

## *Discover Magazine: The Solar System: Teacher's Guide*

**Grade Level:** 9-12

**Curriculum Focus:** Astronomy/Space

**Lesson Duration:** One or two class periods

### **Program Description**

Since manned space exploration was launched some four decades ago, scientists have made unprecedented discoveries about the planets that circle our sun. In segments that cover space telescopes, new findings about the solar system, and the inner workings of the sun, students examine compelling new information about space and the technologies that hold promise for future discoveries. This program includes two feature segments and two short segments..

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### **Onscreen Questions**

- How do telescopes collect light to form images of distant objects?
  - What celestial bodies make up our solar system?
  - What information has been collected from manned missions to the moon?
  - What are the layers of the sun?
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### **Lesson Plan**

#### *Student Objectives*

- Learn about NASA's options for its space program.
- Research which option may be the most viable.
- Make a recommendation based on research.

#### *Materials*

- *Discover Magazine: The Solar System* video and VCR, or DVD and DVD player
- Computer with Internet access
- Paper and pencils
- Newsprint and markers

## Procedures

1. Begin the lesson with a discussion about the space program, which is run by the National Aeronautics and Space Administration, also known as NASA. Ask students if they are familiar with any space missions. Ask if they are aware of any discoveries that have been made through the space program. Write the students' ideas on the board or a large sheet of newsprint. Students may suggest the following:
  - The mission to walk on the moon
  - The study of lunar (moon rock) samples
  - The Hubble Space Telescope, which sends back high-resolution images of celestial bodies
  - The International Space Station, where astronauts live to conduct experiments
2. Discuss the stages that the space program has undergone. Point out that since the space shuttle disasters, the space program has lost its momentum. Officials at NASA are working to set new priorities for the agency.
3. To learn more about space programs under consideration, show students the "Up Close and Far Away" segment. Focus on the researchers discussing traveling to Mars and further travel to the moon.
4. Tell students that the video is a starting point for forming their own ideas about what NASA should plan for the space program. Students will research NASA's ideas for space exploration and then develop their own opinions about options.
5. Divide students into groups of three or four. Have each group research the topic and choose the best option for NASA to pursue. Each group will present its ideas, which must be supported by evidence, including pictures.
6. Give students time in class to research the topic. The following Web sites have useful information:
  - <http://slate.msn.com/id/2078157/>
  - <http://www.martiansoil.com/archives/001073.php>
  - <http://www.npr.org/features/feature.php?wflid=1407363>
  - [http://www.space.com/news/commentary\\_top10\\_030912.html](http://www.space.com/news/commentary_top10_030912.html)
  - [http://www.nasa.gov/pdf/60736main\\_M2M\\_report\\_small.pdf](http://www.nasa.gov/pdf/60736main_M2M_report_small.pdf)
  - [http://www.nasa.gov/vision/space/features/jfk\\_speech.html](http://www.nasa.gov/vision/space/features/jfk_speech.html)
  - <http://spaceflight.nasa.gov>
7. After the groups have completed their research, have them prepare a statement identifying their list of priorities for NASA.
8. Have each group present its ideas. Ask one student to take notes, recording each group's ideas.
9. Conclude the lesson by discussing the groups' ideas to arrive at a class consensus of a recommendation for NASA. Does the class suggest travel to the moon or Mars? Do students



argue for the use of a robot or human for exploration? Summarize their ideas on a sheet of newsprint, and post it in the room for visitors to see.

## Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students participated actively in class discussions; worked effectively with their group in researching recommendations for NASA; prepared an informative report; made a compelling presentation.
- **2 points:** Students participated in class discussions; worked somewhat effectively with their group in researching recommendations for NASA; prepared a competent report; made an informative presentation.
- **1 point:** Students did not participate in class discussions; had difficulty working with their group in researching recommendations for NASA; prepared a disorganized or incomplete report; did not make a good presentation.

## Vocabulary

### Mars

*Definition:* One of the four inner planets, or those closest to the sun; like all the inner planets, Mars has a rocky surface

*Context:* NASA has identified exploring Mars as one of the future goals of the space program.

### moon

*Definition:* Earth's only natural satellite and closet neighbor in space

*Context:* Returning to the moon is under consideration as the next step for the space program.

### NASA

*Definition:* Acronym for the National Aeronautics and Space Administration, a federal agency charged with managing the space program

*Context:* After many setbacks, NASA is working to determine the next steps of the space program.

### space shuttle

*Definition:* A program started by NASA in 1981 in which reusable spacecraft are sent into space, transporting astronauts and equipment

*Context:* NASA is working on the space shuttle Discovery, the first shuttle scheduled since the Columbia crashed on reentry to Earth on February 1, 2003.



## Academic Standards

### National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Science as Inquiry: Understandings about scientific inquiry
- Science and Technology: Understandings about science and technology
- Science in Personal and Social Perspectives: Natural and human-induced hazards; Science and technology in local, national, and global challenges

### Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.

This lesson plan addresses the following national standards:

- Technology – Understands the relationships among science, technology, society, and the individual, Understands the nature of technological design
  - Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media; Reading: Uses reading skills and strategies to understand and interpret a variety of informational texts
  - Life Skills – Thinking and Reasoning: Understands and applies the basic principles of presenting an argument, Understands and applies basic principles of logic and reasoning
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## Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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## DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.



## How To Use the DVD

The DVD starting screen has the following options:

**Play Video** – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

**Video Index** – Here the video is divided into four parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

**Curriculum Units** – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

**Standards Link** – Selecting this option displays a single screen that lists the national academic standards the video addresses.

**Teacher Resources** – This screen gives the technical support number and Web site address.

## Video Index

### I. Up Close and Far Away (6 min.)

Peer through refracting and reflecting telescopes, and discover how the Hubble has transformed the way we see space.

### II. The Last Frontier (20 min.)

Examine our celestial neighbors to glimpse the possibilities for the exploration and colonization of outer space.

### III. The Great Space Race (16 min.)

Exploring the moon was one of the United States' greatest technical achievements, so why did we end the Apollo Program?

### IV. Inside the Sun (5 min.)

The sun's layers produce different light energies – energies that can be both helpful and harmful to life on Earth.



## Curriculum Units

### 1. Light From Space

*Pre-viewing question*

Q: What constellations and planets have you seen in the night sky?

A: Answers will vary.

*Post-viewing question*

Q: How long does it take for light from our closest star to reach Earth?

A: Light from the closest star (aside from the sun) takes 4.2 years to reach Earth. Light from farther stars has taken thousands, and sometimes millions or even billions, of years to reach Earth.

### 2. Using Telescopes

*Pre-viewing question*

Q: Have you ever looked through a telescope?

A: Answers will vary.

*Post-viewing question*

Q: How does a reflecting telescope work?

A: Light enters the telescope tube and is reflected by the concave main mirror so that it converges into a single focal point. Then, a secondary mirror reflects the light onto the telescope's eyepiece, where a lens refracts the light into the observer's eye.

### 3. Colonizing Mars

*Pre-viewing question*

Q: Will humans ever live on Mars?

A: Answers will vary.

*Post-viewing question*

Q: What makes Mars a candidate for colonization?

A: The planet has all the necessary ingredients to sustain human life. It has water and nitrogen to grow crops, as well as iron and silicon for manufacturing. With a simple chemical process, oxygen could be extracted from the planet's carbon dioxide atmosphere.

### 4. Testing Our Skills on the Moon

*Pre-viewing question*

Q: What would it be like to live on the moon?

A: Answers will vary.

*Post-viewing question*

Q: Why might the moon be easier for humans to settle than Mars?

A: The moon is only five days' travel from Earth; Mars is six months'. The closer distance would make it easier to test and refine new technologies, such as space suits and advanced life-support systems. There are already plans to grow crops on the moon and to manufacture bricks and glass from lunar material.



## 5. Mining in Space

*Pre-viewing question*

Q: What would happen if a large asteroid hit Earth?

A: Answers will vary.

*Post-viewing question*

Q: Should we mine asteroids for their resources?

A: Answers will vary.

## 6. The Ninth Planet

*Pre-viewing question*

Q: What is the most interesting thing about space?

A: Answers will vary.

*Post-viewing question*

Q: How can you distinguish a planet from a star?

A: By analyzing images taken over a short time span. During that time, faraway stars stay in the same position but planets, because they are closer, shift in position.

## 7. Observing Pluto

*Pre-viewing question*

Q: Will we ever know everything about our solar system?

A: Answers will vary.

*Post-viewing question*

Q: What have we learned about Pluto?

A: That instead of its moon orbiting Pluto, the two revolve around each, acting like a double planet. We've also learned that Pluto has seasons and an atmosphere, and that it takes the planet 250 years to orbit the sun.

## 8. Searching the Cosmos

*Pre-viewing question*

Q: Do you think there are planets beyond Pluto?

A: Answers will vary.

*Post-viewing question*

Q: Is Pluto a planet?

A: Answers will vary.

## 9. Our Crowning Achievement

*Pre-viewing question*

Q: What would it be like to walk on the moon?

A: Answers will vary.



*Post-viewing question*

Q: Why did the United States first travel to the moon?

A: The U.S. feared it was losing its technological edge to the Soviet Union, when that country launched, in succession, a missile, a dog, and a man into space. To prove its technical superiority, America challenged the Soviets to a "space race" to the moon.

## **10. Lunar Samples**

*Pre-viewing question*

Q: What can we learn by studying rocks?

A: Answers will vary.

*Post-viewing question*

Q: What have we learned from moon rocks?

A: They've taught us about the early history of Earth—moon rocks are better preserved because there is no wind or water erosion on the moon. From them, we also know that the moon was once intensely hot, its entire surface an ocean of molten lava.

## **11. The Moon's Origin**

*Pre-viewing question*

Q: Where did the moon come from?

A: Answers will vary.

*Post-viewing question*

Q: What does the giant impact theory tell us about the moon?

A: That a very large object, something about the size of Mars, crashed into the Earth and blew a lot of material into space, some of which accumulated on the moon. Initially rejected, this theory based on Apollo data is now considered fact.

## **12. An Important Star**

*Pre-viewing question*

Q: Could life on Earth exist without the sun?

A: Answers will vary.

*Post-viewing question*

Q: What are solar flares?

A: These sudden eruptions of hydrogen gas on the surface of the sun are usually associated with sunspots.

