

Secrets of Space

Sample Study Guide



THANK YOU TO OUR EDUCATION SUPPORTERS

MIDDLESEX
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Secrets of Space

About the production

Suni and Mae are dreamers. As young girls, they dreamt about journeying far beyond our solar system, singing among the stars and discovering all that was unknown to them: the secrets of space. Using magical illusions and state-of-the-art digital LED walls, the sisters and the audience embark on an interactive journey across the galaxy. The wonders of outer space are explored with dazzling imagery and key ideas and inventions in science, technology, and engineering.

Brought to you by Cahoots NI, Secrets of Space has been developed with leading space industry experts and features curriculum connections for elementary school audiences in STEAM learning.

Secrets of Space can be separated into eight sections of study which are explored throughout the show. These topics include :

- Evolution
- The Solar System
- Gravity
- Space Travel
- The Overview Effect
- Time Travel
- Stars and Supernovas
- Scale and Size

This production offers a wide range of opportunities to engage with curriculum subjects such as: Science, History, Math, Language Arts, Information, Communication and Technology and Fine Arts.

This study guide includes:

- A vocabulary list
- Suggested resources
- Additional activities that can be enjoyed before or after you attend the performance.

In addition to this study guide, a post-show education workshop is available for small groups to use the play as a catalyst and further explore their own big questions and ideas. To attend this workshop, the children must have already seen the production.

If you are a presenter looking for more information on how to bring this post-show workshop to your community, please contact Holden & Arts Associates at sk@holdenarts.org.

If you are teacher or school group, please contact your presenting venue.



Useful Vocabulary

| Word | Definition |
|-----------------------|---|
| Atmosphere | The gases held by gravity around Earth and around other planets. |
| Black Hole | A place in space where matter and light cannot escape if they fall in. |
| Comet | An icy rock that lets off gas and dust. |
| Constellation | A group of stars in the sky. They're often named after an animal, object, or person and form certain patterns based on where you are. |
| Galaxy | A collection of thousands to billions of stars held together by gravity. The galaxy we live in is called the Milky Way. |
| Gravity | A force that pulls matter together. |
| Light year | The distance light travels in one year. |
| Moon | A natural object that travels around a bigger natural object. Planets can have moons. Even some asteroids have moons! |
| Orbit | The curved path that a planet, satellite, or spacecraft moves as it circles around another object. |
| Planet | A large body in outer space that circles around the sun or another star. |
| Solar Flare | A burst of energy and particles from the sun. |
| Solar System | A set that includes a star and all of the matter that orbits it, including planets, moons, asteroids, comets, and other objects. |
| Spacecraft | A vehicle used for traveling in space. |
| Speed of Light | Light is the fastest thing in the universe. It travels 186,282 miles (299,792,458 meters) every second. |
| Star | A ball of shining gas, made mostly of hydrogen and helium, held together by its own gravity. |
| Supernova | The explosion of a star that makes it as bright as a whole galaxy. |
| Universe | All of space and time, and everything in it. It's everything ever! |
| Vacuum | An empty space that doesn't have any matter. |
| Wave | A way energy moves from one place to another. |

Suggested online resources:

NASA : <https://nasa.gov>

NASA image and video Library : <https://images.nasa.gov/>

Live streams from Space : <https://www.youtube.com/NASA>

Sounds from Space : <https://archive.org/details/nasaaudiocollection>

National Geographic : <https://www.nationalgeographic.com/science/space>

Kennedy Space Center educator resources : <https://www.kennedyspacecenter.com/camps-and-education/educator-resources>

Hubble Telescope resources : <https://hubblesite.org/>

The Overview Effect : <https://vimeo.com/55073825>

Chris Hadfield sings from Space : <https://www.youtube.com/watch?v=KaOC9danxNo>

Production photos from Secrets of Space : <http://www.cahootsni.com/shows/secretsofspace/>



Related Activities

This production can connect with a wide range of curriculum subjects, such as: Science, History, Math, Language Arts, Information, Communication and Technology and Fine Arts.

Here are some suggested related activities for you to enjoy!

Science:

Gravity

-This experiment can get a very wet, so make sure you conduct it over a large basin or outside! Poke a hole near the bottom of a polystyrene cup. Fill the cup with water, keeping your finger over the hole.

Take your finger off the hole and observe what happens. The water should stream out.

Fill the cup again, holding your finger over the hole. This time, you are going to drop the cup and lift your finger off the hole at the same time. What do you think will happen?

Make sure the cup falls into a large bucket or onto the grass - stand back, you might get splashed! You should notice that when you dropped the cup the water no longer sprayed out of the hole.

When you held the cup and lifted your finger off the hole the first time, the water was pulled out of the hole and towards the ground by gravity. When you let go of the cup completely, gravity didn't pull the water out of the cup, because both the water and the cup were moving at the same speed!

History:

Women in Space

-The characters in our show Suni and Mae loved learning all about the women who work in the space industry. In fact, they were named after two incredible examples!

Why not create a research project all about the different women who played various roles in the space industry - finding out things like - where they were born, did they go to space? When and why? Did they go alone?

This can be done as a group or individual project and presented to the class.



Math:

Bode's Law

-The chart below shows the distance from each planet to the Sun rounded to the nearest tenth of an Astronomical Unit (AU).

| Mercury | Venus | Earth | Mars | Asteroids | Jupiter | Saturn | Uranus | Neptune | Pluto |
|---------|-------|-------|------|-----------|---------|--------|--------|---------|-------|
| 0.4 | 0.7 | 1.0 | 1.6 | 2.8 | 5.2 | 10.0 | 19.6 | 30.1 | 39.6 |

Can you find a pattern between the distance from one planet to the Sun and the next planet to the Sun?

To do this, start by subtracting the distance of Mercury to the Sun from the distance of Venus to the Sun

For example: $0.7 - 0.4 = 0.3$

Use the chart below to solve this equation for each of the planets. The first one has been done for you. Continue to subtract the values for all of the planets.

| Mercury | Venus | Earth | Mars | Asteroids | Jupiter | Saturn | Uranus | Neptune | Pluto |
|---------|-------|-------|------|-----------|---------|--------|--------|---------|-------|
| 0.4 | 0.7 | 1.0 | 1.6 | 2.8 | 5.2 | 10.0 | 19.6 | 30.1 | 39.6 |
| | 0.3 | | | | | | | | |

Look closely at the relationship between the numbers in the top row and the bottom row. Can you spot a pattern?

This pattern can also be presented like this :

- List the following numbers, doubling every number after 3 - (0, 3, 6, 12, 24, 48, etc.)
- Add 4 to each number.
- Divide each of the resulting numbers by 10.
- The results are the approximate distances of the planets from the Sun, measured in AU.

This relationship was first discovered by Johann Titius and published by Johann Bode in 1772, hence why it is called Bode's Law.

It was calculated before Uranus, Neptune, and Pluto were even discovered. Astronomers actually found Uranus because they searched the sky at the distance predicted by this relationship!

Can you use the pattern to predict the positioning of some new planets?

If one Astronomical Unit (AU) is equal to about 150 million kilometres (km), can you convert any of the above figures into their massive equivalent in km?

Language Arts

What would you bring?

-Did you know that some astronauts have brought items into Space, sometimes secretly? What one object would you bring with you?

Would it be something of personal value, something useful, or something you think you just couldn't live without in Space? Take into consideration the size of the item, and how usable it would be in zero gravity! Present your decision to your class and explain your reasons.

Diary entry from the moon

-Write a diary entry from the perspective of Neil Armstrong or Buzz Aldrin following the moment they set foot on the moon in 1969. Include what they may have seen and how they may have felt.

Astronomical Acronym

-Create your own acronym to help you remember the order in which the planets of our solar system follow the sun. See how creative you can get! You can use this as an example: My Very Excited Mother Just Served Us Noodles.

Information, Communication and Technology:

Fact Finding Mission

-Using the internet or books, research a planet of your choice and produce a fact sheet containing pictures and various interesting facts about that planet. Things you could explore include the planet's colours, temperature, its position in the solar system and the potential for life.

Fine Arts:

Is there anyone out there?

-Do you think there is life on other planets? What might they look like?

Draw or make your own alien creation and describe their unique features. How are their bodies designed to survive on their planet? What do they eat? What language do they speak?

Star Gazing

-Try keeping a moon diary for a month and watch the moon change shape. Take a look at the moon every night for a full lunar cycle, 28 days. Draw the shape you see and track the changes that happen. Analyse your results - why does this happen?



Let's make a rocket!

Step 1 - Encourage the students to bring in a cardboard tube to use as a rocket.

Step 2 - Provide them with various paints to choose from and allow the children the chance to pick an item to paint the cardboard tube with such as; paintbrush, sponge or glove.

Step 3 - Assist the child when painting the cardboard tube, cone-shaped topper and two rocket boosters (3 triangle pieces of card to place around the bottom).

Step 4 - When everything is dry, the children can then stick the cone topper and card triangles to the sides. Coloured tissue paper can also be used and cut to make flames for the bottom of the cardboard tube.

