

## Satellite 101 - Spot the difference

### Notes for Teachers

#### Activity Summary

- Objective** The aim of this interactive activity is to introduce students to satellites and their importance. Students will learn the definition of a satellite and examples of satellite applications. They will also work with each other to understand how satellites help us in our everyday life.
- Overview**
- 1) The teacher gives a background presentation (provided by CPSX) which describes satellites and provides examples of satellite applications.
  - 2) The teacher gives students time to work in pairs or groups to list as many functions of a satellite as possible.
  - 3) The teacher introduces a set of images of the same location taken at different times. The goal is to introduce one application of satellites: change detection. Students use the pictures to answer the following three questions: describe what you see? What are the differences between the images? (Students can use markers to circle or measure changes). What caused this/what does this tell us/why is this important?
  - 3) Students (either individually, in pairs or as a group, based on abilities) will be shown multiple sets of pictures and they will have to answer the questions above.
- Outcome** Students will leave this activity with a basic understanding of satellites and their application in everyday life. They will also learn about how satellites are used for change detection.

**Curriculum Outcomes** (note: due to the broad application of satellites, this activity can open discussions that cross many fields of study, e.g., environmental sciences, biology, geography, etc.)

#### **Grade 1 (Understanding life systems - Needs and characteristics of living things)**

1.1 identify personal action that they themselves can take to help maintain a healthy environment for living things, including humans (e.g., walk to school instead of being driven in the car; be careful what they put down the drain at home; practise cleanliness to reduce the spread of germs when helping in the kitchen; show care and concern for all living things)

1.2 describe changes or problems that could result from the loss of some kinds of living things that are part of everyday life (e.g., if we lost all the cows, all the insects, all the bats, all the trees, all the grasses), taking different points of view into consideration (e.g., the point of view of farmers, children, parents)

2.6 use appropriate science and technology vocabulary, including investigation, explore, needs, space, and food, in oral and written communication

2.7 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., create a diorama to illustrate the basic needs of plants and animals, including humans)



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3.4 describe the characteristics of a healthy environment, including clean air and water and nutritious food, and explain why it is important for all living things to have a healthy environment

### **Grade 2 (Understanding Earth and Space Systems – Air and Water in the Environment)**

1.2 identify positive and negative impacts that different kinds of human activity have on animals and where they live (e.g., actions of animal lovers and groups that protect animals and their rights, the home owner who wants a nice lawn, people who visit zoos and wildlife parks, pet owners), form an opinion about one of them, and suggest ways in which the impact can be minimized or enhanced

3.3 describe ways in which living things, including humans, depend on air and water (e.g., most animals, including humans breathe air to stay alive; wind generates energy, disperses seeds; all living things need to drink or absorb water to stay alive; water is used for washing and bathing, transportation, energy generation)

3.4 identify sources of water in the natural and built environment (e.g., natural: oceans, lakes, ponds, streams, springs, water tables; human-made: wells, sewers, water supply systems, reservoirs, water towers)

3.6 state reasons why clean water is an increasingly scarce resource in many parts of the world

### **Grade 3 (Understanding Life Systems - Growth and Changes in Plants)**

1.2 assess the impact of different human activities on plants, and list personal actions they can engage in to minimize harmful effects and enhance good effects

3.1 describe the basic needs of plants, including air, water, light, warmth, and space

3.8 identify examples of environmental conditions that may threaten plant and animal survival (e.g., extreme heat and cold; floods and/or droughts; changes in habitat because of human activities such as construction, use of gas-powered personal watercraft on lakes)

### **Grade 4 (Understanding Life Systems - Habitats and Communities)**

3.3 identify factors (e.g., availability of water or food, amount of light, type of weather) that affect the ability of plants and animals to survive in a specific habitat

3.9 demonstrate an understanding of why all habitats have limits to the number of plants and animals they can support

3.10 describe ways in which humans are dependent on natural habitats and communities (e.g., for water, medicine, flood control in wetlands, leisure activities)

### **Grade 5 (Understanding Earth and Space Systems - Conservation of Energy and Resources)**

1.1 analyse the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts (e.g., turning off the faucet while brushing teeth or washing and rinsing dishes conserves water; reusing or recycling products, or using fewer products, conserves natural resources and energy)

### **Grade 6 (Understanding Earth and Space Systems - Space)**



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3.1 identify components of the solar system, including the sun, the earth, and other planets, natural satellites, comets, asteroids, and meteoroids, and describe their physical characteristics in qualitative terms (e.g., The earth's surface is very young; much of it is covered with water. The moon is the earth's only natural satellite. Comets are the largest objects in our solar system; their centres contain rock particles trapped in frozen liquid; their tails are made up of gas and dust.)

3.2 identify the bodies in space that emit light (e.g., stars) and those that reflect light (e.g., moons and planets)

### **Grade 7 (Understanding Life Systems - Interactions in the Environment)**

3.1 demonstrate an understanding of an ecosystem (e.g., a log, a pond, a forest) as a system of interactions between living organisms and their environment

### **Grade 8 (Understanding Earth and Space Systems - Water Systems)**

3.1 identify the various states of water on the earth's surface, their distribution, relative amounts, and circulation, and the conditions under which they exist (e.g., water is a solid in glaciers, snow, and polar ice-caps; a liquid in oceans, lakes, rivers, and aquifers; and a gas in the atmosphere)

3.3 explain how human and natural factors cause changes in the water table (e.g., lawn watering, inefficient showers and toilets, drought, floods, overuse of wells, extraction by bottled water industry)

3.4 identify factors (e.g., annual precipitation, temperature, climate change) that affect the size of glaciers and polar ice-caps, and describe the effects of these changes on local and global water systems

### **Grade 9 (Academic Science)**

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

D2.1 use appropriate terminology related to the study of the universe, including, but not limited to: celestial objects, orbital radius, retrograde motion, and satellite [C]

D3.4 describe the sun's composition and energy source, and explain how its energy warms Earth and supports life on the planet (e.g., with reference to the types of radiation the sun emits and the interaction of the sun's energy with Earth's atmosphere)

D3.6 describe various reasons that humankind has had for studying space (e.g., to develop calendars for agricultural purposes, to forecast weather, for celestial navigation, for religious inspiration) and the conceptions of the universe held by various cultures and civilizations (e.g., Aboriginal peoples; ancient Greek, Mayan civilizations)

### **Grade 11 (Environmental Science)**

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

B1.2 analyse ways in which societal needs or demands have influenced scientific endeavours related to the environment (e.g., the development of drought- and pest-resistant crops to address the rising global



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need for food; research into alternative energy sources in response to demands to address the impact on climate change of burning fossil fuels) [AI, C]

B3.5 describe a variety of human activities that have led to environmental problems (e.g., burning fossil fuels for transportation or power generation; waste disposal) and/or contributed to their solution (e.g., the development of renewable sources of energy; programs to reduce, reuse, and recycle)

### **Grade 12 (Earth and Space Science)**

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

B1.2 analyse why and how a particular technology related to astronomical research was developed and how it has been improved over time (e.g., the evolution from optical to radio telescopes and to the Hubble telescope) [AI, C]

D2.2 use a research process to investigate the geological history of an area in Ontario (e.g., use a sequence diagram, geological maps showing main geological units or associated rock types, and/or surficial/bedrock geology maps to investigate the Oak Ridges Moraine or Niagara Escarpment) [IP, PR]

D2.7 investigate interactions over time between physical, chemical, and biological processes, and explain how they have affected environmental conditions throughout Earth's geological history (e.g., the impact of increasing amounts of atmospheric oxygen on stromatolites; the impact of increasing amounts of atmospheric carbon dioxide on global warming; the influence of plants on the water cycle, other life forms, the atmosphere, weathering, and erosion) [PR, AI, C]

### **Procedure for Teachers**

#### **Preparation**

This activity can be done in one day. Have the PowerPoint prepared before class and provide the students with something to help them write down their answers. Print out the accompanying worksheets, or download for students to view on computers/laptops/tablets, etc. For younger students, you could have them circle the differences on the worksheets. In that case you could insert the worksheets into plastic sheet protectors and have the students use dry erase markers so that you can reuse the sheets.

#### **Presentation**

CPSX has designed a power-point presentation to accompany this activity. The presentation is an introduction to satellites and their applications. Speaker notes are included for every slide of the presentation, in the power-point file. As indicated in these speaker notes, there is an interactive section where sets of images are shown. For each set of images, students are to note what they see, what are the differences between the images (students can use markers to circle or measure changes), what caused this/what does this tell us/why is this important? Once this is done, take up the students' answers with the class. Then, tell them the answer and have them write this on their worksheet.

#### **Background Research**

These questions are intended to be used to help the students understand the material through inquiry. An answer key (in power-point comments) for teachers provides detailed answers, which may surpass what is expected from students, but may help the teacher in explaining concepts and also link to other disciplines of study.

### **Student Experiment**

After introducing the background material to the students, use the set of images as an experiment. Students are to answer the three questions and would be required to share their answers. The teacher would need to provide the students with the answers after the questions have been answered.

### **Follow up**

You may end the class by having the students hand in their answers, but you may follow up by requiring the students to choose a set of the photos provided and write a paper suggesting a solution to a problem they see in the photos that has developed over time. Or, students could write a report on what they think a day without satellites would be like. (See the Space Matters website for this follow-up activity coming soon).

### **Possible Questions for Your Unit Test:**

Define a satellite?

- A satellite is an object, moon, or planet that orbits a sun or planet.

Provide two examples of a satellite.

- Moon, Earth, Mercury, Venus, etc...

What are three applications of satellites?

- Communication (telephone, radio, tv)
- Navigation (GPS)
- ATM
- Rescue response after natural disasters
- Weather forecasting
- Helping farmers assess soil conditions and plan their crops
- Monitoring for near-Earth asteroids

Explain how the depletion of water in Aral Sea in Kazakhstan from 1986 to 2018 affects humans.

- Less water for animals will decrease the biodiversity of the environment.
- Collapse of the fishing industry.
- Dry conditions feed dust storms; the dust suspended and transported from this area is toxic due to nuclear testing in the past.

### **Closing Notes**

Thank you for participating in the education and outreach initiatives of the Centre for Planetary Science and Exploration! We are always thinking of new Planetary Science focused activities to share in classrooms and with the public. If you have any comments, questions, recommendations for how we can make this program stronger, or want a Planetary Scientist to visit your classroom (even virtually!) please field your thoughts to:

**The Centre for Planetary Science and Exploration**

**Outreach Program Coordinator**

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