



## ***Earth vs. Mars***

### **LESSON DESCRIPTION**

Remote satellite images of Earth and Mars are used to compare and contrast physical processes that occur on both planets.

### **OBJECTIVES**

Students will:

- Identify similarities and differences between the physical processes that occur on Earth and Mars
- Classify images of Earth and Mars by observing physical features in each image
- Speculate about the physical features observed in each image

## **NASA SUMMER OF INNOVATION**

### **UNIT**

*Earth and Space Science; remote sensing*

### **GRADE LEVELS**

*Grade levels 7<sup>th</sup> -9<sup>th</sup>*

### **CONNECTION TO CURRICULUM**

*Science, technology, and geography*

### **TEACHER PREPARATION TIME**

*1 hour, This time will vary dependent upon the familiarity of the instructor with landforms and the availability of student internet access.*

### **LESSON TIME NEEDED**

*Estimated 1 hour      Complexity: Basic*

## **NATIONAL STANDARDS**

### **National Science Education Standards (NSTA)**

Science as Inquiry

- Skills necessary to become independent inquirers about the natural world

Physical Science

- Properties and changes of properties in matter
- Motion and forces
- Transfer of energy
- Interactions of energy and matter

Earth and Space Science

- Structure of the earth system
- Earth's history
- Origin and evolution of the universe

Science and Technology

- Understanding about science and technology

### **National Geography Standards (NCGE)**

- Places and Regions
- Physical Systems

### **ISTE NETS and Performance Indicators**

- Research and Information Fluency

## MANAGEMENT

This lesson uses the Mission Geography Educator's Guide, Module 2, Investigation 3. [www.missiongeography.org/II-2-3.pdf](http://www.missiongeography.org/II-2-3.pdf)

The student briefing and log sheets will need to be downloaded and printed in advance of the lessons. The satellite images will need to be downloaded and copied - one set per student or student group. It is recommended that these sets also be laminated for future, frequent use.

Research various Mars and Earth facts resources that the students can use in the completing the compare and contrast chart. This chart, entitled, Earth vs. Mars, may be found at: <http://whyfiles.larc.nasa.gov>

It is recommended that students work in pairs while scrutinizing their images as each may see and interpret images differently. This is also helpful with materials management.

## CONTENT RESEARCH

Mars and Earth's physical features and processes may be similar because they may share similar origins. One theory assumes that some planets in our solar system formed from the debris of an exploded star that was once in the location of the Sun. Different agents of erosion (wind, water, ice) produce different landforms.

NASA scientists currently study satellite images for evidence of these physical processes. Satellite observation technology enables us to see landforms that we can't see with our eyes alone. By comparing and contrasting the images of Mars and Earth, NASA scientists can draw conclusions as to whether or not the same processes occur on both planets and if they could create a suitable environment for life on Mars. Understanding Mars is an important task because NASA is currently investigating plans to send the first humans to Mars within the next two decades. Mars could possibly be the future home for explorers.

## Key Terms:

**Plate tectonics:** the movement of rigid plates (lithosphere) on a mobile upper mantle (asthenosphere).

**Erosion:** The movement or grinding away of surface materials by wind, water, ice or gravity.

**Dendritic drainage patterns:** networks of stream channels cause by flowing waters.

**Permafrost:** frozen layer at variable depth below the surface in frigid regions of a planet.

**Impact Craters:** Craters formed when objects or impactors smashed into the surface.

**Ejecta** is the material thrown out of the area that becomes the crater during impact. This does not account for all material since much is vaporized or melted.

**Rays:** The bright streaks starting from a crater and extending away for great distances.

**Raised Rim:** Rock thrown out of the crater and deposited in a ring-shaped pile at the crater's edge during an impact.

**Crater Floor:** The bowl shaped or flat area of a crater, usually below the surrounding ground level unless filled in with lava.

## MATERIALS

### Student Briefing and Log:

[www.missiongeography.org/II-2-3.pdf](http://www.missiongeography.org/II-2-3.pdf)

Student pages 1 – 4; lesson pages 9 – 12

One per student or student group

### Satellite Images of Landforms Set:

Lesson pages 4 – 8 (figures 3 – 12)

Copied and laminated – one per student or student group

### Earth vs. Mars Chart

<http://whyfiles.larc.nasa.gov>

Page 15

One per student of student group

## LESSON ACTIVITIES

### Earth vs. Mars – What similar physical processes occur on both Earth and Mars?

<http://www.missiongeography.org/II-2-3.pdf>

In this activity, students work in pairs to compare and contrast the physical processes that may be inferred through the observation of images of both Mars and Earth. They will discuss the processes that have occurred on the Earth and the outcomes that have resulted and transfer this knowledge to the interpretation of the processes that may have occurred on Mars.

### Earth vs. Mars – Charting the physical characteristics of both Earth and Mars.

<http://whyfiles.larc.nasa.gov> page 15

In this activity, students work together to fill in the missing information on the comparison chart (link above). They will then use other resources to create a representation (Venn diagram, graph, powerpoint, etc.) to share with the class. This representation will show how Earth and Mars are alike and different.

## ADDITIONAL RESOURCES

In addition to the resources listed within the lesson guide, the following may be helpful in providing student research references:

- Explore Mars Inside and Out  
This site has topography maps and Mars facts.  
<http://www.lpi.usra.edu/education/explore/mars>
- Mars Links  
This site has a mission theme for interaction.  
<http://spacekids.hq.nasa.gov/osskids/mars/index.htm>
- Mars Reconnaissance Orbiter  
This site has Mars facts as well as mission information.  
<http://mars.jpl.nasa.gov/mro>

## DISCUSSION QUESTIONS

- What are some of the physical processes that shape Earth? *Earthquakes, volcanoes, floods, water and wind erosion, glaciation, and mountain building*
- Could these same processes occur on other planets? *Answers will vary.*
- If you were to compare images of both Earth and Mars, what features would you expect to see that are similar? What features would you expect to see that are different? *Why? Answers will vary.*
- What would you like to know about each planet that would help you decide? *Answers will vary.*
- Can you tell from the images which feature was created first? How? *Answers will vary.*  
– this leads to an excellent follow up activity -  
<http://ares.jsc.nasa.gov/education/activities/destmars/destmarsLes4.pdf>.

## ASSESSMENT ACTIVITIES

- Check each set of images to see if the students have accurately matched the image set.
- Ask each team to point out three features that are similar and three that are different. They should be able to offer an explanation for their classifications.
- As a class, determine the criteria for the representation the teams will create and present following their research on the Earth vs. Mars chart. The team presentations should then be scored using the criteria recommended.

## ENRICHMENT

- <http://ares.jsc.nasa.gov/education/activities/destmars/destmarsLes4.pdf> This activity provides an opportunity for the student teams to further their knowledge about the physical processes that shaped both Earth and Mars. They will gain skills in observing the images by analyzing the images to determine which features are older.
- Have the students research “terraforming.” <http://quest.nasa.gov/mars/background/terra.html>  
Activity One: have teams of students create a topographic 3D map of a section of the surface of Mars. They may then add elements that would be created during terraforming.  
Activity Two: have the teams of students debate the pros and cons of terraforming Mars.