Name: Date: Class:

Student Sheet

Solar Eclipse Story Map Student Sheet

Part A: Engage: The Sun is a Star!

A.1. Is life on Earth possible without the Sun? Explain

A.2. Both the Sun and Jupiter are made of gas. How is the Sun different from Jupiter?

A.3. What process inside the core of the Sun makes all of the Sun's energy?

A.4. Fill in the blank. The Sun is just one of billions and billions of _____ in the universe.

Table 1. Life and Death of a Planetary System			
	Time	**What is happening?**	**Key Terms**
1: A Star is Born			
2: From Cloud to Disk			
3: Collisions, Collisions			
4: Moving Around			
5: Settling Down			
6: Aging into Gianthood			
7: Death and New Life			

A.5. Fill out Row 1: A Star is Born in Table 1 in your student sheet.

A.6. Fill out Row 2: From Cloud to Disk in Table 1 in your student sheet.

A.7. Fill out Row 3: Collisions, Collisions in Table 1 in your student sheet.

A.8. Fill out Row 4: Moving Around in Table 1 in your student sheet.

A.9. Fill out Row 5: Settling Down in Table 1 in your student sheet.

A.10. Fill out Row 6: Aging into Gianthood in Table 1 in your student sheet.

A.11. Fill out Row 7: Death and New Life in Table 1 in your student sheet.

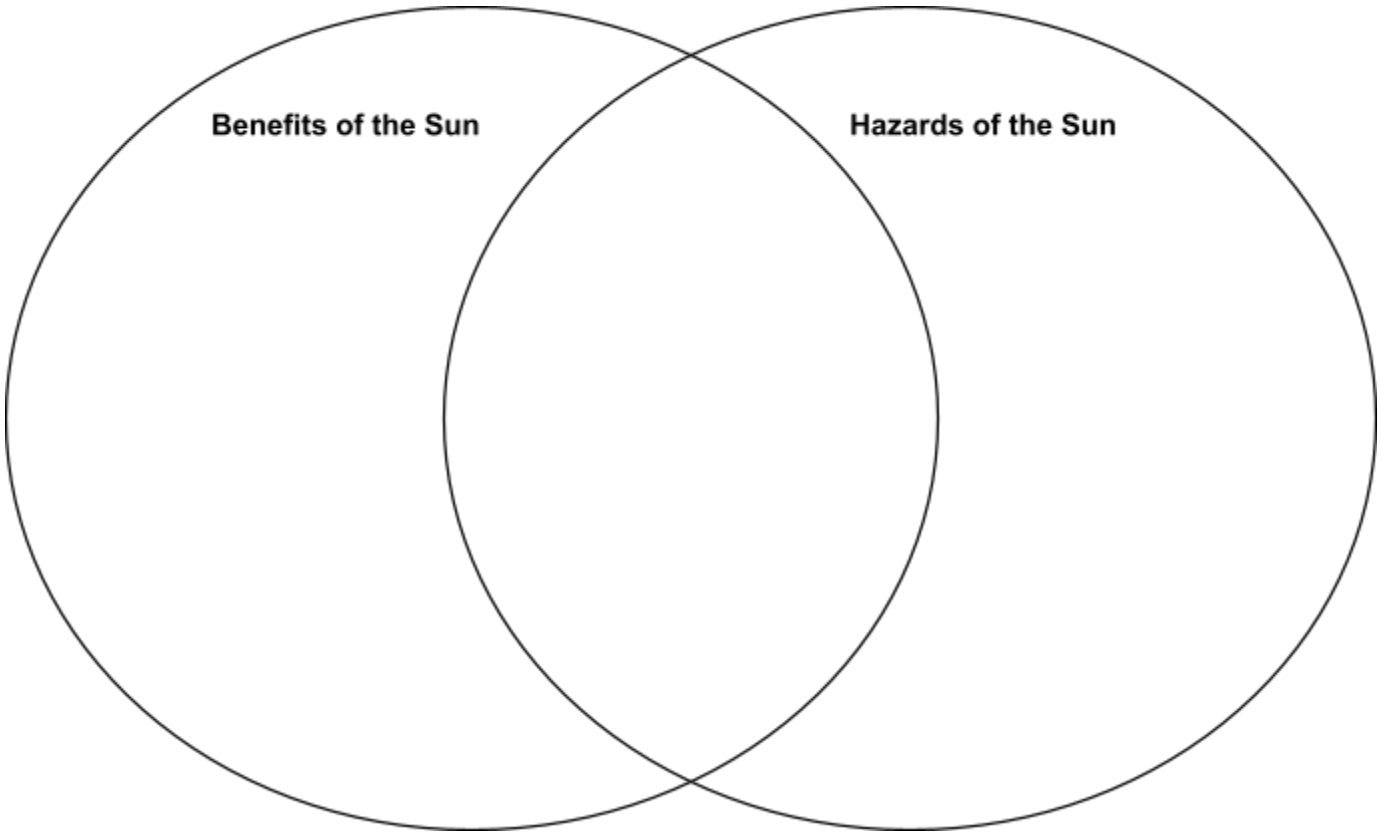
A.12. What is the surface temperature of the Sun?

A.13. What is the luminosity?

A.14. What does it mean when we call a star a main-sequence star?

Part B: Explore

Graphic Organizer 1. Benefits and Hazards of the Sun



B.1. Use Graphic Organizer 1: Benefits and Hazards of the Sun (a Venn Diagram) in your student to document the different benefits and hazards of the Sun.

B.2. Is space weather a benefit or a hazard to Earth? Explain your reasoning.

B.3. If you haven't already, add the term 'space weather' to the appropriate section of Graphic Organizer 1: Benefits and Hazards of the Sun.

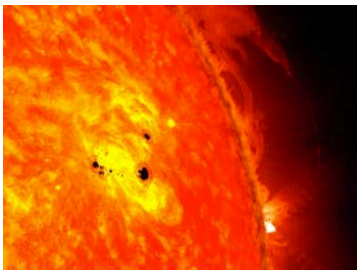
B.4. How do you rely on technology in your everyday life? What powers that technology?

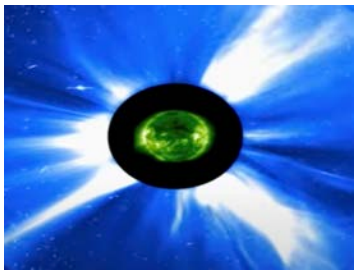
B.5. Have you ever lost electricity during a bad storm? How did it affect your daily activities?

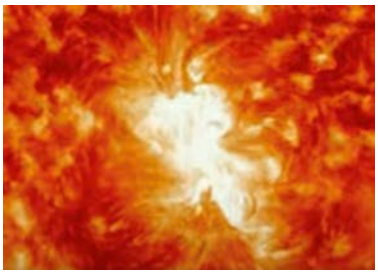
B.6. Make a prediction: if Earth storms can damage electrical grids, can space storms affect satellites and satellite communications?

B.7. Match the picture to the correct vocabulary term in your student sheet.

Coronal Mass Ejection (CME) ***Sunspots*** ***Solar Flares***







B.8. What time on the video does the solar wind hit SDO?

B.9. Fill out Graphic Organizer 2. Space Weather in your student sheet.

Graphic Organizer 2. Space Weather

In my own words, space weather is….

If I could draw space weather, it would look like this…

B.10. What happens on the sun approximately ever eleven years?

B.11. What does this event cause?

B.12. Compare visual data from the solar minimum and solar maximum. What do you notice about the number of sunspots, solar flares, and CMEs during each time period? Record your observations in Table 2. Solar Cycle of your student sheet.

Table 2. The Solar Cycle	
Solar Minimum	**Solar Maximum**

B.13. What differences do you notice between Solar Cycle 23 and Solar Cycle 24?

B.14. Use the slider to find the year when the most sunspots were recorded. What year is this?

B.15. What do scientists think Solar Cycle 25 will look like? (Look at the red line for predicted values)

B.16. How do you think scientists made the predictions for Solar Cycle 25?

B.17. Comparing the red line to the data points recorded so far this year, have scientists been accurate with their predictions? What is your evidence?

B.18. How do atmospheres protect planetary bodies from the solar wind?

B.19. How do magnetospheres protect planetary bodies from the solar wind?

B.20. Even though Jupiter has both an atmosphere and magnetosphere, like Earth, why isn't Jupiter a good place for life?

Part C: Explain

C.1. Document which glasses are safe to view the Sun and which glasses are not safe to view the Sun. In your student sheet, drag the images on the right side of Graphic Organizer 3. Safely Observing the Sun to their correct position using the answer key shown in the panel.

Graphic Organizer 3. Safely Observing the Sun

Which eyewear is safe to observe the Sun with?

YES!	NO!
Solar Eclipse Glasses	Sunglasses 3D Glasses Safety Goggles

C.2. Use your pinhole projector to make a Sun observation. Record your observations in Table 3. Pinhole Projector Observations in your student sheet.

<table>
<tr><th colspan="2">Table 3. Pinhole Projector Observations</th></tr>
<tr><td>Date and Time of Observation:</td><td rowspan="4">Observations:
Sometimes very large sunspots can be visible with a pinhole projector, but the sun would have to be close to the Solar Maximum. Other features of the Sun can be observed with more advanced equipment.

Draw what you observe:</td></tr>
<tr><td>Conditions Outside:
Clear
Haze: Heavy Medium Light
Clouds: Heavy Medium Light
Wind: Yes No</td></tr>
<tr><td>  </td></tr>
<tr><td>Drag the icons above to show the conditions during observations:</td></tr>
</table>

C.3. What is the Sun's atmosphere called?

C.4. What does the "occulting disk" do?

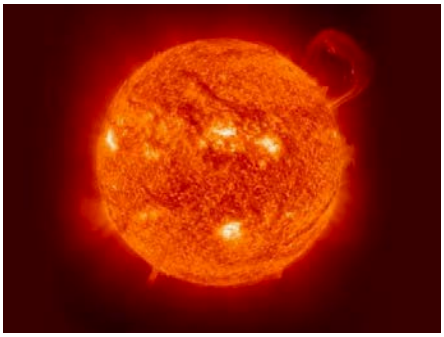
C.5. What solar features have you learned about so far that you can see on STEREO's coronagraph?

C.6. We know that space weather can interfere with satellite signals. Do you see evidence on this video that suggests this is true? Explain.

C.7. In your student sheet, arrange the images in Graphic Organizer 4. Solar Eclipse to show how these celestial bodies must be lined up to have a solar eclipse. Click and drag the images in your student sheet.

Graphic Organizer 4. Solar Eclipse

Arrange the images to show how these three celestial bodies must be lined up to have a solar eclipse. Click on the image to drag.



*images not to scale

C.8. In your student sheet, label each image in Graphic Organizer 5. Total or Partial Eclipse as either a total or partial solar eclipse.

Graphic Organizer 5. Total of Partial Eclipse

Label each image as a total or partial eclipse

Photo: NASA / Armstrong's Gulfstream III Satellite

Photo: NASA/ Bill Ingalls, Ground-based Observer

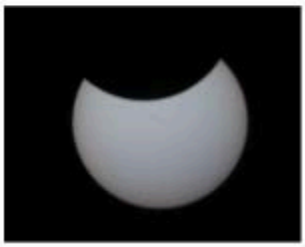


Photo: NASA/ Randy Bresnik aboard the International Space Station

Photo: NASA/ Jim Jeletic, Ground-based Observer

C.9. Where were you during the last total solar eclipse? Place an X on the map in your student sheet to indicate where you were during the August, 2017 total solar eclipse.

C.10. Why are scientists interested in studying the corona?

C.11. On the map in your student sheet, place an X to indicate approximately where you will be during the 2024 eclipse.

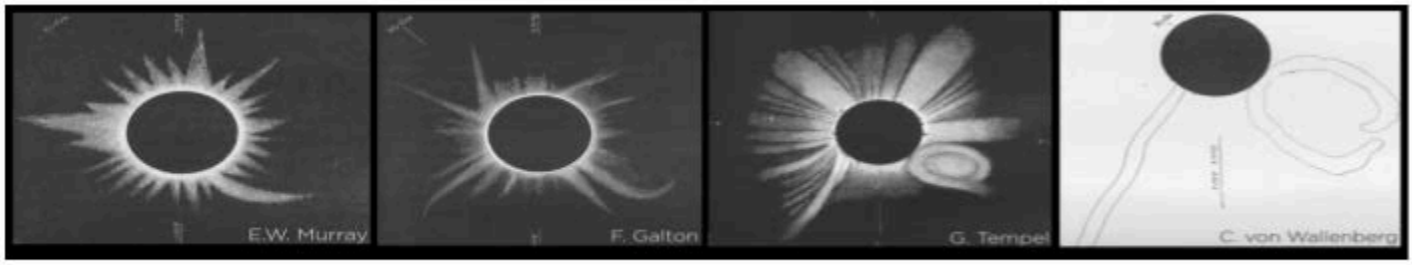
The total solar eclipse path crosses from Mexico, through the United States from Texas to Maine, and up through Canada.
Image Credit: ©2021 Great American Eclipse, LLC, Used with Permission.

C.12. Analyze the two images in the panel. What do these views of the Sun have in common?

C.13. In Graphic Organizer 6. Features of the Sun in your student sheet, draw arrows to point out the features in the drawings.

Graphic Organizer 6. Features of the Sun

Draw arrows to point out the different features in each drawing.



Solar Wind | Corona | Solar Flare | CME

C.14. Use the following instructions to make your own eclipse drawing.

Step 1: Cut out a circle in cardstock or heavy paper and color it with chalk.

Step 2: Put the circle on the piece of black construction paper and use tissue or your hands to smudge from the circle outward to the black construction paper in all directions.

Step 3: Remove the circle.

Step 4: Total Solar Eclipse! See the beautiful corona!

C.15. Why would scientists want to measure the radiation on Mars?

C.16. Which missions have multiple spacecraft?

C.17. What have we learned from Parker Solar Probe?

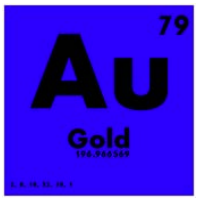
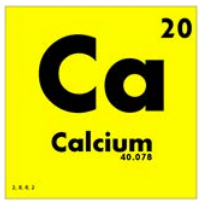
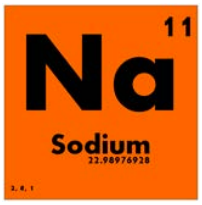
C.18. What does it mean when we say that Parker Solar Probe “touches the Sun”?

C.19. Why do you think there are so many accounts of eclipses in human recorded history?

C.20. How do we still know many of the ancient stories told about eclipses today?

Part D: Elaborate

D.1. In your student sheet, fill in the empty columns with the atomic number for each element shown in Graphic Organizer 7. Atomic Numbers.

Graphic Organizer 7. Atomic Numbers			
Element	Atomic Number	Element	Atomic Number
			
			
			

D.2. How is the periodic table a map of the history of our universe?

D.3. How do stars make life on Earth possible?

D.4 In your student sheet, drag the green checkmarks onto Graphic Organizer 8. Elements of the Universe to indicate which elements are found in each "scoop" of the Universe.

Graphic Organizer 8. Elements of the Universe						
✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓						
Universe						
Sun						
Supernova Remnant						
Meteorite						
Earth's Atmosphere						
Human Body	✓	✓	✓	✓	✓	✓

D.5. What objects have the same elements as the human body? Explain.

D.6- Which element in the human body can only be created during the Big Bang?

D.7- Which of the elements in the human body can only be created from exploding, massive stars?

D.8- Could life exist without exploding stars? Explain.

Part E: Evaluate

E.1. What is Astrobiology and how do NASA scientists study it?

E.2. Fill in the blank. “Astrobiology isn’t the search for life, but the search for _____”.

E.3. Why do scientists believe we would most likely find life in the form of prokaryotes elsewhere in the solar system?

E.4. What role do you think stars have in astrobiology and the search for life?

E.5. Why do scientists study exoplanets?

E.6. How do stars help us study exoplanets?

E.7. What differences or similarities exist between transits and eclipses?

E.8. What can learning about exoplanets teach us about our own planet Earth?

E.9. What differences exist between our solar system and the system you chose to explore in the activity? Describe differences in stars, types of planets, and the habitable zone of the system in your answer.

E.10. What similarities exist between our solar system and the system you chose to explore in the activity?

E.11. Would life be possible in the system you chose to explore? How do you know?

E.12. Fill out each section of Graphic Organizer 9. What Does the Sun Teach Us About the Universe?

Graphic Organizer 9. What Does the Sun Teach Us About the Universe?

What Does the Sun Teach Us About the Universe?

In each section, describe how the Sun teaches us about the following topics. Use examples of data and from this lesson as evidence to support your reasoning.

The Sun and Space Weather	Elements and Life on Earth	Astrobiology and Exoplanets