the night sky? How does it compare to the planets and other objects in the solar system?

Materials You Will Need:

- ☐ Statements about the Sun
- ☐ OPTIONAL: TRUE/FALSE cards

Procedures:

1. Find the statements laid out on the table in front of you.
2. Read a statement and decide if you think it is true or false.
3. Tilt the card back so you can read the answer on the bottom to determine if you were correct.
4. Read the statement on the bottom of each card for more information about the Sun.

The Sun is on fire.	**The Sun is a star.**
FALSE The Sun is not burning because there is not enough oxygen available. The Sun is made of a high-energy state of matter called plasma.	**TRUE** The Sun is a G-type main-sequence star in the G2V spectral class.
The Sun orbits around the Earth every 24 hours, which is why we experience day and night.	**The Sun is the brightest star in our galaxy.**
FALSE The Sun is at the center of the solar system, and the Earth orbits around it. The Earth rotates once every 24 hours.	**FALSE** Although the Sun is brighter than 85% of the stars in the Milky Way Galaxy, it is far from the brightest.

The Sun is the largest star in our galaxy.	**The Sun contains more than 99% of the matter in our solar system.**
FALSE The Sun is small enough to be called a dwarf star, but it is larger than 90% of stars in the Milky Way Galaxy.	**TRUE** The Sun actually contains 99.86% of the matter, meaning all the planets only contain about 0.14% of the matter.
It takes more than 8 minutes for light from the Sun to reach Earth.	**Without the Sun, the planets would drift off into space.**
TRUE The Sun is so far away that the light takes about 8 minutes and 20 seconds to get to Earth.	**TRUE** The strong gravitational pull of the Sun keeps the planets in stable orbits.

The Sun is more than 100 times as wide as the Earth.

TRUE

The earth's diameter is 7,917 miles, and the Sun's diameter is 865,370 miles.

The Sun is approximately 4.567 billion years old.

TRUE

The Sun is about halfway through its life.

It is warmer in the northern hemisphere on Earth's surface in the summer, because Earth is closer to the Sun.

FALSE

The Sun is farthest from the Sun during our summer. The seasons are a result of the tilt of Earth's spin axis.

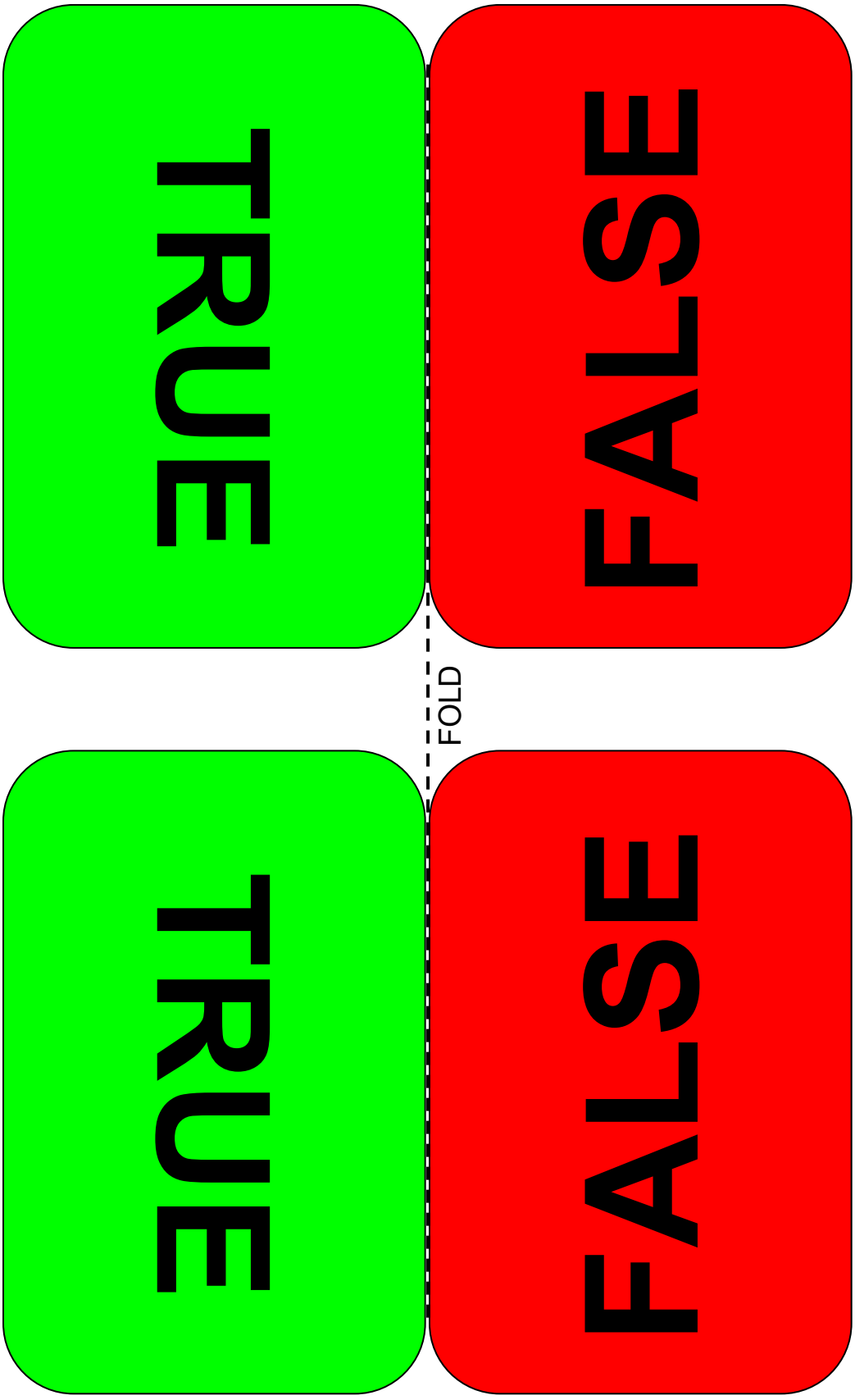
The Sun does not rotate.

FALSE

Galileo observed the rotation of the Sun by tracking the motion of sunspots across its surface.

The temperature of the Sun's core can reach 28 million degrees Fahrenheit.	**When the Sun runs out of hydrogen fuel, it will expand and engulf most of the inner solar system, including Earth.**
TRUE The temperature in the Sun can vary greatly, but its core is the hottest place in the solar system.	**TRUE** The Sun will become a red giant as it cools and expands. Don't worry, this won't happen for another 5 billion years.
Sunspots are dark and cool.	**The Sun has a solid surface.**
FALSE Sunspots are relatively cool and dark but can reach 6,700 degrees Fahrenheit and are brighter than the full moon.	**FALSE** The part that looks like the surface is called the photosphere. It is thin enough to be transparent and let light escape.

The Sun - Activity 1 - TRUE/FALSE Cards



Our Solar System: The Sun

Activity 2: Anatomy of the Sun
Facilitator Notes

Objective:
Students will construct a model of the Sun to identify key structures and processes.

Materials Needed:
- ☐ Sun model printout
- ☐ Colored pencils, crayons, and/or markers
- ☐ Scissors
- ☐ Glue
- ☐ Example images

Summary of Student Action:
Students will color the layers of the Sun, cut out the layers, and glue them together in order. Next, students will cut out the text for each layer. Last, they will fold back half of each layer and paste the appropriate text.

Setup Instructions:
- Print and display the instructions.
- It would be helpful to create an example for this activity in advance and display it or pictures of the steps, so students have a visual reference.
- Be sure the layers are collated and grouped for the students.

Delivery:
- This activity is intended to be delivered in person. For virtual alternatives, explore the extension links in the implementation guide.
- Links to Sun anatomy diagrams are also included in the implementation guide.

Additional Notes:
- To increase engagement, you may choose to have students write their own notes on the flaps in this model, rather than paste the included notes.

Our Solar System: The Sun

Activity 2: Anatomy of the Sun
Student Instructions

Activate Your Knowledge:

What do you know about the structure of the Sun? Is it solid like the Earth? Does it have layers or a uniform composition? Like the Earth, the Sun has distinct layers, including an outer visible layer, a convection zone, and a core. However, the makeup of these layers is very different from the layers of the Earth.

Materials Needed:

- ☐ Sun model printout
- ☐ Colored pencils, crayons, and/or markers
- ☐ Scissors
- ☐ Glue

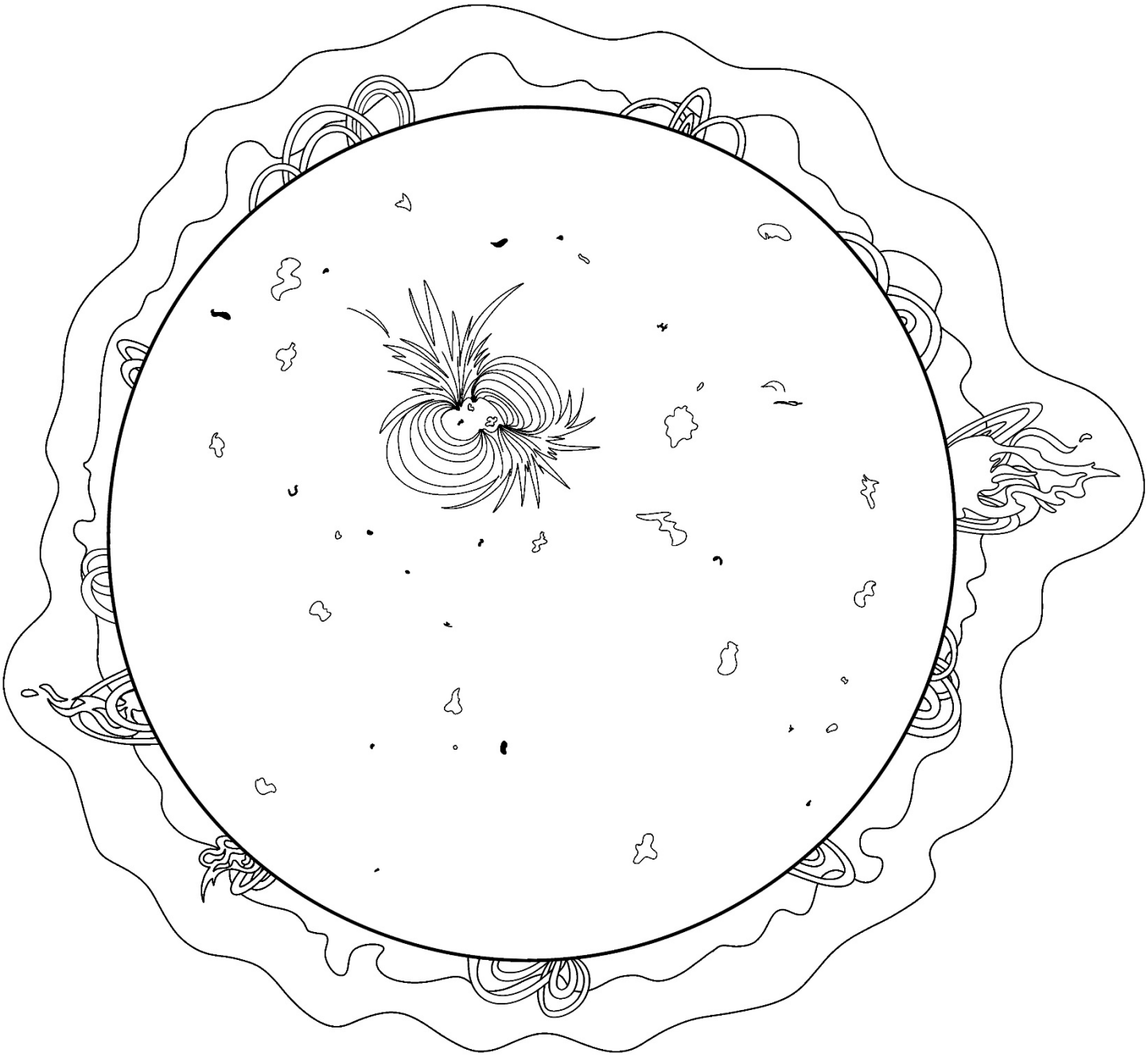
Procedures:

1. Color each layer of the Sun.
2. Cut out each layer around its outer edge.
3. Apply glue to the labeled areas and stack the layers in order.
4. Firmly press the layers together to ensure the glue sticks well.
5. Fold back each layer to the line where the glue starts.
6. Cut out and paste each set of notes on the back of the previous layer, so they can be read while viewing the corresponding layer.

NOTE: Reference the example image for guidance.

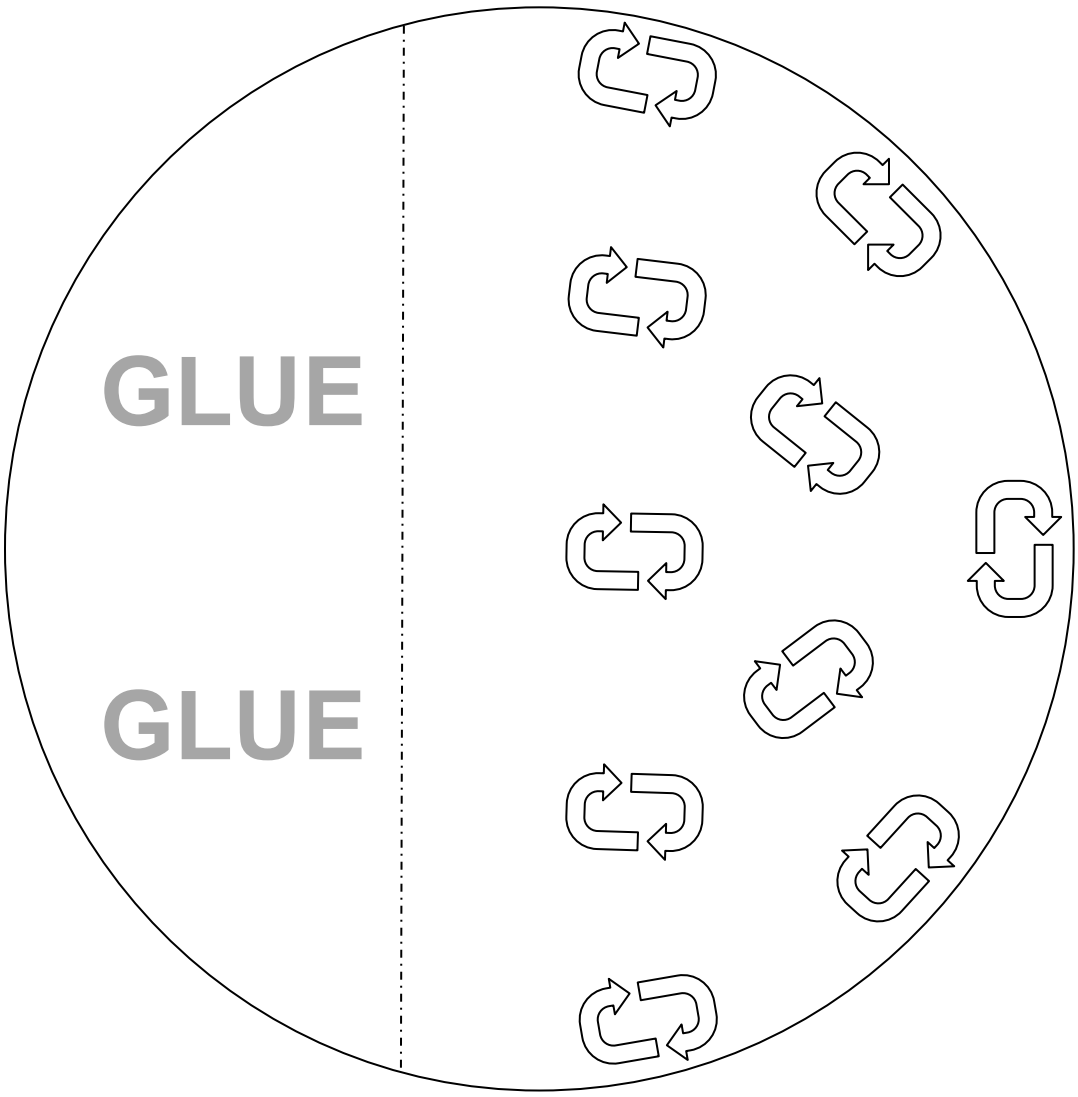
The Sun - Activity 2 - Anatomy of the Sun - Layers of the Sun

Corona, Chromosphere, and Photosphere



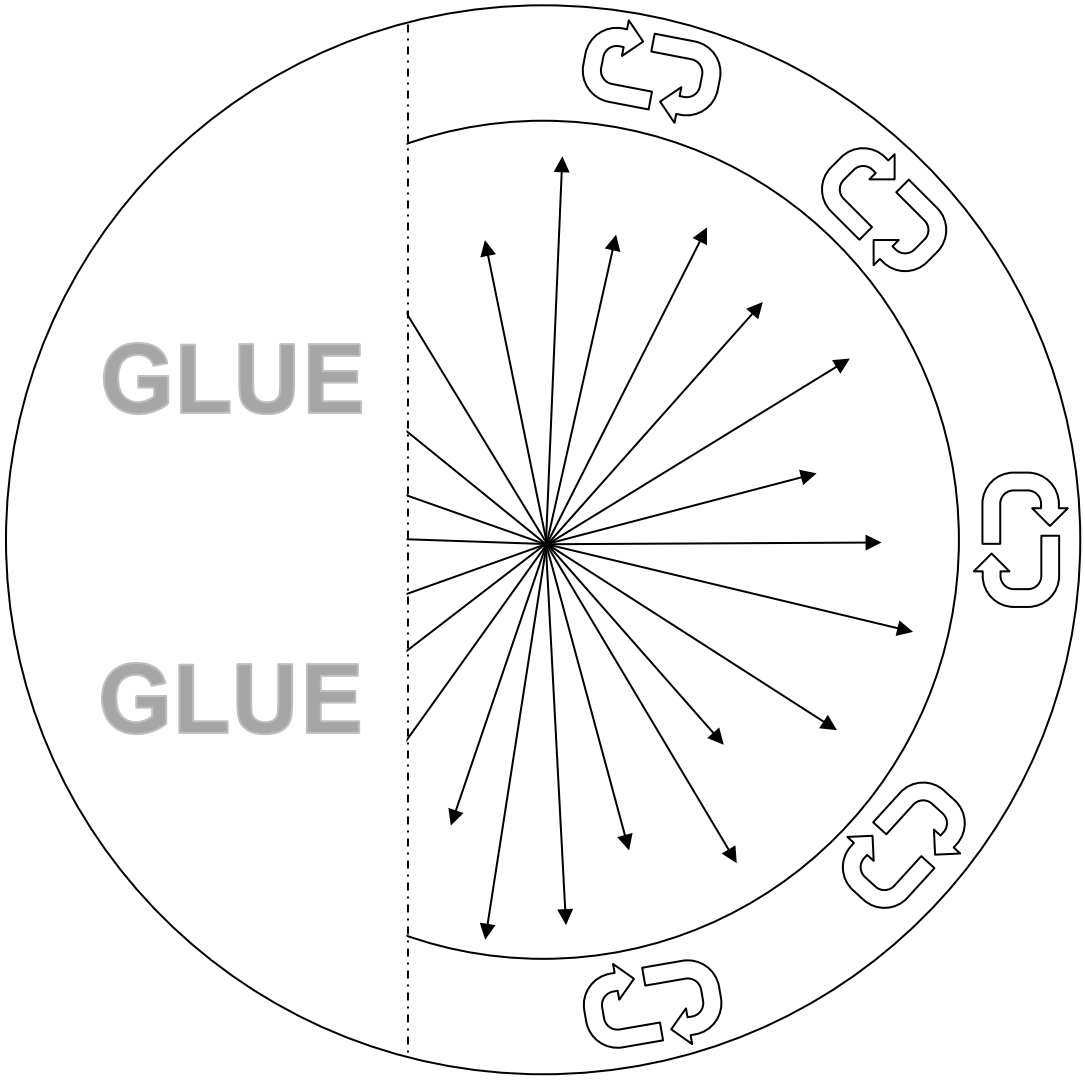
Top Layer

Convection Zone



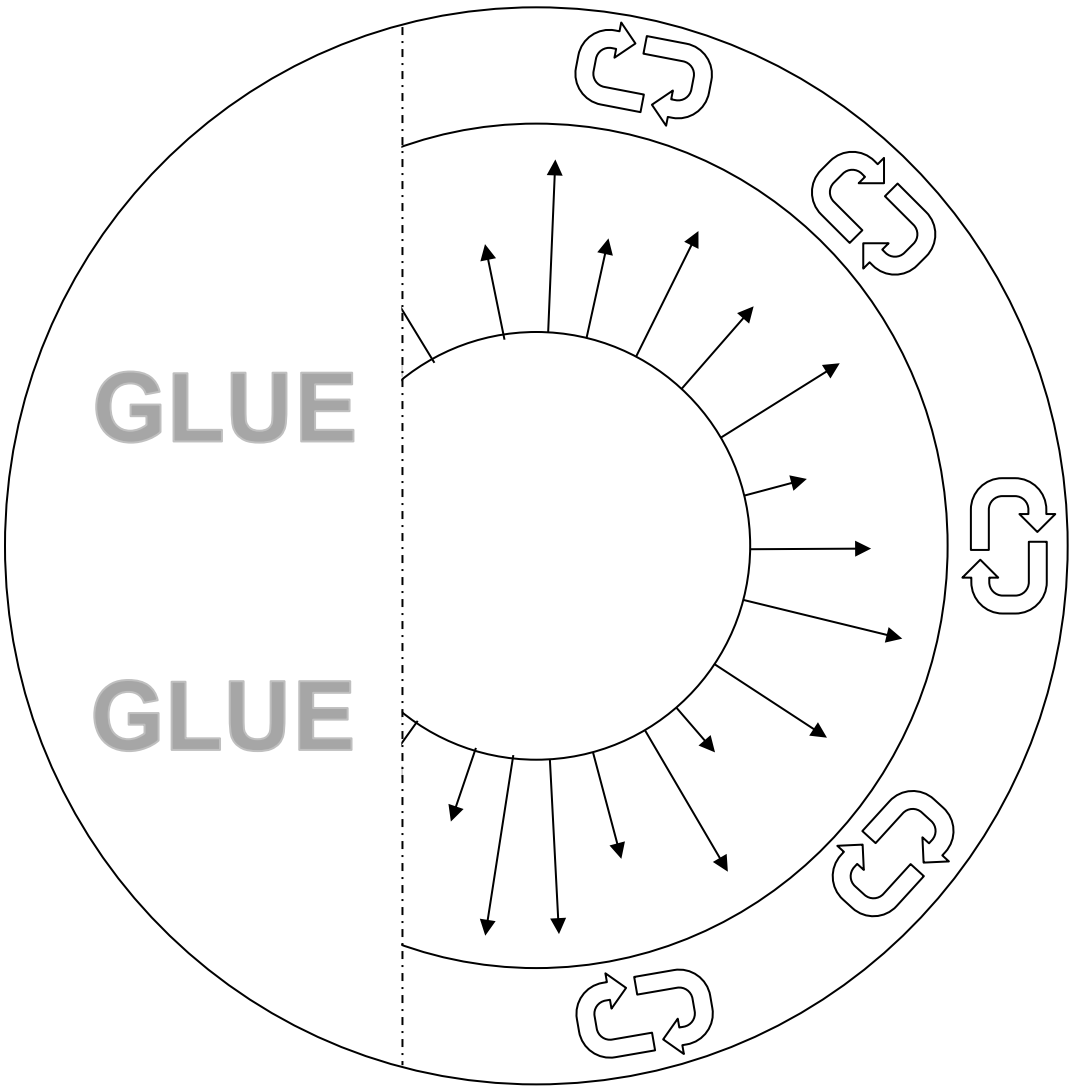
Second Layer

Radiative Zone



Third Layer

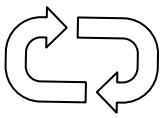
Core



Bottom Layer

Convection Zone

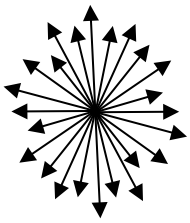
Energy flows through this layer in rising and falling flows called **convection currents**. Hot material rises from the lower layers and cool matter sinks back down from the surface.



^ glue on the back of the corona, chromosphere, photosphere flap

Radiative Zone

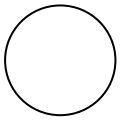
In this zone, energy leaves the core and begins its journey toward the surface.



^ glue on the back of the convection zone flap

Core

The core is at the center of the Sun, under all the other layers. This is where **nuclear fusion** take place, which produces all the energy release by the Sun. The temperature can reach 29 million degrees in the sun's core.



^ glue on the back of the radiative zone flap

Corona

The corona is the "crown" of the Sun. It extends far above the surface and starts the **solar wind**.

Chromosphere

Chromosphere means "sphere of color" and can only be seen during a total **solar eclipse**.

Photosphere

The photosphere is like the Sun's surface. It is the layer that emits **radiation**, including visible light. **Sunspots** occur in the photosphere and appear darker than the rest of the surface because they are relatively cool.

^ glue on the back of the core layer

Example 1

Front

Inside

Example 2

Front

Inside

Our Solar System: The Sun

Activity 3: Radiation Shielding

Facilitator Notes

Objective:

Students will experiment with heat lamps to demonstrate how energy radiates from the Sun and how effective various materials are at blocking radiation.

Materials Needed:

- ☐ Heat lamp and bulb
- ☐ Infrared thermometer
- ☐ Black tiles (5)
- ☐ Aluminum foil
- ☐ Plastic wrap
- ☐ White paper
- ☐ Dark paper (black, purple, dark blue)
- ☐ Glue stick

Summary of Student Action:

Students will use the infrared thermometer to measure the temperatures of the tiles and observe how the temperature will vary based on the material used to cover the tile. After completing these observations, students can attach pieces of the materials to a piece of construction paper, which they will take home to observe what happens if they set it in the Sun for a few hours.

Setup Instructions:

- Set up a heat lamp and place four tiles under it.
- Place another tile to the side, so it is not affected by the heat lamp.
- Place the infrared thermometer and other materials on the table.
- Lay one piece of each material on a tile and turn on the lamp before students arrive.

Delivery:

- This activity is intended to be delivered in person.
- Other thermometers may be used, or students may lift the cover and touch the tile to make qualitative observations.
- If it is a sunny day, you can conduct this experiment outside and use the actual Sun as your source of radiation.

Our Solar System: The Sun

Activity 3: Radiation Shielding

Student Instructions

Activate Your Knowledge:

How does energy from the Sun reach Earth? What is the name for this type of energy transfer? Why is it important to understand how to block this energy? The Sun emits energy in the form of electromagnetic radiation, including visible light, infrared (IR) radiation, and ultraviolet (UV) radiation. The Sun's radiation provides heat and light for life on Earth, but high-energy radiation can be harmful. Some materials can effectively block different forms of radiation.

Materials You Will Need:

- ☐ Heat lamp and bulb
- ☐ Infrared thermometer
- ☐ Black tiles (5)
- ☐ Aluminum foil
- ☐ Plastic wrap
- ☐ White paper
- ☐ Dark paper (black, purple, dark blue)
- ☐ Glue stick

Procedures:

🚫 Safety Tip: Do NOT point the laser of the thermometer at a person. 🚫

1. Measure the temperature of the tile that is not under the heat lamp.
    - To do this with the infrared thermometer, point it at the sample and pull the trigger. How does this compare to the temperature in the room?

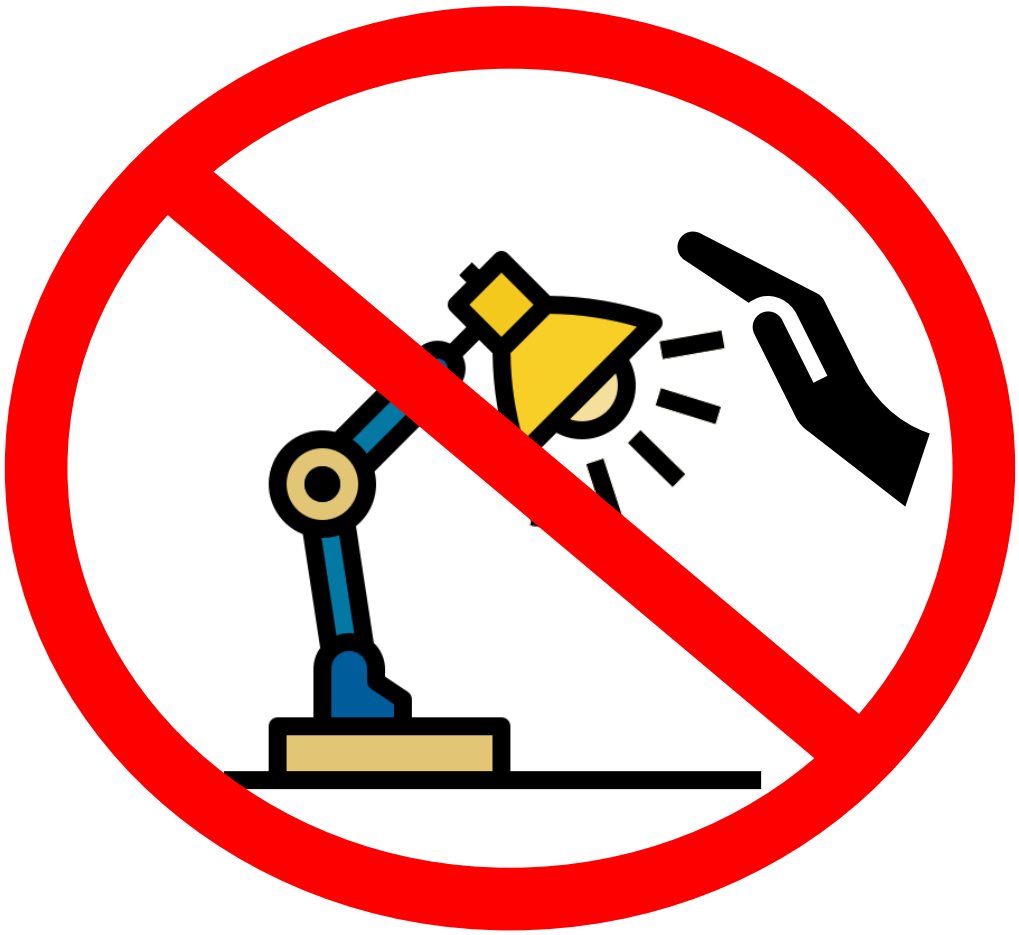
2. Measure the temperature of the tile under the heat lamp that has nothing covering it. How does its temperature compare to the temperature of the first tile?

3. Measure the temperature of the other three tiles by lifting the covering slightly and pointing the thermometer at the surface of the tile. Which material is best at blocking the heat lamp's radiation?

4. Use a stapler or glue stick to attach pieces of aluminum foil, white paper, and plastic wrap to a piece of dark paper. You will lay this out in the Sun at home to investigate how well they protect the dark-colored paper.

CAUTION:
LAMP IS HOT

PLEASE DO NOT TOUCH



Our Solar System: The Sun

Activity 4: The Sun's Energy
Facilitator Notes

Objective:
Students will watch videos, play a game, and read text to learn about the Sun's energy, space weather, and auroras.

Materials Needed:
- ☐ Video: "Where Does the Sun's Energy Come From?"
- ☐ Game: "Helios"
- ☐ Video: "What is an Aurora?"

Summary of Student Action:
Students will learn about the structure of the Sun and the role of nuclear fusion in producing light, heat, and other forms of energy. They will play a game to demonstrate nuclear fusion by building larger atoms from subatomic particles. They will then investigate the causes of the aurora on Earth and explore the basics of space weather.

Setup Instructions:
- Open all links in advance to ensure they work as expected.

Delivery
- This activity is intended to be delivered virtually.
- You may choose to share your screen to watch the videos.
- The link to the "Helios" game should be sent to students after watching the first video.
- This activity can be delivered in person by setting up a tablet for each resource.

Additional Notes:
- Ask questions before each activity to engage the students' prior knowledge and set the stage for the content they will see in each.
- Additional resources are linked in the implementation guide, allowing students to explore these concepts in more depth.