**NASA Space Place**

**STEM Topics -** Astronomy of the Solar System and Universe

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**Grade Level:** 6-8 Grade

**Standards:**

NGSS:

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**Goals**: Learn the different astronomical structures and bodies of the Solar System and Universe through the NASA Spaceplace website.

**Learning Objectives:**

1. SWBAT learn about structures in the Universe such as supernovas, exoplanets and space volcanoes.
2. SWBAT navigate through the NASA space place website to find answers and information about the Earth, Moon, Solar System and Universe.

**Materials:**

Videos :

1. Our Moon isn’t the only moon

<https://www.youtube.com/watch?v=o33NZIlfKys&t=9s> - 2 min 40 sec

2. The Solar System’s Formation

<https://www.youtube.com/watch?v=RT4OO0TFLHw&t=8s> – 3 min 02 sec

3. How to make a cloud mobile!

<https://www.youtube.com/watch?v=aCsRG2hgb9E&t=72s> - 1 min 56 sec

1. Less than Five: What is a Supernova?

<https://www.youtube.com/watch?v=YIKXvDlf8_0> – 5 min 04 sec

1. Space Volcanoes: Shelf Life 360

<https://www.youtube.com/watch?v=5uwHOx2V2jI> - 5 min 03 sec

1. Gravitational Waves Explained

<https://www.youtube.com/watch?v=4GbWfNHtHRg> – 3 min 19 sec

1. Searching for other planets like ours

<https://www.youtube.com/watch?v=UDCyLAAqD9s> – 1 min 56 sec

Website:

<https://spaceplace.nasa.gov/>

Website Links

Lunar Eclipses and Solar Eclipses (Investigation Page under Earth Category) <https://spaceplace.nasa.gov/eclipses/en/>

Why does Saturn have rings? (Investigation Page under Solar System Category)

<https://spaceplace.nasa.gov/saturn-rings/en/>

What is the Kuiper Belt? (Investigation Page under Solar System Category)

<https://spaceplace.nasa.gov/kuiper-belt/en/>

How many Moons? (Investigation Page under Solar System – Includes video)

<https://spaceplace.nasa.gov/how-many-moons/en/>

How did the Solar System form? (Investigation under Solar System – Includes video)

<https://spaceplace.nasa.gov/solar-system-formation/en/>

Make Oreo Moon Phases! (Activity Page under Earth Category)

<https://spaceplace.nasa.gov/oreo-moon/en/>

Make a Cloud mobile (Activity Page under Earth Category – Includes video)

<https://spaceplace.nasa.gov/cloud-mobile/en/>

Play Helios: A game about how the Sun makes Energy (Game under the Sun Category)

<https://spaceplace.nasa.gov/helios-game/en/>

Go with the Flow: An oceans current game (Game under the Earth Category­)

<https://spaceplace.nasa.gov/ocean-currents/en/>

Documents:

WebQuest NASA Space Place.doc

WebQuest NASA Space Place Answers.doc

WebQuest NASA Space Place Example.doc

WebQuest NASA Space Place Example Answer.doc

**Vocabulary:**

**Solar eclipse -** happens when the moon gets in the way of the sun’s light and casts its shadow on Earth.

**Lunar eclipse -** Earth gets in the way of the sun’s light hitting the moon. That means that during the night, a full moon fades away as Earth’s shadow covers it up.

**Kuiper Belt -** is a ring of icy bodies just outside of Neptune’s orbit. Pluto is the most famous Kuiper Belt Object.

**Supernova -** a star that suddenly increases greatly in brightness because of a catastrophic explosion that ejects most of its mass.

**Exoplanet -** a planet that orbits a star outside the solar system.

**Gravitational Wave -** an energy-carrying wave propagating through a gravitational field, produced when a massive body is accelerated or otherwise disturbed.

**Setup:**

* Open the NASA space place website and navigate to the links for the Investigational pages under the Earth and Solar System Categories. Get to them through the website links listed under the Materials section and also through the icons presented under each category. Go to the pages for **Lunar Eclipses and Solar Eclipses**, **Why does Saturn have rings?**, **What is the Kuiper Belt?**, **How many Moons?**, **How did the Solar System form?**. Navigate and get yourself familiar with the content of each page as you will be discussing each one (although not in a lot of detail) with the students. Also watch the videos with the **How many Moons?** & **How did the Solar System form?** Pages in order to comment about them afterwards or take questions from the students.
* Study the two documents **WebQuest NASA Space Place.doc** and **WebQuest NASA Space Place Answers.doc.** Study the just the WebQuest activity document first and notice that the titles of each activity is the title of the investigational webpage that contains the information the students will be looking for. Go to those webpages and find where the written answers and pictures are found within each document. Remember there are more picture answers than written ones. Note also that the students can just copy and paste the written answers as well as the pictures into the document from the webpages. Then go the WebQuest answer page and compare what the answers are to what you searched for to make sure they are the same.
* Next, look at the two documents **WebQuest NASA Space Place Example.doc** and **WebQuest Space Place Example Answer.doc** the same way you did with the previous ones mentioned above. This will be the way you will introduce the WebQuest activity to the students. This example you will do as a demonstration to the students so make sure you know ahead of time what you’re looking for to complete this part of the lesson.
* Have the four videos - **Less than Five: What is a Supernova?**, **Space Volcanoes: Shelf Life 360**, **Gravitational Waves Explained**, **Searching for other planets like ours** ready for viewing before the lesson starts. Make sure you watch the videos ahead of time so that you can lead a short discussion of each one or ask a question or two to all the students from each video.
* Make sure you have the two game website links for **Play Helios: A game about how the Sun makes Energy** and **Go with the Flow: An oceans current game** ready for the students to copy and paste on their web browsers so that they can play the games themselves. Make sure to play these games a few times through first in case the students need some help with knowing what to do while playing.

**Lesson Plan Procedure:**

1. The lesson begins with a short discussion of certain parts of the space station that have not been covered yet. These include the large solar panels on the station and a certain module that expands after it has been installed. The videos **STEMonstrations : Solar Energy** and **The future of the international space station is inflatable** talk about these areas of the space station. Show both videos and conduct a short discussion of each topic. [10 minutes]

2. Next start the lecture discussion of traveling in space by showing the power point **Space Station Traveling.pptx**. The first part of the lecture again reviews EVAs are and also the space suit itself by covering the equipment that the suit uses. These are the first two slides of the presentation. Next show the video **STEMonstrations : spacewalk part 2 : spacesuits**. After this, then show 1 slide covering space docking – how it is used for cargo ships going to the space station and also the space shuttles. Afterwards show the space shuttle docking to the space station with the video **Space shuttle Atlantis docks with the international space station.** [15 minutes].

3. Take a break from the power point presentation and then have the students do a drawing exercise. Have them get out their tracing paper or blank printer paper sheets, pen or pencil and a set of colored pencils. Deliver hard copies or have the students download the following files that contain pictures of two space shuttles or two space suits - **Space Shuttle One.doc**, **Space Shuttle Two.doc**, **First EVA picture.doc**, **Second EVA picture.doc**. The students will choose one space shuttle picture and one spacesuit picture from the set of four pictures. They will then draw both of them as time permits. [30 minutes].

4. Resume the power point presentation by discussing the space ship travel to space station game. The next four slides talk about what the game look likes and how it relates to the coordinate plane and vectors, an example of game moves from one space station to the next and two slides that show the Spacecraft docking chart that they must fill out after they complete a game. The slides have animated steps so review them before presenting. Remember the game has the rule where you move in alternates of three and then one move in the x or y positive and negative direction. Pay attention to the types of thrusters (their names) and which directions they go (same colors as the arrow moves). The **Spacecraft Coordinate Plane Docking Chart.doc** file contains four separate charts that is meant for the students to play the game at least four times. After they play the game the summary of game moves will appear on the bottom right part of the game. They must fill out each chart sheet after each game. The chart sheet contains spaces for the four different space stations the spaceship travels to in each of the coordinate planes. It also contains spaces for where to record the number of moves for each thruster. There are a total of four thrusters. Next, go over the last three slides that discuss analytical geometry topics such as ordered pairs and vectors. Go over the examples on each slide before you present it to them. [15 minutes].

5. After the power point is finished do a demonstration of the game to the students. Remember you must travel to a space station in each of the four coordinate planes with alternating moves of three or one spaces in the negative or positive x or y direction. They must reach the next station at the exact coordinate in the plane. This means that they usually must maneuver several times around the target to reach it exactly. Now have the students download and open the file **SpaceVector.html** file themselves to play the game. Remember to tell them to play the game four times and record all of the game moves in the spacecraft docking charts. You may need to review this with them again before they play themselves. One incentive to get the students to play is to note which space station took the most and least moves. Maybe also have them do an average of all moves for the four space stations and have them tell you which game gave the best results. [45 minutes].