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| Level | <h1>Introduction to Satellites</h1> | |
| Middle School | | |
| Time Required | Lesson Summary | |
| 3 ½ - 50 min class periods (175 min) | During this lesson, students will learn about satellites. Students will carry out a research project in small groups. The research will be presented in poster form which will be shared with peers through a gallery walk. | |
| Standards | | |
| <p>NGSS</p> <p>MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.</p> | | |
| Vocabulary | Objectives | |
| Satellite Geostationary satellite Transponder | <ul style="list-style-type: none"> • Students will understand the basics of how satellites work • Students will be able to describe the history of satellites • Students will describe the contributions of various cultures in the development of the modern satellite • Students will understand that electromagnetic waves can be used for communication purposes | |
| Materials | | |
| <ul style="list-style-type: none"> • class set of computers • large poster boards (~18 X 24 inches) • scissors • glue sticks | | |

Pre-Requisites

Basics of electromagnetic energy
 Fundamentals of wave mechanics (frequency, wavelength, velocity, amplitude)

Safety Considerations

None

Pacing Notes

Day one: introduce satellites, satellite communication activity, assign groups
 Day two: research
 Day three: poster creation
 Day four: (half of class) gallery walk and class discussion

Before the Lesson

Make sure the video will play on your computer. Also, be sure to have copies of all handouts for students and the materials for poster making.

| Assessments | Classroom Instructions |
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| Pre-Activity Assessments | Introduction |
| | As you complete administrative tasks have the students create a list of all the things they know about satellites (both natural and manmade) |
| Activity Embedded Assessments | Activities |
| | I. Discussion Give students the opportunity to share what they know about satellites. If someone says something and other students question the truth of that statement consider adding that topic to the research. |

While the video is playing walk around the room. Be sure students are focused on the video and the questions they are supposed to answer.

The research works best if you can put students in groups of four.

2. Go through the satellite presentation with your students. Do not spend too much time on this part of the presentation. The idea is not for students to be able to identify the type of satellite but rather so they have an impression of the different types of satellites. Explain that while this presentation contains a variety of satellites it is not inclusive. Students will learn about even more satellites during their research.
3. This video will give students a basic understanding of satellites. Hand out the video comprehension page before the video starts.
https://www.youtube.com/watch?v=_liPMG43L54
(last viewed (1/12/23))

Ask: Does anyone have any questions?
Take all questions before transitioning back to the presentation.

4. Direct instruction on satellite communication
 - a. Please pass out the Satellite communication sheet to students. This has questions for both the video as well as the Satellite communication game.
 - b. There are two slides in the presentation on this topic. That is followed by a short video which is linked on the third slide.
 - c. After the video **Say:** The video was discussing how NASA communicates with satellites however every government agency or private company that uses satellites has a similar system.
5. Satellite communication game
You can either allow students to work with a partner or have them work alone.
Please be aware that the questions for this activity are on the same sheet as the video questions.

<https://spaceplace.nasa.gov/dsn-game/en/> (last accessed 5/13/23)

6. **Say:** Now that you have been introduced to the topic of satellites, you will investigate to learn more. You will be working in a group of four. Split up the research so you can complete it by the end of the

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| <p>Walk around while groups are assigning topics. Help groups overcome differences about who should do what. If necessary the research topics can be broken into different sections so that more than one student can be involved in each.</p> <p>Create a rubric for the poster. This will help students understand what is required.</p> <p>Grade the poster according to your rubric.</p> | <p>day tomorrow. You will then have one day to create a poster.</p> <p>7. Hand out the research instructions Either give students the time to read the instructions for themselves or read them aloud.</p> <p>Ask: Are there any questions?</p> <p>8. Research</p> <p>Say Use your best research skills to find the information requested. Once you have found all the required information then find something related to your topic but not requested.</p> <p>Be sure to record the citations for all information.</p> <p>9. Poster Creation</p> <p>Students should print things to attach to the poster if possible. This will alleviate the problem of not being able to read something a student wrote.</p> <p>10. Gallery Walk To remain orderly assign each group a starting place. Give the students 3 minutes per poster. During that time each student should write down one thing they really liked about the poster.</p> |
| <p>Post Activity Assessments</p> | <p>Closure</p> |
| <p>It is best to encourage participation in discussions without evaluating student contributions. If you feel you need a grade consider participation.</p> | <p>Class Discussion</p> <p>Ask questions similar to the following:</p> <p>Did all the posters list the same satellite components? Why do you think those parts are necessary?</p> |

Which country has the most satellites?
Why are so many satellites necessary?
Which person most impressed you with their contribution to the development of satellites?

Educator Resources

The links below were last viewed on 8/1/23.

<https://airandspace.si.edu/explore/topics/technology-and-engineering/satellites>

<https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-a-satellite-58.html>

<https://www.nro.gov/Portals/65/documents/foia/declass/HEXAGON%20Records/92.pdf>

<https://www.americanscientist.org/article/fifty-years-of-earth-observation-satellites>

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Below is a list of the lesson titles included in the series. All lessons can be accessed from this web page, <https://superknova.org/educational-resources/>.

Middle School

Introduction to Satellites

Weather Predicting

Introduction to Radio Wave Communication

The Importance of Radio Astronomy

Cubesat Model Building

Understanding FM Radio

Radio Frequency Technology

Who Decides if You Get 5G?

High School

The Uses of Radio Waves and Frequency Allocation

Is Radio Technology Safe?

Diffraction of Radio Waves

Measuring Sea Surface Temperatures with Satellites

Marine Animal Tracking and Bathymetry

How to Design Your Own Crystal Radio

How Radio Waves Changed the World

Simple Wireless Communication
Seeing and Hearing the Invisible
Local Wireless Radio Frequency Communication
Investigating the Internet Connection
The Geometry of Radio Astronomy

Informal

Modeling Radio Astronomy



