SUCCESS ACADEMY EDUCATION INSTITUTE

Earth in Space

Name: _____

Teacher: _____

Class: _____

Earth and Space Science
Unit 5
Lab Notebook

Lesson 1:
Is Anyone Out There?

Question: Why do we study space?

Directions: Record notes about the study of space using the articles and videos provided:

Source	Notes

Lesson 1

Take notes while watching the International Space Station video: What is the purpose of ISS?

List any questions you still have about the study of space below.

Lesson 1

Analysis Question: Why do scientists study outer space? Include evidence and reasoning to support your response. [3]

Lesson 2:
The Beginning

Question: How did the universe begin?

Directions:

1. Choose a galaxy and locate it in the galaxy field on the worksheet Labeled Galaxy Field 1.

2. Lay Labeled Galaxy Field 2 over Labeled Galaxy Field 1 and align the two so your chosen galaxy is in the same place on both sheets.

3. Record your observations about how the other galaxies appear to have moved.

4. Use a transparency marker to draw an arrow from each galaxy's position at time 00:00:00 to where it has moved 1 second later.

5. Record your observations and answer the following questions.

Data:

Record observations about how the galaxies appeared to move.

Lesson 2

Discussion Questions:

1. What is happening to the universe?

2. What can you infer about the origin of the universe?

3. What might the universe look like thousands of years from now?

Analysis Question: Construct a hypothesis about the origin of the universe. Explain how the available evidence supports your idea.

Lesson 3:
Our Universe, to Scale

Question: How big is the universe?

Directions: Record your observations while viewing the space interactives on your computer.

Notes on the Universcale.

Notes on the Interstellar Trip Planner.

Lesson 3

Use your observations to create a diagram showing the major parts of our universe — planets, stars, solar systems, and galaxies using a relative scale.

Lesson 4:
Our Solar System, to Scale

Question: What is the scale of our solar system?

Directions: Complete the "Solar System Scale Data" section below. Then use the data to make a scale model of the solar system.

Object	Approx. Distance from the Sun (km)	Scaled Size for Model (include units!)	Estimated Diameter (km)
Mercury	60,000,000		5,000
Venus	110,000,000		12,000
Earth	150,000,000		13,000
Mars	230,000,000		7,000
Asteroid Belt	330,000,000		150,000,000
Jupiter	780,000,000		135,000
Saturn	1,400,000,000		113,000
Uranus	2,900,000,000		50,000
Neptune	4,500,000,000		48,000

Lesson 5:
Pieces of the Universe

Question: What are the different parts of the universe?

Do Now: Record notes on the following objects found in our solar system.

Object Classification	Description	Sketch
Star		
Planets: *Inner Planets* *Outer Planets*		
Moon		
Asteroid		
Comet		
Dwarf Planet		

Lesson 5

Directions: As you explore the Hubble Deep Field, record your answers to the academy prompts in the space provided below.

1.
2.
3.
4.
5.

Lesson 5

Discussion Questions

1. What patterns exist among various stars, galaxies, and solar systems?

2. What do all galaxies have in common?

3. What do all solar systems have in common?

Lesson 6:
Is the Sun the Largest Star?

Question: Is our Sun the largest star in the universe?

Directions: Use two small flashlights and one large flashlight to develop a model that represents how certain stars seem brighter than others at night. Consider the following questions:

1. Which light has the largest beam? Can you make all of the beams appear to be the same size? How?

2. Which light shines most brightly on the wall/floor? Can you make all of the beams look equally bright? How?

3. Can you make the two identical flashlights appear to have *different* sizes/brightness? How?

4. What do your findings make you think about the apparent size and brightness of the stars in the night sky? What does this tell you about their distance from Earth?

Create a diagram of your model in the space below.

Lesson 6

Write an explanation of how your model works, including the strengths of your model and any limitations.

Lesson 7:
The Celestial Dance

Question: Why does the night sky look different throughout the year?

Directions: Follow the procedure below to create your Star Wheel.

1. Take one circular sky map and one outer sleeve.

2. Trim away the gray corners of the sky map so you are left with a circle 8 inches across.

3. Take the outer sleeve and trim away the white border around the edge. **Do NOT cut the white rectangle off the bottom.** Simply trim along the black line when you get to that area. When you're done, cut out the white oval in the middle.

4. To make a Star Wheel, fold back the white rectangle at the bottom of the outer sleeve so it's underneath the front. Then staple or tape the rectangle to the front at the locations marked by short white lines to either side of the oval. Now slip in the circular sky map so it shows through the oval.

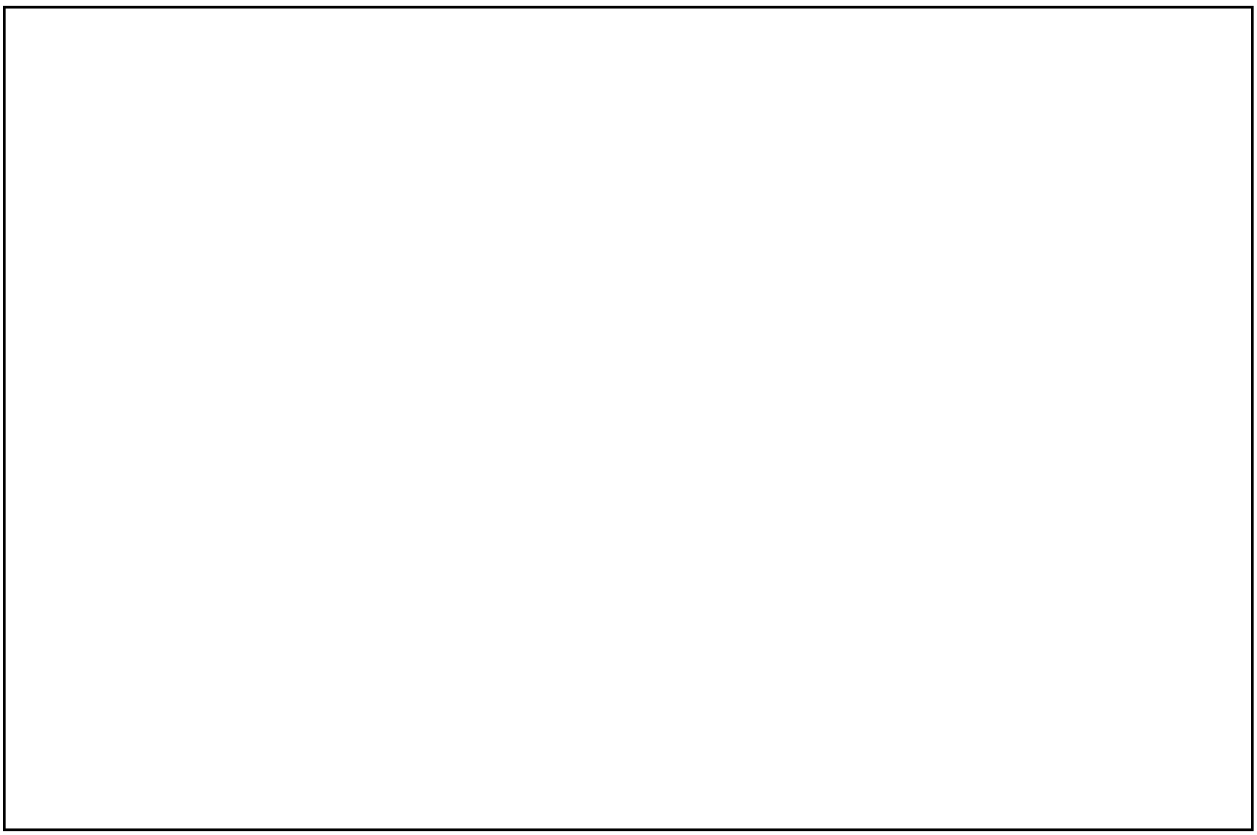
5. Rotate the wheel to study the orientation of the night sky throughout the year.

6. Record your observations and use the model to determine whether you think the stars are moving relative to the Earth.

7. Record a conclusion and explain your evidence using the model.

Lesson 7

Observations of the Star Wheel



Conclusion: Are the stars moving relative to the Earth? Use evidence from the model to support and justify your response.

Lesson 7

Conclusion Revision: Are the stars moving relative to the Earth? Use evidence from the model to support and justify your response.

Lesson 8:
Total Eclipse of the Science Lab

Question: What causes an eclipse to occur?

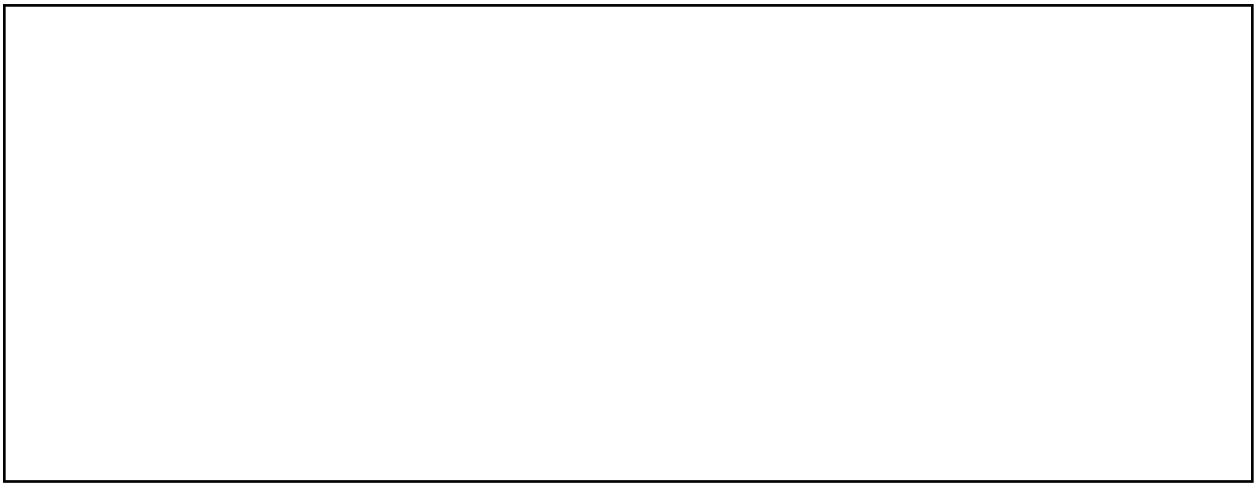
Directions: Record observations of partial and total lunar eclipse videos.

Partial eclipse

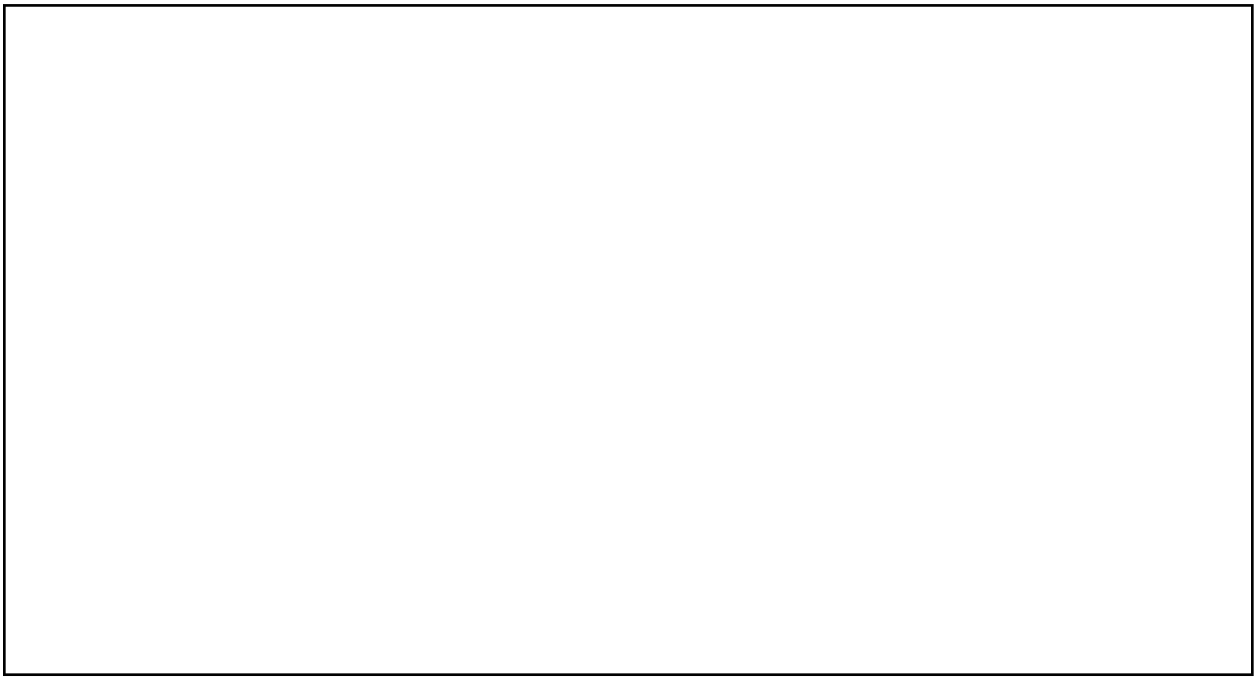
Total eclipse

Lesson 8

Use the space below to predict the arrangement of the Earth, Sun, and Moon during a partial lunar eclipse.



Use the provided materials to make a scaled model of the Earth and the Moon and draw it in the space below. Include labels and measurements.



Lesson 8

Use the flashlight and your scaled model of the Earth and the Moon, determine the cause of both partial and full lunar eclipses.

Use the space below to draw the arrangement of the Earth, Sun, and Moon during a partial lunar eclipse.

Use the space below to draw the arrangement of the Earth, Sun, and Moon during a full lunar eclipse.

Discussion Questions:

1. What were the strengths of your model?

2. What were the limitations of your model?

3. What causes eclipses to occur?

4. Why don't humans see eclipses all the time?

Lesson 9:
Invisible Forces

Question: How is the universe held together?

Directions: Follow and complete the steps below.

1. Define gravity:

_____

_____

_____

2. Use the physical model demonstrated by your teacher to model the interactions between the celestial bodies in space and discover the factors that affect gravitational force. Consider the following questions as you work with the model:

    - What happens if you put a more massive ball in the middle and a less massive ball into orbit?
        - Is that true for every possible combination or larger and smaller balls?
        - What happens when you put a less massive ball in the middle and a more massive ball into orbit? Why?
        - Do you think mass affects gravitational force?
    - What happens if you put a larger ball in the middle and a smaller ball into orbit?
        - Is that true for every possible combination or larger and smaller balls? Do you think size affects gravitational force?
    - Is there a difference in the way an object orbits when it is closer to the center object versus farther away? Why do you think that is?
    - *Challenge: Can you use the materials to create two separate orbits (the Moon around the Earth and the Earth around the Sun) in the same model?*

3. Follow the Gravity Factors PhET Simulation using the procedure below:
    - Select the Earth/Sun option.
    - Ensure that the blue gravity arrow is on.
    - Ensure the Path button is on.
    - Without manipulating settings, watch the simulation and record initial observations:

- Then manipulate the following settings one at a time and record any differences you notice in the table below.

Factor Manipulated	Observations
Mass of star	
Mass of planet	
Distance from planet to Sun	
Gravity turned off	

Discussion Questions:

1. What factors affect the gravitational force between objects?

2. What were the strengths of each model?

3. What were the limitations of each model?

Lesson 10:
Crash Landing

Question: What makes a planet habitable?

Directions: Read the Habitable World Analysis Sheet. Record notes below on what is necessary to support life on a planet.

Data: Analyze and take notes on the different celestial bodies in Solar System X in the table below.

Planet/Moon	Is Life Possible? (unsure, possible, impossible)	Rationale

Lesson 10

Planet/Moon	Is Life Possible? (unsure, possible, impossible)	Rationale

Analysis Question: Which planet/moon in Solar System X would be your best option for a crash landing? Include evidence and reasoning to support your response.

Lesson 11:
A Cosmic Finale

Question: How can we explain the phenomena observed in our universe?

Directions: Create a poster that answers the questions below. Use the space below and on the next page to plan your work.

1. Why does the planet get lighter and darker each day? Why are some parts of the year cold while others are hot?

2. Why do the planet's stars and moons sometimes seem to be partially or fully "covered up"?

3. Why do the stars in the sky appear to move around throughout the year?

4. Why don't the planet's two moons fly away into space?

5. Why does one moon look much bigger than the other (even though they are the same size)?

Record notes on information you want to include on your poster.

Lesson 11

Design a draft of your poster in the space below.