How the Sun Works – Unit Assessment

Name: _____ Hour_____Date: _____

Date Packet is due:_____ Why late? _____Score: _____
Day of Week Date If your project was late, describe why

Overview: You will be demonstrating your capacity to address the driving questions from this unit through a group presentation.

Main Questions

1. How can the sun burn for billions of years without 'running out of fuel'?
2. How does the sun's size, temperature, and other factors enable the processes that result in the release of large amounts of energy?
3. How could we possibly know anything about the sun without the ability to take any direct measurements?

Weekly Schedule

Part 1: Introduction
- Intro to the Sun Unit Project
- Review of Key Concepts

Part 2: Work Time
- Time allotted for completing the project.

Part 3: Peer Review
- Acquiring peer feedback on your first draft

Part 4: Final Preparation
- Determining specifics about your presentation.

Part 5: Presentation
- Presenting your work

NGSS Standards:
HS-ESS1-1: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

Semester Schedule

How the Sun Works
Week 1: What is matter? What is energy?
Week 2: What's inside the sun?
Week 3: How can we measure the sun?
Week 4: Where does the sun's energy come from?
Week 5: Unit Assessment

The Life of Stars
Week 1: How long do stars last?
Week 2: Why do stars die?
Week 3: What happens after stars die?
Week 4: Unit Assessment

How It All Began
Week 1: How can we determine the universe's size?
Week 2: How can expansion determine the universe's age?
Week 3: What can we learn from background radiation?
Week 4: Unit Assessment

Navigating Space
Week 1: How and why do things orbit in space?
Week 2: How can we predict orbits?
Week 3: Unit Assessments

Part 1: Introduction to the Project

Introduction: In this project, you will work in groups of 3-4 to develop a presentation describing how the sun is able to 'burn' continuously for billions of years, and how scientists determined this. You should use a presentation program (such as Microsoft PowerPoint or Google Slides) to address each item below. **Begin by reviewing each of the following concepts**. Rank each from 1 (unsure) to 3 (confident) based on your ability.

Week 1 – Matter & Energy

1. What is the difference between matter and energy?
2. How are the following different from each other? *Atoms, mass, elements, molecules*
3. Both ethanol and water are clear liquids. Why does ethanol burn but water does not?
4. What happens to the matter and energy in a substance when that substance is combusted?

Week 2 – What's inside the sun?

5. What are three kinds of radiation? Summarize each.
6. What determines whether electromagnetic radiation exists as radio waves, light, X-rays, etc.?
7. What is spectroscopy? What is a spectral signature? What is the difference between an absorption line and an emission line?
8. What are the parts of an atom? How do these relate to the spectral signatures we can observe?
9. Why do different substances have different spectral signatures? In your response, be sure to address the
10. following*: electron, higher orbit, lower orbit, photon, wavelength.*
11. What is the sun made from? How do we know this?

Week 3 - How can we measure the sun?

12. What is a parallax? What is a non-astronomical example of a parallax?
13. What is the 'transit of Venus'? How could this astronomical event be used to determine the distance between the earth and the sun?
14. What is an astronomical unit (AU)? How can the value of an AU be used to measure the size of the sun?
15. What is a blackbody? How can a blackbody radiation curve be used to determine the temperature of the surface of the sun or any star?
16. How can we measure the distance to the sun? How can we measure the size of the sun?

Week 4 - Where does the sun's energy come from?

17. What is the relationship between pressure and temperature in a gas?
18. What does $E = mc^2$ mean? Explain each symbol and summarize what this formula indicates (and how).
19. Summarize the findings of Einstein, Aston, and Perrin. Then explain how Eddington used the collective findings of Einstein, Aston, and Perrin to develop an evidence-based argument for how the sun functions.
20. What is the Coulomb Barrier? How does it relate to both nuclear fusion & the function of the sun?
21. Summarize each step of the proton-proton chain, and explain how this results in the conversion of matter into energy.
22. In space, some balls of helium and hydrogen form planets (like Saturn). Some form stars (like our sun). And some are unstable and explode. What determines which outcome occurs and why?
23. How does the sun produce vast amounts of heat and light for billions of years?

Part 2: Work Time

Introduction & Directions: Use this time to complete your group presentation. Remember that you're not done until your group is completely finished. If you finish your portion of the presentation, help other group members complete their portion, check the presentation for errors, or add additional components to your presentation to improve its professionalism and appeal.

Part 3: Peer Review

Overview: You will be critiquing another group's presentation. For each of the items on the next page, provide a score based on their current work. Use the rubric below to determine if each item should receive +, ✓, or -.

An item needs a "+ "for all the criteria above to receive an overall "plus" score. For example, if you notice a particular item has a spelling error, is missing a key consideration, or could be delivered in a more appealing manner, that item should receive a ✓ or -. A + is reserved for items that could not be reasonably improved.

Item	*Plus (100%)*	*Check (70-90%)*	*Redo (0%)*
Accuracy – *Are all components factually correct?*	This presentation is 100% factually accurate without any errors or omissions.	Overall, the presentation was mostly factually accurate.	Students are still making progress towards a final draft.
Thoroughness – *Did you address all aspects?*	This addresses all of the information needed for each objective.	Almost all of the required information was included for each objective.	Students are still making progress towards a final draft.
Professionalism *– Does this look like it was professionally produced?*	This presentation reflects the work of a group of adult professionals.	This is acceptable work for high school students.	Students are still making progress towards a final draft.
Effort – *How much work went into this presentation?*	Effort exceeds what would be expected of a high school student.	Effort is acceptable for a high school student.	Students are still making progress towards a final draft.

	+	✓	-
Week 1 – Matter & Energy			
- What is the difference between matter and energy?			
- How are the following different from each other? *Atoms, mass, elements, molecules*			
- Both ethanol and water are clear liquids. Why does ethanol burn but water does not?			
- What happens to the matter and energy in a substance when that substance is combusted?			
Week 2 – What's inside the sun?			
- What are three kinds of radiation? Summarize each.			
- What determines whether electromagnetic radiation exists as radio waves, light, X-rays, etc.?			
- What is spectroscopy? What is a spectral signature? What is the difference between an absorption line and an emission line?			
- What are the parts of an atom? How do these relate to the spectral signatures we can observe?			
- Why do different substances have different spectral signatures? In your response, be sure to address the			
- following*: electron, higher orbit, lower orbit, photon, wavelength.*			
- What is the sun made from? How do we know this?			
Week 3 - How can we measure the sun?			
- What is a parallax? What is a non-astronomical example of a parallax?			
- What is the 'transit of Venus'? How could this astronomical event be used to determine the distance between the earth and the sun?			
- What is an astronomical unit (AU)? How can the value of an AU be used to measure the size of the sun?			
- What is a blackbody? How can a blackbody radiation curve be used to determine the temperature of the surface of the sun or any star?			
- How can we measure the distance to the sun? How can we measure the size of the sun?			
Week 4 - Where does the sun's energy come from?			
- What is the relationship between pressure and temperature in a gas?			
- What does $E = mc^2$ mean? Explain each symbol and summarize what this formula indicates (and how).			
- Summarize the findings of Einstein, Aston, and Perrin. Then explain how Eddington used the collective findings of Einstein, Aston, and Perrin to develop an evidence-based argument for how the sun functions.			
- What is the Coulomb Barrier? How does it relate to both nuclear fusion & the function of the sun?			
- Summarize each step of the proton-proton chain, and explain how this results in the conversion of matter into energy.			
- In space, some balls of helium and hydrogen form planets (like Saturn). Some form stars (like our sun). And some are unstable and explode. What determines which outcome occurs and why?			
- How does the sun produce vast amounts of heat and light for billions of years?			

Part 4: Final Preparation

Overview: Use this time to make corrections based on your peer review. You should also prepare your speaking notes and determine who is primarily responsible for each section. Note that your instructor may assign a group to present only on a specific topic; if so, your group should be prepared to discuss each item as a group (if only one person from your group delivers the entire presentation, you would not score as well based on the rubric below compared to a group where everyone presents).

Part 5: Presentation

Grading: Your grade will be determined using the following considerations:

Item	*Plus (100%)*	*Check (70-90%)*	*Redo (0%)*
Accuracy – *Are all components factually correct?*	This presentation is 100% factually accurate without any errors or omissions.	Overall, the presentation was mostly factually accurate.	Students are still making progress towards a final draft.
Thoroughness – *Did you address all aspects?*	This addresses all of the information needed for each objective.	Almost all of the required information was included for each objective.	Students are still making progress towards a final draft.
Professionalism *– Does this look like it was professionally produced?*	This presentation reflects the work of a group of adult professionals.	This is acceptable work for high school students.	Students are still making progress towards a final draft.
Group Involvement – *Was everyone involved?*	Every member was involved with the development of the presentation as well as its delivery.	Most of the time, all group members were fully involved in the development and delivery of this presentation.	A portion of the group was fully involved in this project.
Effort – *How much work went into this presentation?*	Effort exceeds what would be expected of a high school student.	Effort is acceptable for a high school student.	Students are still making progress towards a final draft.

Remember – your grade is partially- or completely-dependent on your oral presentation, so if you run out of time before you research all your topics, it will probably be ok.

Please provide your names below and give to your instructor when you present so that they can use it to record your grade.

Names: _____