

star party





# Star Party

Grades 9-12

Prep Time: ~10 min

Lesson Time: 105 - 140 minutes



## WHAT STUDENTS DO: Use a model to resolve competing arguments.

Students use a model to create stars from a stellar nebula and track those stars through their life cycles in an attempt to resolve conflicts and answer questions from party attendees. They will collect evidence of star colors, luminosity, solar mass, lifespans, composition, and temperature along their journey.

### NRC FRAMEWORK/NGSS CORE & COMPONENT QUESTIONS

#### WHAT IS THE UNIVERSE AND WHAT IS EARTH'S PLACE IN IT?

NGSS Core Question: ESS1: Earth's Place in the Universe

#### What is the universe, and what goes on in stars?

NGSS ESS1.A: The Universe and Its Stars

### Instructional Objective (IO)

*Students will be able to*

**IO1: Compare competing arguments related to the life cycle of stars and evaluate empirical evidence provided as a scientific way of knowing.**

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## 1.0 Materials

### Required Materials:

#### Please Supply:

- Computer or Laptop – 1 per student
- Supported Browsers: Chrome; Edge; Firefox; Safari

#### Please Print:

##### From Student Guide

- (A) Star Survey Recording Sheet - 1 per student
- (B) Describing Models - 1 per student
- (C) Misconceptions or Scientific Claims - 1 per student
- (D) Considering Alternatives - 1 per student
- (E) Resolve the Star Party Conflict - 1 per student

### Optional Materials:

##### From Teacher Guide

- (F) Describing Models (Key)
- (G) Misconceptions or Scientific Claims (KEY)
- (H) Considering Alternatives (KEY)
- (I) Resolve the Star Party Conflict (KEY)

##### From Alignment Documents

- (N) Star Party Alignment Rubrics



## 2.0 Unit Timeline

### Star Party Lesson Timeline:

Time:

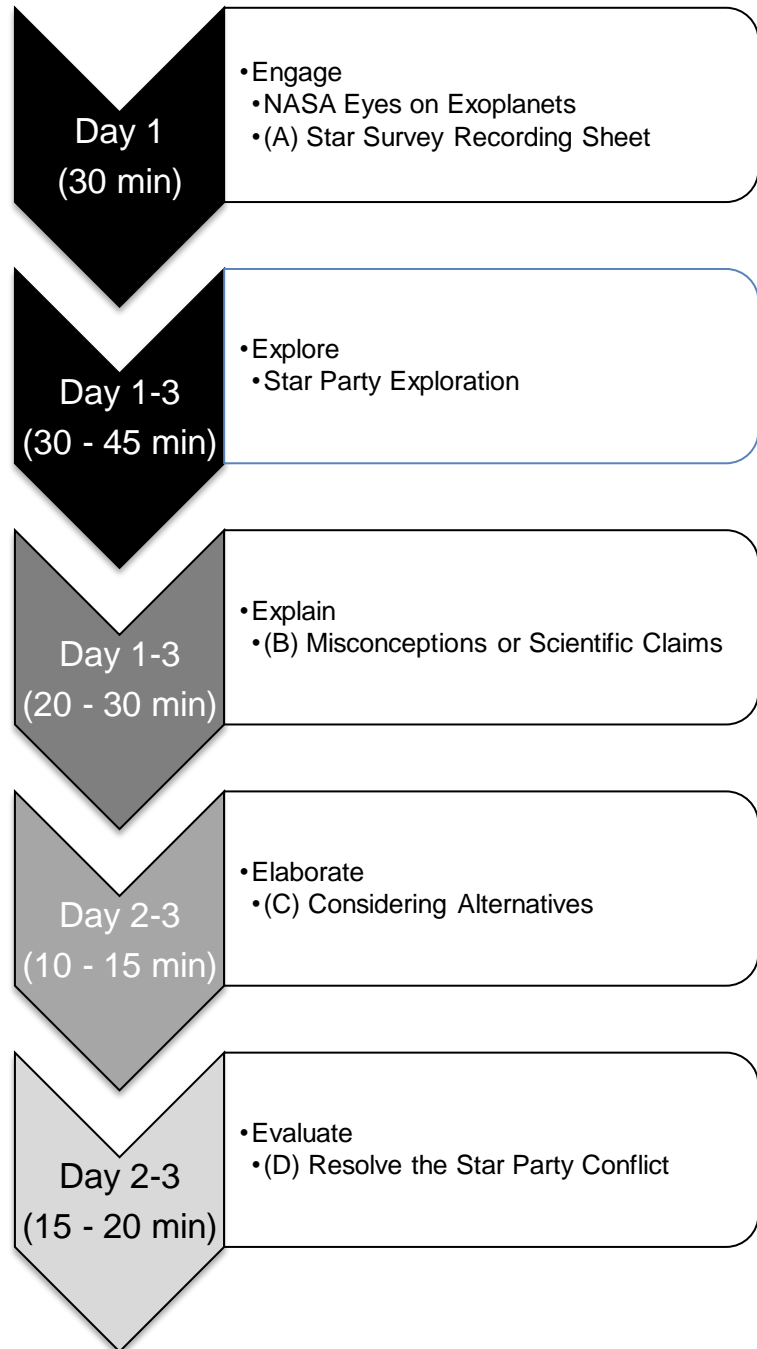
- 105 - 140 minutes

Materials:

- Student Guide pages

5-E Inquiry Process:

- The arrow color represents the 5-E step students will be primarily engaging in for that class session



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### 3.0 Vocabulary

<b>analyze</b>	consider data and results to look for patterns and to compare possible solutions
<b>black hole</b>	a region of space having a gravitational field so intense that no matter or radiation can escape; end stage in the lives of massive stars
<b>composition</b>	the makeup of the star's interior
<b>empirical evidence</b>	knowledge gained through direct or indirect observation
<b>explanations</b>	logical descriptions applying scientific information
<b>giant</b>	a star typically 10-100 times larger than the sun
<b>hr diagram</b>	a graphical representation of star life cycles based on luminosity and temperature of the star
<b>kelvin</b>	a temperature measurement where zero represents absolute zero, the point where all atoms in matter stop moving
<b>lifespan</b>	the range in lifetime of a star from birth to death
<b>limitation</b>	a restrictive weakness or lack of capacity
<b>luminosity</b>	the amount of energy radiated by a star
<b>main sequence</b>	a branch of the HR diagram represents the life of a star until it begins to die
<b>model</b>	representation of an idea, a process, or a system that is used to describe phenomena that we cannot experience directly
<b>nebula</b>	the birthplace of a star made of gas and dust
<b>neutron star</b>	a very dense and small celestial body left behind after a supernova
<b>observations</b>	specific details recorded to describe an object or phenomenon
<b>phenomenon</b>	a natural, observable event that generates scientific questions
<b>planetary nebula</b>	ring shaped gas formed by the expanding shell of an aging star
<b>red giant</b>	very large, cool, and luminous star in the late stages of star life
<b>remnant</b>	the leftovers
<b>solar mass</b>	a measure of star mass based on the Sun at 1 solar mass ( $M_s$ )
<b>supernova</b>	the stage in a stars life cycle where it suddenly increases in brightness during a catastrophic explosion release most of the stars mass
<b>supergiant</b>	a very large star that is brighter and larger than a giant, yet cooler
<b>theoretical value</b>	the value expected from an equation, assuming perfect or near-perfect conditions
<b>white dwarf</b>	a very small, low-mass celestial body that is the core of a dead star

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## 4.0 Procedure

### PRIOR KNOWLEDGE & SKILLS

- A. Temperature
- B. Nuclear Fusion
- C. Periodic Table
- D. Big Bang

### PREPARATION

- A. Reserve computers or tablets for exploration days.
- B. Visit <https://infiniscope.org/lesson/star-party/> for access to the digital learning experiences and additional resources.
- C. Enroll students in lesson if you would like to retain their progress after closing the browser window and to track their learning behavior and progress. For tips on how to enroll students in a lesson see the [Beeswax and Honeycomb Knowledge Base for Infiniscope](#)
- D. PRINT THE FOLLOWING:
  - Student **Recording Sheets (A-D)** – 1 per student

### STEP 1: ENGAGE (~30 minutes)

#### Night Sky Observations

- **Fun Tip:** Since the students will be joining a star party, why not have fun with it! Have a star themed party to set the tone! Food, beverages, decorations, nametags with star names, go all out! [Send us your star party photos!](#)
- A. Prior to starting the digital lesson *Star Party*, hand out **(A) Star Survey Recording Sheet** and have students answer the questions in **Part A** to demonstrate their current understanding of stars.
- B. Have students pair up on a computer to complete **Part B**. In Part B students will access the Eyes on Exoplanets tool to make observations about stars that have been observed by Kepler Telescope and stars they can observe in the night sky from their location on Earth. Instructions and questions are provided on the **(A) Star Survey Recording Sheet Part B**.
- C. Possible narrative you can use to engage the students in the experience. This will also set the tone for the ways of knowing and cue them to that portion of the activity:
  - a. *You've documented some great knowledge statements and observations so far! All of these observations come from different ways of knowing. There are many ways of knowing the world around us. Some of your knowledge and*

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*observations are based on personal experience and some are based on scientific evidence. But there are also likely to be misconceptions in your list. Misconceptions happen easily as our brains attempt to make sense of a phenomena we observe or hear about. You are about to join a Star Party and the lead astronomer needs your help! She knows there are attendees with misconceptions at the party and she is providing you with a model to determine what is a misconception and what is supported by scientific evidence. Keep an eye on your list as you work through the statements from the attendees. If you find some of your statements are misconceptions, mark them with an "M" as you find them. Let's get in there and join the party!*

- d. Hand out or assign individual computers and ask students to access the *Star Party* lesson linked above. If you have enrolled your students, your students will access your class or lesson via enrollment feature instead.

## **STEP 2: EXPLORE** (~ 30 - 45 minutes)

### **Star Party Space Exploration**

- A. Students will complete their exploration of the stellar life cycle through the web browser, alternating between EXPLORE and EXPLAIN activities.
  - **Teacher Tip:** If students seem to be stuck in an activity, it isn't responding in a way that seems correct, or if an error occurs, students can attempt to refresh their browser or select "*Restart Lesson*" at the bottom of the page. "*Restart Lesson*" will clear all of their progress and bring them back to the start screen. Hitting the browser's "*Refresh*" button will not restart the activity.
  - **Teacher Tip:** If you would like to analyze student interactions in this activity, you can sign up to join the [Infinscope Teaching Network](#) and enroll your class into the activity. By enrolling, you will gain access to the analytics of the activity by student to see how students progressed through the activity. You also have the ability to adopt the activity and adapt it to the specific needs of your classroom, school, or community.

## **STEP 3: EXPLAIN** (~ 20 - 30 minutes)

### **Models and Misconceptions?**

- A. Hand out **(B) Describing Models and (C) Misconceptions or Scientific Claims**. Students will complete these recording sheets as they work through *Star Party* lesson. The goal is to keep running documentation of the use of models and the statements they explore and providing evidence to support whether it is a misconception or based in science.





## STEP 4: ELABORATE (~ 10 - 15 minutes)

### Considering Alternatives

- A. Before handing out the final evaluation sheet, present students with **(C) Considering Alternatives**. Here students will be presented a statement unrelated to star life cycles and asked how they would go about evaluating the validity of the statement. Students will base their plan upon the use of models and classifying statements as a personal way of knowing or scientific.

## STEP 5: EVALUATE (~ 15 - 20 minutes)

### Evaluate Star Party

- A. At the conclusion of *Star Party* lesson students are tasked with resolving the argument between two attendees. To capture their knowledge of stellar evolution hand out **(D) Resolve the Star Party Conflict**. Students will recall the resolution to the agreement and provide scientific evidence to support the resolution to the conflict.

## 5.0 Evaluation/Assessment

Use the *(N) Star Party Rubric* as a summative assessment, providing final assessment of the learning activities. The rubrics evaluate the activities using the Next Generation Science Standards, NRC Framework, Common Core State Standards, and 21<sup>st</sup> Century Skills

## 6.0 Extensions

1. [NASA's Exoplanet Exploration](#)
2. [James Webb Telescope](#)
3. [TESS](#)
4. [Kepler Telescope](#)





**(A) Star Survey Recording Sheet Part A**

**Name:** \_\_\_\_\_

Before joining the Star Party, let's consider what you already know about stars. In the area provided below, list everything you know about stars.

When you have finished documenting your star knowledge, place an asterisk (\*) next to the things you know from scientific evidence not personal experience or observation.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
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4. \_\_\_\_\_  
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5. \_\_\_\_\_  
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6. \_\_\_\_\_  
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7. \_\_\_\_\_  
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8. \_\_\_\_\_  
\_\_\_\_\_

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**(A) Star Survey Recording Sheet Part B**

Name: \_\_\_\_\_

Visit the <https://exoplanets.nasa.gov/eyes-on-exoplanets/> website to complete the following.

1. Using the *VIEW > FROM SPACE* view (lower left of the window), you can see all the stars that have been observed by the Kepler Space Telescope. This telescope is making observations from an Earth trailing orbit.
  - a. Revisit the list you made earlier, are there any of your statements that you can now add an asterisk (\*) to because they are supported by scientific evidence? Any additional observations you would like to add to your list?
  
2. Switch to the *VIEW > FROM EARTH*, then select where you live. Once you are on Earth, be sure to click the checkbox in the lower right *Display > Only stars visible to the naked eye* for more observations. Record additional observations here:
  - a. \_\_\_\_\_  
\_\_\_\_\_
  - b. \_\_\_\_\_  
\_\_\_\_\_
  - c. \_\_\_\_\_  
\_\_\_\_\_
  - d. \_\_\_\_\_  
\_\_\_\_\_
  
3. You are about to join a Star Party and the lead astronomer needs your help!
  - a. Before joining the party, be sure you close the browser window for Eyes on Exoplanets so your party doesn't get bogged down with any extra pesky electrons.
  - b. AKA – close the browser tab before moving on to save bandwidth.
  - c. Enjoy the party!

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**(C) Misconceptions or Scientific Claims (Page 1)**

Name: \_\_\_\_\_

As you work to gather scientific evidence for each claim/question, keep track of your work by completing this table. After collecting evidence, revisit the original claim/question. Write the correct claim or answer to the question below the original.

Claim/Question	Misconception (Y/N)	Evidence
Original:		
Correct:		
Original:		
Correct:		
Original:		
Correct:		

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**(C) Misconceptions or Scientific Claims (Page 2)**

Claim/Question	Misconception (Y/N)	Evidence
Original:		
Correct:		
Original:		
Correct:		
Original:		
Correct:		

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**(D) Considering Alternatives**

Name: \_\_\_\_\_

Consider what you've learned about misconceptions and ways of knowing during your exploration of stars. The goal is to apply this new understanding to a different situation.

**Claim:** There is no gravity in space. I know this because I've seen video of astronauts in the space station and they are floating. There is no gravity once you leave Earth's atmosphere.

1. Circle the way of knowing used in this claim:

scientific way of knowing

personal experience as a way of knowing

2. What clues did you use to classify the way of knowing?

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3. Without access to a model or documents for research, how might you respond to this statement?

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**(E) Resolve the Star Party Conflict**

Name: \_\_\_\_\_

At the conclusion of the Star Party, Gene tells Pete he thinks stars live forever. Provide an explanation below for why Gene’s comment is a misconception and Pete uses a scientific way of knowing. In your explanation include the evidence each uses to support their argument. Don't forget an accurate description of the life cycle of a star in your explanation.

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**(F) Describing Models (Key)**

Your first interaction with a star party attendee involved a conversation about the use of models. Explain the purpose, benefits, and limitations of the model in describing the Sun's life cycle.

*Models are representations of an idea, a process, or a system that are used to describe phenomena that we cannot experience directly. They help us develop explanations and make predictions. Models can be physical replicas, mathematical representations, analogies or computer simulations. Sometimes the things we want to study are too large or too small, or they happen too fast or too slow for us to observe them directly. A model does not exactly duplicate the real-world system it represents. It combines specific observations from a large number of experiments to bring certain parts of the system into focus. Some parts of the system may be completely ignored and assumptions often have to be made so it is important to recognize that models do have limitations.*

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**(G) Misconceptions or Scientific Claims (Page 1 Key)**

As you work to gather scientific evidence for each claim/question, keep track of your work by completing this table. After collecting evidence, revisit the original claim/question. Write the correct claim or answer to the question below the original.

Statement	Misconception (Y/N)	Evidence
Original: <i>All stars are white</i>	Y	<i>Different color stars observed at different masses</i>
Correct: <i>Stars are a variety of colors</i>		
Original: <i>All stars are about the same size as the Sun</i>	Y	<i>Solar mass is the measure of a star's size. The sun is 1 solar mass. Stars can range from .075 solar masses all the way up to 250 solar masses</i>
Correct: <i>Stars can be smaller than the Sun and up to 250 times the size of the Sun</i>		
Original: <i>All the elements we see today were formed at the same time in the Big Bang</i>	Y	<i>Stars use hydrogen and helium as their fuel for nuclear fusion. That hydrogen and helium come from the nebula. When stars reach the end of their lives, they have produced a variety of elements such as carbon, oxygen, neon, silica, sulfur, and iron. The remainder of the elements occur when stars reach supernova.</i>
Correct: <i>Elements are formed from supernova of old stars</i>		

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**(G) Misconceptions or Scientific Claims (Page 2)**

Statement	Misconception (Y/N)	Evidence
Original: <i>The more massive the star the shorter its life</i>	N	<i>Larger stars start with more fuel, but tend to burn hotter with more luminosity (energy) causing the fuel to burn up faster than smaller stars. This results in shorter life as the fuel is used more quickly than it is in smaller stars.</i>
Correct:		
Original: <i>How long will the Sun live?</i>	N	<i>Using the HR diagram, the Sun is currently on the main sequence. It's life span is 10 billion years with 5 billion to go before it begins to red giant and consume Earth.</i>
Correct: <i>The Sun will exist another 5 billion years</i>		
Original: <i>All stars go supernova when they die</i>	Y	<i>The final stage of a stars life is dependent upon it's mass. Smaller stars will planetary nebula and end as white dwarfs. Only massive stars will supernova before becoming a neutron star or a black hole.</i>
Correct: <i>Massive stars supernova, while smaller stars will planetary nebula</i>		

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**(H) Considering Alternatives (KEY)**

Consider what you've learned about misconceptions and ways of knowing during your exploration of stars. The goal is to apply this new understanding to a different situation.

**Claim:** There is no gravity in space. I know this because I've seen video of astronauts in the space station and they are floating. There is no gravity once you leave Earth's atmosphere.

4. Circle the way of knowing used in this claim:

scientific way of knowing

personal experience as a way of knowing

5. What clues did you use to classify the way of knowing?

"I've seen" is a big clue. There is no reference to scientific research or using a model to test the ideas.

6. Without access to a model or documents for research, how might you respond to this statement?

Student responses should acknowledge the observation and indicate they should look deeper into this observation to see if there is additional information or data that could explain the observation.

***(I) Resolve the Star Party Conflict (KEY)***

At the conclusion of the Star Party, Gene tells Pete he thinks stars live forever. Provide an explanation below for why Gene's comment is a misconception and Pete uses a scientific way of knowing. In your explanation include the evidence each uses to support their argument. Don't forget an accurate description of the life cycle of a star in your explanation.

*Key points that should be included in the response:*

- *Gene's way of knowing is through personal experience. His observations focus on personal observations, individual data points, and doesn't consider the length of time the process of star birth and death can take.*
- *Pete uses the model and scientific ways of knowing. The model demonstrates the birth, life and death of stars based on their solar mass. Small mass stars tend to be yellow and orange stars that live billions of years and ending as white dwarves. Large mass stars tend to be blue stars, living millions of years and end as either neutron stars or black holes. A star like our sun, an average yellow star, will live 10 billion years with 5 billion to go and end as a white dwarf.*