



Mars Exploration Debate Teacher Guide



GOAL

Students debate whether future Mars exploration should be continued with robotic missions and/or human missions.

OBJECTIVE

Students are assigned societal roles and use information provided on role cards to argue opinions in a class debate. Students must then research their roles to provide evidence to argue their case. The teacher will decide if and how the debate is judged.

NATIONAL SCIENCE STANDARDS

Grade Level	Content Standard	Developing Student Understanding Area	Underlying Fundamental Concepts and Principals
5 - 8	Science in Personal and Social Perspectives	Risks and Benefits	Important personal and social decisions are made based on perceptions of benefits and risks.
5 - 8	Science in Personal and Social Perspectives	Science and Technology in Society	Science influences society through its knowledge and world view.
5 - 8	History and Nature of Science	Science as a Human Endeavor	Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity
5 - 8	History and Nature of Science	Nature of Science	Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science.

TIME FRAME

- 2 class periods (100 minutes)

MATERIALS

- Role Cards (1 per student group)



TEACHER PREPARATION

- Cut out Role Cards.
- Decide if and how the debate will be judged. Options include:
 - Have students debate, but *leave open*, what the future of Mars exploration should be.
 - Have students debate, and then *decide as a class* how future exploration of Mars should take place. (They can vote as their assigned roles or as themselves.)
 - Create a “World Leader” group to whom that the other groups argue their case. Then have the *World Leaders decide* the future of Mars exploration for the class.
- Decide on the length of student presentations. Assuming that it takes 5 minutes to explain the activity to the class, 5-10 minutes for students to prepare their presentations, and 5-10 minutes to debrief at the end of the class, you will have between 25-35 minutes for presentations in a fifty minute class period. Because classroom situations vary, we leave it to the instructor to decide how much time each group will have to present and whether questions will be entertained between presentations or after all groups have presented. You may also choose to form less than 8 groups. While this increases the number of students in each group, it allows more time for each group to present and answer questions.
- Prepare resources for students to conduct research on their roles. These can include textbooks, newspaper and magazine articles, and sources on the internet. Several resources available on the internet have been provided below.

PROCEDURE

- 1) On the first day, explain to students how the debate will run and how the outcome of the debate will be determined (if there will be an outcome).
- 2) Assign students to 8 groups (or less than 8 groups if you would like more time for each group to present).
- 3) Give each group a different Role Card. Have students read their group Role Card and discuss further arguments supporting their case. The remainder of the class should be dedicated to student research on the topic of Mars exploration and gathering of evidence to support their case. Possible research resources are provided below under “Research Resources.” Students should prepare an argument supporting their role. You will have to limit the length of these presentations depending upon the amount of time you plan to spend on the debate (see above). Announce to students how long their presentation should be and whether questions from the class will be entertained between each presentation or after all groups have presented. Give students time to prepare their presentations and questions for other groups.
- 4) On the second day, groups present their arguments. Depending upon how you run the debate, you can entertain questions for the group either between each presentation or after all groups have presented (see above).
- 5) If no decision will be reached, the debates can end with a class discussion.
- 6) If a decision will be reached, either as a class or by the “World Leaders” group, that decision would be made after all arguments and questions have been presented and answered.



RESEARCH RESOURCES

Below is a list of websites that students may investigate and use to gather evidence for the debate. Additionally you should encourage students to find their own sources of information. Be sure to emphasize the importance of evaluating the reliability of various information sources.

- Exploring Mars: Educational Brief
<http://www.lpi.usra.edu/expmars/edbrief/edbrief.html>
- Budget of the United States Government: Main Page
<http://www.gpoaccess.gov/usbudget/>
- NASA Budget Documents
<http://www.nasa.gov/about/budget/index.html>
- NASA press release archive
<http://www.nasa.gov/audience/formedia/archives/index.html>
- NASA's Mars Exploration Program Main Page
<http://mars.jpl.nasa.gov/missions/>
- "Why explore Mars?" from the Mars Polar Lander Mission Website
<http://mpfwww.jpl.nasa.gov/msp98/why.html>
- NASA's Human Spaceflight Web section on Mars Exploration and Beyond
<http://spaceflight.nasa.gov/mars/>
- NASA Roadmap for the Robotic and Human Exploration of Mars
http://images.spaceref.com/news/2005/srm2_mars_rdmp_final.pdf



Stakeholder Position Summary Sheet

Role	Should We Continue Exploring Mars?	Should we use Robotic Exploration?	Should We Pursue Human Exploration?
Opinion #1	Yes, we must continue exploring. Exploration is part of human nature. There are also lots of resources in space that will help us progress.	No, robots are too limited for the level of exploration that needs to be done. We should focus our efforts on human exploration.	Yes, humans are more adaptable and have a wider range of skills than machines. Human exploration is also needed to inspire future generations.
Opinion #2	Yes, we have to learn whether life has ever existed on Mars. The discovery of life on the planet would revolutionize our understanding of biology.	Yes, robotic missions are the safest, cheapest, and cleanest way to explore the Martian environment without damaging it at the same time.	No, we shouldn't send humans unless we are certain there is no life on Mars. A human presence on Mars would contaminate the planet.
Opinion #3	No, we've already polluted the Earth enough, and we shouldn't pollute Mars too. Also, it takes energy and resources to explore Mars, and this creates even more pollution here on Earth.	No, landers and rovers become space junk on Mars after their research is done.	No, as much junk as robots leave, humans would leave much more.
Opinion #4	Yes, we need to stimulate the economy, and continued exploration of Mars will help do that.	Yes, sending robots to Mars creates new jobs and technologies that help everyone.	Yes, preparing to send humans to Mars would create even more jobs and technologies than robotic exploration.
Opinion #5	Yes, through exploration we will learn things about climate change and other planetary processes that are important to our understanding of Earth.	Yes, information from robotic missions will help us solve problems on our own planet. We also need to learn more about Mars before we send humans.	Yes, humans are better detectives than robots. To fully understand Mars, we will eventually need to send humans as well as robots.
Opinion #6	No, we already have economic and social problems on Earth that need to be solved. We've explored Mars enough. We need to focus our attention on problems that need to be fixed here.	No, these explorations are too costly. We need to dedicate our money and resources to issues that are closer to home.	No, exploring with humans would be much too costly and dangerous.
Opinion #7	Yes, exploring Mars provides an opportunity for us to work cooperatively with other nations. As a technology leader, we need to take part in this effort.	Yes, robotic technology will be useful both in space and here on Earth.	Yes, sending humans to Mars could involve a huge multinational effort that would bring nations together and benefit the entire planet.
Opinion #8 (This may be replaced by the World Leader group if that option is chosen.)	No, we already know everything we need to know about Mars because aliens have already told us. We don't need to keep exploring Mars.	No, these missions fail because Martians don't want us invade their planet.	No, we just need to talk to Martians who are already here on Earth.



Mars Exploration Debate Role Card

Your class will debate whether future Mars exploration should be continued with robotic missions or human missions. Your group should defend the opinions described on this card.

- Work with your group to prepare a speech defending your position.
- Also, come up with questions for other groups.

ROLE: Opinion #1

Debate Topic	Position
Should we continue to explore Mars?	Yes, we must continue exploring. Exploration is part of human nature. There are also lots of resources in space that will help us progress.
Should we use robotic exploration?	No, robots are too limited for the level of exploration that needs to be done. We should focus our efforts on human exploration.
Should we pursue human exploration?	Yes, humans are more adaptable and have a wider range of skills than machines. Human exploration is also needed to inspire future generations.



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ROLE: Opinion #2

Debate Topic	Position
Should we continue to explore Mars?	Yes, we have to learn whether life has ever existed on Mars. The discovery of life on the planet would revolutionize our understanding of biology.
Should we use robotic exploration?	Yes, robotic missions are the safest, cheapest, and cleanest way to explore the Martian environment without damaging it at the same time.
Should we pursue human exploration?	No, we shouldn't send humans unless we are certain there is no life on Mars. A human presence on Mars would contaminate the planet.



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ROLE: Opinion #3

Debate Topic	Position
Should we continue to explore Mars?	No, we've already polluted the Earth enough, and we shouldn't pollute Mars too. Also, it takes energy and resources to explore Mars, and this creates even more pollution here on Earth.
Should we use robotic exploration?	No, landers and rovers become space junk on Mars after their research is done.
Should we pursue human exploration?	No, as much junk as robots leave, humans would leave much more.



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ROLE: Opinion #4

Debate Topic	Position
Should we continue to explore Mars?	Yes, we need to stimulate the economy, and continued exploration of Mars will help do that.
Should we use robotic exploration?	Yes, sending robots to Mars creates new jobs and technologies that help everyone.
Should we pursue human exploration?	Yes, preparing to send humans to Mars would create even more jobs and technologies than robotic exploration.



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ROLE: Opinion #5

Debate Topic	Position
Should we continue to explore Mars?	Yes, through exploration we will learn things about climate change and other planetary processes that are important to our understanding of Earth.
Should we use robotic exploration?	Yes, information from robotic missions will help us solve problems on our own planet. We also need to learn more about Mars before we send humans.
Should we pursue human exploration?	Yes, humans are better detectives than robots. To fully understand Mars, we will eventually need to send humans as well as robots.



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ROLE: Opinion #6

Debate Topic	Position
Should we continue to explore Mars?	No, we already have economic and social problems on Earth that need to be solved. We've explored Mars enough. We need to focus our attention on problems that need to be fixed here.
Should we use robotic exploration?	No, these explorations are too costly. We need to dedicate our money and resources to issues that are closer to home.
Should we pursue human exploration?	No, exploring with humans would be much too costly and dangerous.



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ROLE: Opinion #7

Debate Topic	Position
Should we continue to explore Mars?	Yes, exploring Mars provides an opportunity for us to work cooperatively with other nations. As a technology leader, we need to take part in this effort.
Should we use robotic exploration?	Yes, robotic technology will be useful both in space and here on Earth.
Should we pursue human exploration?	Yes, sending humans to Mars could involve a huge multinational effort that would bring nations together and benefit the entire planet.



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ROLE: Opinion #8

Debate Topic	Position
Should we continue to explore Mars?	No, we already know everything we need to know about Mars because aliens have already told us. We don't need to keep exploring Mars.
Should we use robotic exploration?	No, these missions fail because Martians don't want us invade their planet.
Should we pursue human exploration?	No, we just need to talk to Martians who are already here on Earth.





Mars Exploration Debate Student Role Card



Your class will debate whether future Mars exploration should be continued with robotic missions or human missions. Your group should defend the opinions described on this card.

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ROLE: Opinion #1

Debate Topic	Position
Should we continue to explore Mars?	Yes, we must continue exploring. Exploration is part of human nature. There are also lots of resources in space that will help us progress.
Should we use robotic exploration?	No, robots are too limited for the level of exploration that needs to be done. We should focus our efforts on human exploration.
Should we pursue human exploration?	Yes, humans are more adaptable and have a wider range of skills than machines. Human exploration is also needed to inspire future generations.



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ROLE: Opinion #2

Debate Topic	Position
Should we continue to explore Mars?	Yes, we have to learn whether life has ever existed on Mars. The discovery of life on the planet would revolutionize our understanding of biology.
Should we use robotic exploration?	Yes, robotic missions are the safest, cheapest, and cleanest way to explore the Martian environment without damaging it at the same time.
Should we pursue human exploration?	No, we shouldn't send humans unless we are certain there is no life on Mars. A human presence on Mars would contaminate the planet.



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Debate Topic	Position
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Debate Topic	Position
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ROLE: Opinion #7

Debate Topic	Position
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Should we pursue human exploration?	Yes, sending humans to Mars could involve a huge multinational effort that would bring nations together and benefit the entire planet.



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ROLE: Opinion #8

Debate Topic	Position
Should we continue to explore Mars?	No, we already know everything we need to know about Mars because aliens have already told us. We don't need to keep exploring Mars.
Should we use robotic exploration?	No, these missions fail because Martians don't want us invade their planet.
Should we pursue human exploration?	No, we just need to talk to Martians who are already here on Earth.



Mars Exploration Debate



Mars Exploration Debate Student Role Card



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