**Space Stations (Lesson 4 of 4)**

**Docking to a Space Station**

**STEM Topics -** Math topics – coordinate plane, points, vectors

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**Grade Level:** 6-8 Grade

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**Goals**: Learn the process of planning a space trip to a space station using math to guide you.

**Learning Objectives:**

1. SWBAT learn analytical geometry ideas such as coordinate plane, point, lines and vectors.
2. SWBAT interact successfully with a coordinate plane spaceship game where the player travels to four different space stations using thrusters.
3. SWBAT learn common activities and equipment on the space station.

**Materials:**

Videos :

1. STEMonstrations : Solar Energy

<https://www.youtube.com/watch?v=5CzuwztCw-E&feature=emb_logo> - 2 min 40 s

2. The future of the international space station is inflatable / Impossible Engineering

<https://www.youtube.com/watch?v=yr6BBGoDWKk&t=1s> – 2 min 56 sec

1. STEMonstrations : Spacewalk Part 2 : Spacesuits

<https://www.youtube.com/watch?v=xv3uSmMBPPw> – 5 min 51 s

4. Space shuttle Atlantis docks with international space station

<https://www.youtube.com/watch?v=iwwE-m917CY> - 2 min 01 s

Power points:

Space Station Traveling.pptx

Documents:

Space Shuttle One.doc

Space Shuttle Two.doc

First EVA picture.doc

Second EVA picture.doc

Spacecraft Coordinate Plane Docking Chart.doc

Materials:

Blank printer paper or tracing paper (at least two sheets per student)

A pen or pencil

A set of colored pencils for each student

HTML – Internet Game Files:

SpaceVector.html (Traveling to space stations with space ship in a coordinate plane)

LINK

<http://kattsustaineducation.com.s3-website.us-east-2.amazonaws.com/Games/SpaceVector.html>

**Vocabulary:**

**Ordered pair –** Two numbers within parenthesis separated by a comma that give the x-coordinate and y-coordinate of a point within a coordinate plane.

**Extravehicular Mobility Unit (EMU):** The space suit containing several life support systems, work and safety units that is used by astronauts on space walks.

**Vector -** a quantity having direction as well as magnitude, especially as determining the position of one point in space relative to another.

**Setup:**

* The lesson begins with a few videos about the space station. Have the videos **STEMonstrations : Solar Energy** and **The future of the international space station is inflatable** ready for viewing.
* Next the lesson proceeds with the power point presentation Space Station Traveling.pptx, so have that file ready to go. Also during the presentation you will show the videos **STEMonstrations : Spacewalk part 2 : Spacesuits** and **Space shuttle Atlantis docks with the international space station** ready for viewing.
* Halfway during the power point presentation after the EVA / spacewalking and docking portions are done (the slides and both videos above), you will need the students to open the 4 files or deliver hard copies of them – **Space Shuttle One.doc**, **Space Shuttle Two.doc**, **First EVA picture.doc**, **Second EVA picture.doc** so that they can do some drawings. You will also need them to get some blank paper or tracing paper, a pen or pencil and some colored pencils.
* During the second half of the power point presentation you will have a slide showing the spacecraft docking chart (blank and completed), give each student a **Spacecraft Coordinate Plane Docking Chart.doc** sheet (have them download it) for them to use as they play the spaceship vector game. Next, have the **SpaceVector.html** game ready for the students to play. It can be downloaded as a standalone game (doesn’t need image files associated with it).

**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].