



Guide Lites

Interactive Lesson: Stars
Grades 8-12

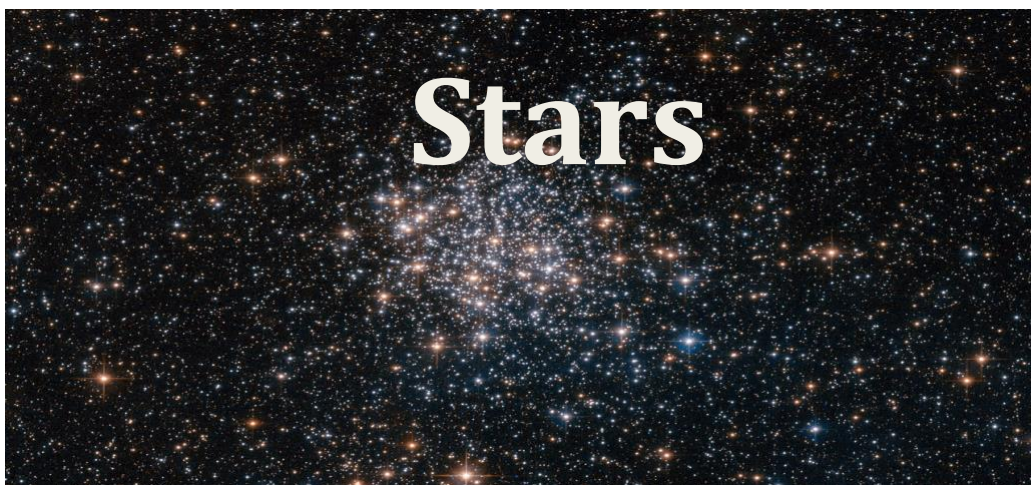
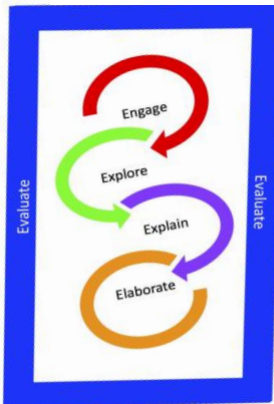


Image Credit: www.nasa.gov/multimedia/imagegallery/

NASA eClips™ Guide Lites are individual supplemental activities that are developed for formal and informal educational settings. Currently there are two types of Guide Lites:

- 1) excerpts from approved NASA eClips™ Educator Guides; and
- 2) targeted vocabulary lessons that help students confront science misconceptions addressed within NASA Spotlights, student-produced videos.

NASA eClips Guides use the "Five E" constructivist model developed by Roger Bybee. Constructivism is an educational philosophy that promotes student-centered learning where students build their own understanding of new ideas. The 5E instructional model consists of five sequential stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.



- The ENGAGE stage piques student interest and gets them personally involved in the lesson, while pre-assessing prior understanding.
- The EXPLORE stage gets students involved in the topic, providing them with the opportunity to build their own understanding.
- The EXPLAIN stage provides students with an opportunity to communicate what they have learned so far and understand what it means. This lesson introduces vocabulary in context and confronts misconceptions.
- The EXTEND stage allows students to use their new knowledge and continue to explore its implications.
- The EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.

This NASA eClips™ Guide Lites Interactive Lesson Plan is designed to support existing curriculum. The goal of this lesson is to correct a science misconception through watching a video (**Engage**), learning new vocabulary collectively, and participating in discussions (**Explore** and **Explain**). The suggested **Extend** activities are included to deepen conceptual understanding and can be used at the discretion of the teacher. The **Extend** activities will require additional instructional time.

The hyperlinks included in this document open PDFs or webpages and may perform differently based on the device being used. Links may have to be cut and pasted into a web browser to open. PDFs and other documents may need to be downloaded to view.

Standards

Next Generation Science Standards

Earth's Place in the Universe

HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements.

ESS1.A The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.

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Student Misconception

Students incorrectly think that all stars look white. Students don't realize that stars are many colors.

Objective

In this activity, students will explain how a star's color indicates its surface temperature as a result of watching the NASA Spotlight video, learning the vocabulary collaboratively, and discussing a star's size and the position in its lifespan.

Time Frame

Approximately 45 minutes (pretest, video review and discussion (20 minutes), collaborative vocabulary with Frayer Model (25 minutes), posttest. Additional time needed for completion of extension activities.

Materials:

Per student: copy of pretest and posttest (alternatively, these can be completed online)

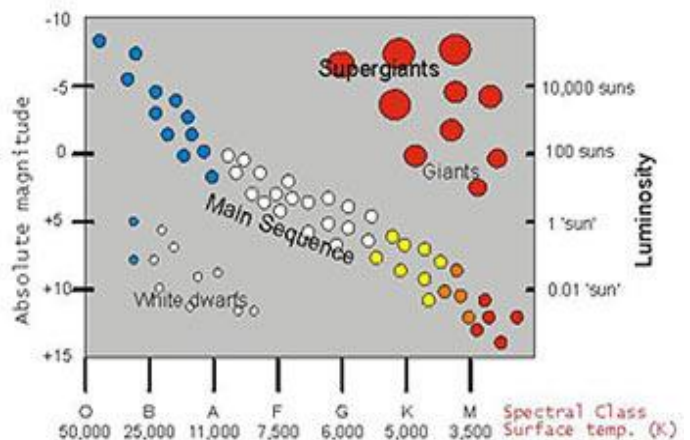
Per small group: copy of Frayer Model (alternatively, these can be completed online)

Per classroom: chart paper for posting final vocabulary definitions

Background Information

- Stars appear to be white at first but if we look carefully there is a range of colors.
- The color a star appears to our eyes can give us information about its surface temperature and where it is in its life cycle.
- Using a special tool called a spectroscope, scientists can analyze additional light emitted from a star. Each element in the periodic table gives off a unique series of bright lines. By studying these spectral lines, astronomers can determine the elements, density and mass of a star.
- Stars can be blue, blue-white, white, yellow-white, yellow, yellow-orange, and red.
- The sun is a medium-sized yellow star about halfway through its predicted lifespan of about 10 billion years.
- The Hertzsprung-Russell diagram (above) shows how size, color, luminosity, spectral class, and absolute magnitude of stars relate. Each dot on this diagram represents a star in the sky whose absolute magnitude and spectral class have been determined. For more information on the Hertzsprung-Russell diagram:

http://www.atnf.csiro.au/outreach/education/senior/astrophysics/stellarevolution_hrintro.html



Pre-Assessment

Probe for students' prior knowledge using one or both of these pre-assessments.

1. **Stars** Pre / Post Test include in packet. For an electronic version use this link to view to the NASA Spotlite Interactive Lesson Plan – **Stars** Pre / Post Test at ClassFlow:
<https://prod.classflow.com/classflow/#!/product/itemId=a09e11313f2d45549c6d0b55fc7f12b1>

2. Discussion questions:

- What do we know about a star’s composition from its color?
- What color indicates the hottest star?
- Where is our sun in its life cycle?

Engage

1. Ask students to watch the Spotlite video on stars that can be found at the following link, <https://youtu.be/HOxpdWsl-lw>. After viewing the video, lead a discussion with students to identify the misconception addressed in the video. (Misconception: All stars are white.)

The Spotlite video simply and directly addresses this common misconception. The process of researching a science misconception (becoming a subject matter expert), creating a scientifically accurate yet engaging script, and producing a Spotlite video is a rigorous process that enables high school students to demonstrate their understanding through a performance-based assessment.

2. Identify key vocabulary words and phrases in the video.
(Examples: temperature, star, element, composition, range, mass, life cycle, magnitude. Additional words can be added as needed.)

**These words, and other key vocabulary terms, can be found in the NASA eClips™ Virtual Vocabulary, <https://nasaclips.arc.nasa.gov/teachertoolbox/vocab>.

Explore and Explain

Use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

Using a digital interactive Frayer Model enables students to explore ideas collaboratively and simultaneously on the same digital document.

Several digital Frayer models can be found at:

- ClassFlow:
<http://tinyurl.com/FrayerModelClassFlow>
- PDF Filler:
<http://tinyurl.com/FrayeronPDFfiller>
- Google Slides
<https://docs.google.com/presentation/d/1a8RaLcmOmSwlYxZBFPWHgbkoEZrJnnp5gicNeEIXzjc/edit?usp=sharing>

Implementation Note

Within the Frayer Model, students EXPLORE concepts through brainstorming and researching AND EXPLAIN and synthesize their understanding.

Example: Place the word **temperature** in the center of the graphic organizer.

1. Facilitate a discussion with students exploring why this word is key vocabulary to this study.

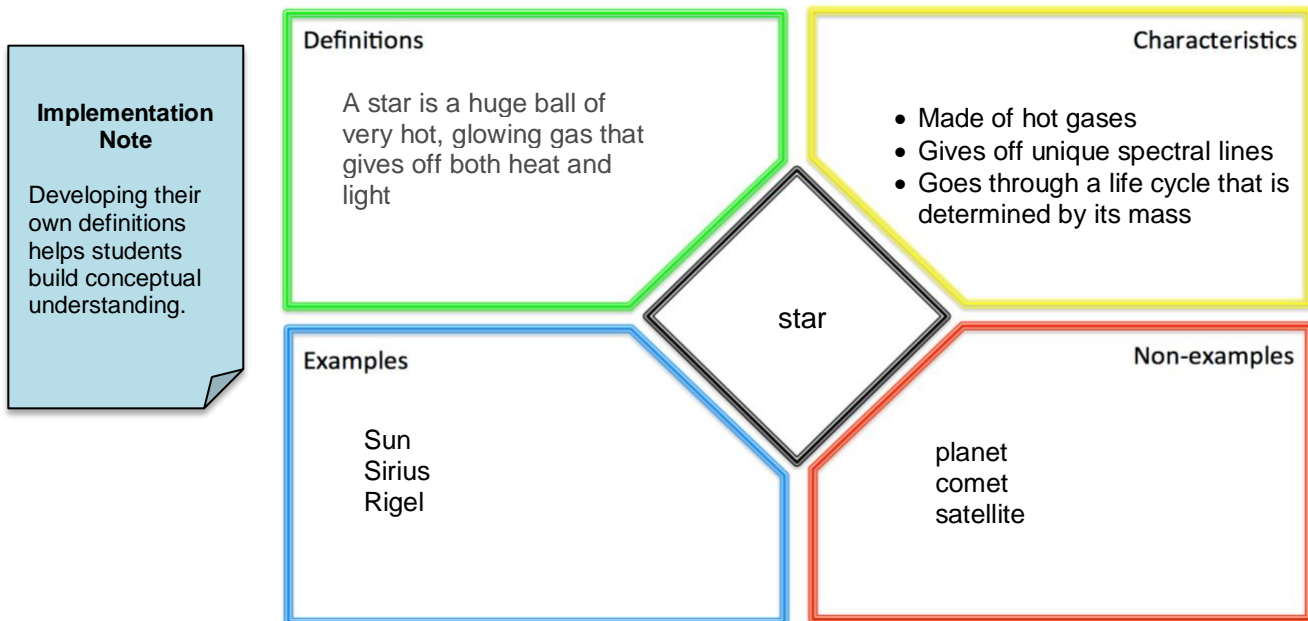
2. **(EXPLORE):** Ask students to brainstorm *characteristics of **temperature*** and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. **(EXPLAIN):** Next, ask students to add *examples and non-examples* in the Frayer model. (*Emphasize the higher-level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?*)
5. Using the information provided, ask students to develop their own definition of the word **temperature** that is clear and concise. An example to guide work is started below.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word.
8. Compile final definitions and post so all students have access for later work.

Implementation Note

Doing this activity in pairs or teams builds students' collaboration skills.

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



Evaluate

Return to these discussion questions:

- What do we know about a star's composition from its color?
- What color indicates the hottest star?
- Where is our sun in its life cycle?

Compare student responses to Pre-assessment and Evaluate questions to determine if students have a clear understanding of the vocabulary.

Stars Pre / Post Test include in packet. For an electronic version use this link to view to the NASA Spotlite Interactive Lesson Plan – **Stars** Pre / Post Test at ClassFlow:

<https://prod.classflow.com/classflow/#!/product/itemId=a09e11313f2d45549c6d0b55fc7f12b1>

Explore

For additional videos and activities to reinforce content, visit the related web site linked to the NASA eClips™ video **Launchpad: Life Cycle of a Star**.

<https://nasaclips.arc.nasa.gov/playlists/launchpad?v=launchpad-life-cycle-of-a-star>

Stellar Evolution: A Journey with Chandra interactive activity provide an opportunity for students to learn more about the different types of stars and their life cycles.

http://chandra.harvard.edu/edu/formal/stellar_ev/stellar_ev_flash.html.

The Chandra X-Ray Observatory allows scientists from around the world to obtain X-ray images of exotic environments to help understand the structure and evolution of the universe. The Chandra X-ray Observatory program is managed by NASA's Marshall Center for the Science Mission Directorate, NASA Headquarters, Washington, D.C. For more information on the Chandra X-Ray Observatory, visit:

https://www.nasa.gov/mission_pages/chandra/astronomy/index.html

After analyzing **Star-forming Nebula NGC 3603 lithograph**, students will conduct research to answer questions they have about how stars change over time.

http://amazingspace.org/resources/print/lithos/ngc3603_litho.pdf

Extend

To extend student understanding of stars utilize this activity that integrates mathematics skills:

Pulsating Variable Stars and the Hertzsprung-Russell Diagram

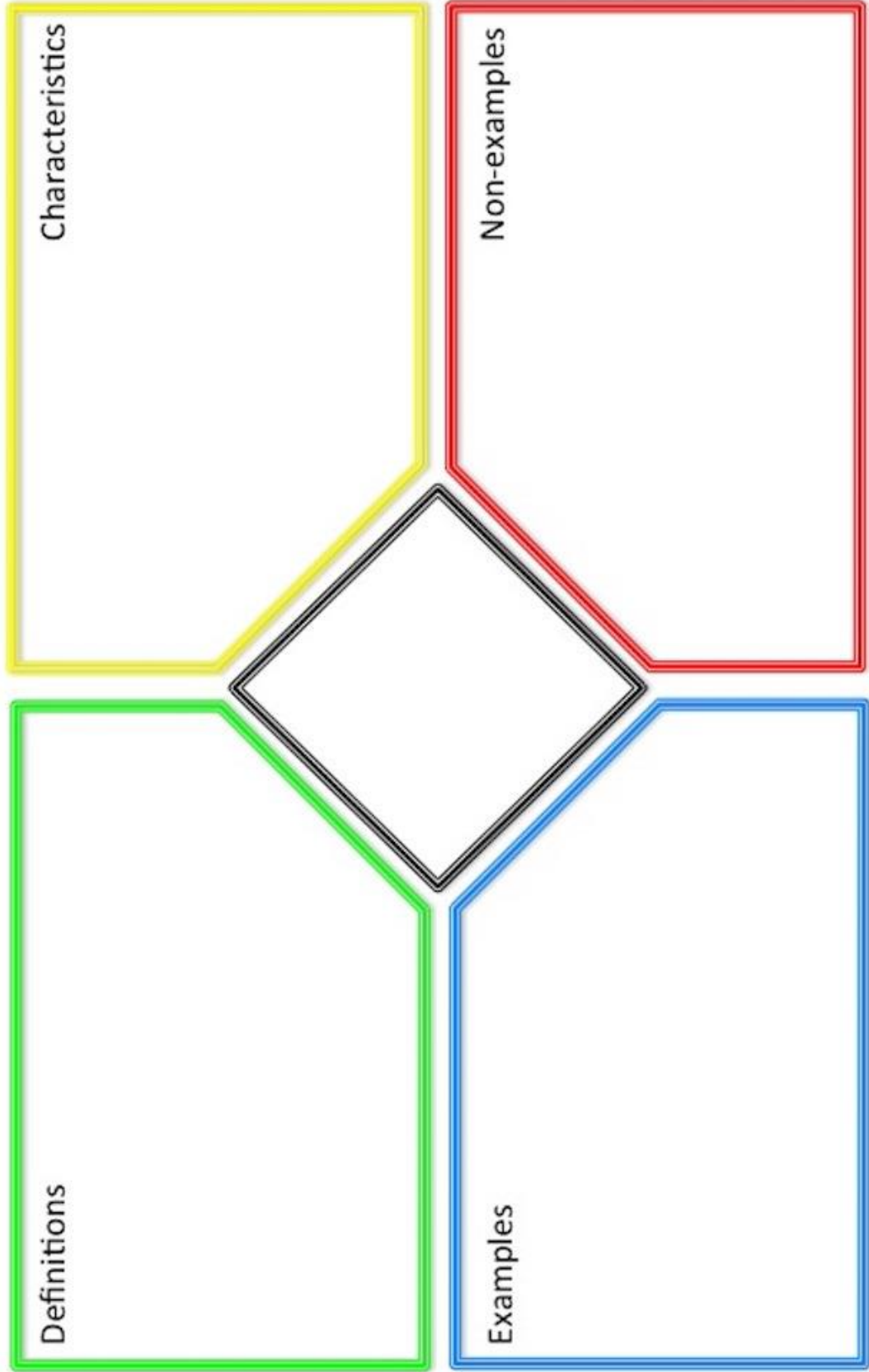
http://chandra.harvard.edu/edu/formal/variable_stars/Student_Variable_Star_HRDiagram_Activity.pdf

Chandra X-Ray Observatory's activity, **Stellar Cycles Post Assessment Activity**, asks students to apply their knowledge of the characteristics of stars.

http://chandra.harvard.edu/edu/formal/stellar_cycle/

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



The diagram is a Frayer Model graphic organizer. It consists of a central diamond shape with a double black border. Four rectangular boxes are attached to the sides of the diamond, each with a different colored border: a green box on the left, a blue box on the right, a yellow box on the top, and a red box on the bottom. Each box is labeled with a category: 'Definitions' (green), 'Examples' (blue), 'Characteristics' (yellow), and 'Non-examples' (red). The boxes are currently empty, intended for student input.



Stars Grades 8-12 Pre / Post Test NASA Spotlight Interactive Lesson

This assessment was designed for the interactive lesson plan featuring the student produced NASA Spotlight video Stars. <https://youtu.be/H0xpdWsL-lw>

1. Which statement about stars is true?
 - A. All stars are white.
 - B. Stars can be blue, white, yellow and red.
 - C. All stars are yellow.
 - D. Stars can be blue, purple and tan.

2. Star color and spectral analysis of other light emitted from a star can indicate all but which of the following?
 - A. any planets associated with the star
 - B. surface temperature
 - C. stage in its life cycle
 - D. elements

3. What is the predicted life cycle of the sun?
 - A. 5 billion years
 - B. 7 Billion years
 - C. 20 Billion years
 - D. 10 Billion years

4. The life cycle of a star can be predicted by the star's _____?
 - A. brightness
 - B. location
 - C. color
 - D. distance from Earth

5. What color star has the hottest temperature?
 - A. red
 - B. orange
 - C. yellow
 - D. white
 - E. blue

6. What color star has the coolest temperature?
 - A. red
 - B. orange
 - C. yellow
 - D. white
 - E. blue

**Stars Grades 8-12 Pre / Post Test
NASA Spotlight Interactive Lesson**

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