Astronomy (Part I) Stars and Solar Systems

SDH 2017

OVERVIEW:
Always fascinating, always perplexing, and truly overwhelming, the night sky offers endless discoveries to those wanting to learn and explore. Students will discover the evening sky by gazing through our telescope and learn more about the systems that organize our solar system and beyond!

OBJECTIVES:
Students will be able to:
- Identify the characteristics of stars in the sky.
- Summarize the size and scope of Earth in the solar system and the universe.
- Describe the relationship between our planet and the solar system.

VOCABULARY:

Stars	***Planets***	***General Lesson Plan***	***Earth's Moon***
Milky Way Galaxy	Planet	Astronomy	Satellite
Star	Earth Cycle	Astrology	Moon
Sun	Gravity		Lunar Cycle
Solar Energy	Orbit		
Solar System			

NEXT GENERATION SCIENCE STANDARDS:
- Solar energy reaches the Earth through radiation, mostly in the form of visible light. (6.4.b)
- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1 and ESS1.A)
- The orbits of earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. (5-ESS1-2 and Ess1.B)

Materials:
Binoculars/Celestrons or Star Gazers
Flashlight

Procedures:
1. Introduction: Astronomy vs. Astrology?
   A. Have students form a circle. Then have them turn around to stare up at the stars while remaining silent. Have them observe the night sky and discuss with them what they saw. Is it different compared to what they may see back home. How is our relationship different with stars today than it was fifty years ago? One hundred years ago? Two thousand years ago?
   B. Ask students what the difference is between **astronomy** and **astrology**. Why is it important to know the difference? Why is the study of astronomy important? Astrology? Explain that the focus of this lesson will be astronomy.
2. Characteristics of a Star Discussion
   A. Explain to students that **stars** are giant balls of super-heated hydrogen and helium that produce energy through nuclear fusion.
      i. Activity – Make a Night Sky (found in activity glossary)
      ii. Debrief: What affects the brightness of a star? (*distance from viewpoint, temperature, size)* How is the temperature of a star similar to the colors in a campfire? *(The coolest stars/flames are red, then orange, ranging up to the hottest stars/flames, which are blue/white.)* Which of these lights would be the hottest star? The coolest? If they are all the same distance away, which one might be the biggest? Why? *(brightest=biggest in size, relative to other stars same distance away)*. Where on the spectrum does the Sun fall? *(orange-yellow, medium-heat, sun is 11,000 degrees F)* Why does the Sun appear bigger and brighter than hotter stars in our galaxy? (*because of its proximity to Earth).*
   B. Tell students that the Sun, only an average size star, is the central and largest body in the solar system. The Sun's diameter is 110x larger than the Earth's. The Sun's diameter is 865,000 miles wide, while

the Earth's is 7,918 miles, approximately 109 times larger than that of Earth's. A total of 1.3 million Earths could fit inside of the Sun.

C. Tell students that the Sun produces **solar energy** that is the basis for all life on Earth. Why? Without the Sun, producers (plants) would not be able to create energy (food) through photosynthesis. Consequently, consumers (like humans) would not be able to eat.
D. How fast does light travel through space? Solar energy takes about 8.5 minutes to reach the Earth. It travels at the speed of light, approximately 186,000 miles per second. That is fast! Compare that with driving to the Sun travelling at 60mph; it would take 177 years to get there.
E. Explain that the **Milky Way Galaxy** is home to our solar system and many other solar systems that orbit around a star. Every star that the students see has the potential to be the center of a system similar to ours and could possibly be home to a planet like the Earth. Even if only 0.1% of stars in the Milky Way Galaxy have planets, there are still more than 10 million solar systems in the galaxy.

3. *Experiment: SkyWatch*

A. Students look through binoculars/Celestrons or use the Star Gazers.
B. Were you able to see all the StarGazer constellations in the sky tonight? If not, why?
C. Were you able to see anything differently through the Celestron?
D. What did you see?
E. How can this help you understand other aspects of the universe?
F. What can you do to study astronomy at home?

4. Wrap Up

A. [*What?*] Concisely review the major points of the lesson, all the way back from the introductory activity.
B. [*So what?*] What was important for you to discover from the lesson? Why was it important for all of us to take this class?
C. [*Now what?*] What can you now do with this information? What changes can you make in your life? What can you teach to others? Who will you tell? What will you say?
D. Pass out beads after all students have contributed.

Astronomy (Part II) The Moon and The Planets

SDH 2017

1. Earth's Moon Discussion
   A. Tell students that each planet is considered a natural **satellite** of the Sun. What is a satellite? A satellite is something that orbits around another object, and can be natural (the **moon**) or manmade (television, weather, etc.). Many planets also have their own natural satellites. (ex. Earth 1 (the moon), Mars 2, Jupiter 60+, Saturn 40+, Uranus 15, Neptune 8, Pluto 1).
   B. Ask students how they think Earth's moon formed. Recent studies suggest a planet-sized object hit the Earth 4.5 billion years ago, sending debris into space that formed into our moon. The only minerals inconsistent between Earth and its satellite's crust are the heavy metals that would have already sunk to the center of Earth as the inner core began forming.
   C. Explain that these natural satellites have cycles just like the planets**.** The Moon takes 29.5 days to complete its orbit around the Earth. This is called the **lunar cycle** and starts with a new moon.
      i. Activity– Phases of the Moon (found in activity glossary)
      ii. Debrief: How long is the lunar cycle? (29.5 Earth days). How is the lunar cycle significant in our daily life (basis of our calendar, affects tides, etc.)
2. Planets in our Solar System
   A. Ask students what they know about the **planets** in our solar system. Ask students if anyone knows the order of the planets? Memory trick: **M**y **V**ery **E**ducated **M**other **J**ust **S**erved **U**s **N**oodles.
   B. Tell students that Mercury, Venus, Earth and Mars are the four closest planets to the sun, comprising the rocky planets. Lead into discussion on whether Pluto is a planet or not? The students will have heard about this discussion. What do they think? Why? Ask how the decision to define Pluto as something other than a planet impacts our views of the solar system and space?
   C. Inform students that Jupiter, Saturn, Uranus and Neptune are the four planets farthest from the Sun and are known as the gaseous giants.
   D. Explain that all of the bodies of the solar system are held in their **orbits** by the **gravity** of the Sun. What is an orbit? A path around something.
3. *Experiment: Planet Walk*
   A. Conduct Experiment.
   B. As you walk, between the planets discuss the following:
   C. Debrief: What did you think the solar system looked like? Was it larger or smaller? Why did you think it looked differently?
   D. In this model, the width of your little finger shows the distance between Earth and its moon. That is the farthest mankind has ever travelled! To reach the next star Alpha Centauri, you would have to pace for more than 200 miles. That's like walking to Bakersfield… from the dining hall!
4. Wrap Up.
5. Wrap Up
   A. [*What?*] Concisely review the major points of the lesson, all the way back from the introductory activity.
   B. [*So what?*] What was important for you to discover from the lesson? Why was it important for all of us to take this class?
   C. [*Now what?*] What can you now do with this information? What changes can you make in your life? What can you teach to others? Who will you tell? What will you say?
   D. Pass out beads after all students have contributed.

Things to Think About:

Special Needs: Scared of the dark, safety – night time can be a scary time for your students to be hiking around, be sure to frontload safety – no pushing, horseplay, etc.

Time Fillers: Talk about solar/lunar eclipses and or black holes. Anything you'd like to add if you have extra time, be warned the students will have lots of questions!

Weather: Cloudy, Cold Weather – Make sure your students are dressed extra warm at night, especially since you won't be hiking as much as a day class. Bring blue pads if it is cold to provide extra insulation.