Lesson Topic: Physical Properties of Stars

Objective:
Students will be able to:

1. Identify the physical properties of stars.
2. Research a star and take note of its characteristics.
3. Create their own star applying the physical properties learned in the lesson.

Time Required: 70 minutes

Materials Needed:

- Image of Polaris (attached)
- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Physical Properties of Stars handout (attached)
- Popular Stars Website: What Are The Most Famous Stars?

Teacher Preparation:

- Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson.
    - Content Review - Middle School - Physical Properties of Stars
- Make copies of Physical Properties of Stars Worksheet (1 per student)

Engage (10 minutes):

1. Ask students “With the person sitting next to you, discuss the following question: What is a star?” (A star is a bright ball of gas, mostly hydrogen and helium, held together by its own gravity)
    a. Give students time to discuss, then share out.
2. Tell students “Stars are bright balls of gas, mostly hydrogen and helium, held together by their own gravity.”
3. Show students a picture of Polaris.
    a. Ask students if they know what star it is, then tell them: Polaris, the North Star.
4. Give them all the details of Polaris.
    a. Polaris is a yellow supergiant.
    b. Stays nearly still while the northern sky moves around it.
    c. Points due north
    d. 430 light years away
    e. Brightness of 2,500 Suns
    f. Polaris is also the closest and brightest Cepheid variable star – a type of star that astronomers use to figure distances to star clusters and galaxies
5. Tell students “Today we are going to talk about the physical properties of stars.”

Explore (15 minutes):

1. Pass out the Physical Properties of Stars handout.
2. Tell students to choose the name of one of the stars listed at the top.

3. Students should do some preliminary research about the star and take notes about the star in their notebook. Students can use this website for their research: What Are The Most Famous Stars?
4. Tell students “Take note of similar vocabulary you read about. Write down facts and bits of information you find interesting in your notebook.”
5. Give students time to research.
6. Then, have students share out what they learned in small groups.
    a. Encourage students to compare and contrast their stars.

Explain (20 minutes):

1. Tell students, “Stars incredible because they are light years away from Earth, but yet we can still see their brightness every clear night. All stars have certain properties, or characteristics, that we are going to talk about today.”
    a. First, let’s write down some vocabulary.”
        i. Brightness - the amount of light the star radiates (luminosity) taking into account its size and distance from Earth (magnitude)
        ii. Color - the star’s color is based on surface temperature: cooler stars are redder, hotter stars are bluer, mid range temperatures are white or yellow.
        iii. Surface Temperature - measured on the Kelvin scale, the coolest reddest stars are around 2,500 K while the hottest stars can reach 50,000 K (The Sun is about 5,500 K)
        iv. Mass - measured in terms of the Sun, called Solar mass. If a star is larger than our Sun, it might have a mass of 7.5 solar masses.
        v. Size - measured by the Sun’s radius (1 solar radii is the same size as the sun).
2. Go through the Properties of Stars Chart with students as you explain each one
    a. Write the information on the board so students can copy it down.
        i. Protostar - how a star begins. It is a bunch of gas that has collapsed from a giant cloud. This phase could last 100,000 years.
        ii. Main Sequence Star - Most stars in our galaxy are main sequence stars, including our Sun. They all convert hydrogen into helium by releasing a lot of energy.
        iii. Neutron - Unlike most stars that become a white dwarf to die, it dies in a supernova explosion and the core that remains is a neutron star. It is made entirely of neutrons.
3. Tell students “A few things to keep in mind is that one star’s lifetime could be many types of stars and change colors. Over time, a star eventually dies. It may take billions of years, but a star that begins as a dwarf star may change into a supergiant.
    a. Each star has a unique life cycle and transition to different stars.

Elaborate (15 minutes):

1. Tell students “A new star has just been discovered! You have been given the task of finding out all of the information about this new star and reporting back all the details.”
    a. Have students look at their handout and create their own star.
    b. They get to come up with all of the details.
2. Tell students “Even though you get to come up with your own details about this star, it

needs to be realistic and follow the guidelines we recorded in our chart. If you decide it is a white dwarf, then your facts should stay consistent with the white dwarf facts."

3. Give students time to work on their Star.
4. If time allows, let students share their stars with the class.

Evaluate (10 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Content Review playlist.
2. Analyze student results to determine what concepts need to be a focus for reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a custom playlist with an instructional game and pre and post assessment.
- To use Legends for a quick formative assessment, create a 5-question assessment in a playlist.
- To use Legends for a student-directed experience, create a targeted freeplay playlist.
- Encourage students to play on their own at home in Legends of Learning: Awakening for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

Name: _____

Physical Properties of Stars

Circle the star you choose to research. Take notes in your notebook.

Popular Stars

- Sirius
- Betelgeuse
- Arcturus
- Rigel
- Altair
- Vega
- Canopus
- Deneb
- Antares
- Aldebaran

Key Terms

Brightness -

Color -

Surface Temperature -

Mass -

Size -

Protostar -

Main Sequence Star -

Neutron -

Fill in the table below.

Star Type	Brightness	Color	Surface Temperature	Mass	Size
T Tauri					
Red Giant					
White Dwarf					
Red Dwarf					
Supergiant					

Star Discovery

A new star has just been discovered! You have been given the task of finding out all of the information about this new star and reporting back all the details.

Type of Star	Brightness	Color	Surface Temperature	Mass	Size

Draw and color an image of your star in the space below.

Polaris

Microsoft Commons

Name: **KEY**

Circle the star you choose to research. Take notes in your notebook.

Answers will vary. Use this website as a reference.

Popular Stars

- Sirius
- Betelgeuse
- Arcturus
- Rigel
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Size - measured by the Sun's radius (1 solar radii is the same size as the sun).

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Main Sequence Star - Most stars in our galaxy are main sequence stars, including our Sun. They all convert hydrogen into helium by releasing a lot of energy.

Neutron - Unlike most stars that become a white dwarf to die, it dies in a

supernova explosion and the core that remains is a neutron star. It is made entirely of neutrons.

Star Type	Brightness	Color	Surface Temperature	Mass	Size
T Tauri	Bright	Orange to red	cool	Less than 3 solar masses	large
Red Giant	Very bright	Reddish/ orange	cool	About 8 solar masses	Extremely large (100 times larger than the Sun)
White Dwarf	Not very bright (because of its small size)	White, but changes throughout its life to blue and then red	Hot, but cools throughout its life.	1.2 solar masses	Relative to the sun's size
Red Dwarf	Very faint	red	cool	0.08-0.6 solar mass	small

Supergiant	So bright (30-500 Suns)	Red (cooler) or blue (hotter)(depending on the temperature	Hot or cool	10-70 solar masses	Largest stars (1000 solar radii)