Is Science Worth the Cost?
Group Discussion

Group Assignment

Meet with the other members of your group. Assign group roles. Print names below. Your name must appear below in order to receive credit.

Recorder - writes down group’s ideas

Timekeeper - keeps the group on task within time allowed

Mediator - helps group arrive at a consensus, oversees voting on issues

Clarifier - reads while Recorder writes, makes sure everyone understands

Encourager - makes sure everyone contributes, encourages group members to talk

Speaker - proposes any group questions to TA/Instructor

(In groups of 5, the Encourager is also the Speaker)

Reporters - summarizes group’s findings (at the end of the discussion time anyone in the group may be asked to serve as the Reporter)

FOR THIS ACTIVITY: Pretend your group is a congressional committee and you must produce results reflecting the consensus of opinion among your group members. (When all else fails, VOTE!)

I. SHOULD WE (as a nation) PURSUE SCIENCE?

Science is one method by which our species seeks to obtain knowledge. The scientific method was presented to you early in this course since it is the basis on which scientists claim to know things about the universe. The steps in this method were presented as:

1. Form a hypothesis based on current knowledge (knowledge here means very well supported hypotheses).
2. Test the hypothesis using prediction, repeatable observations, new observations, and/or experimentation.
3. Revise the hypothesis and repeat process; or the hypothesis begins to gain strength and acceptance with demonstrated consistency.
Scientific knowledge rests on the premises that no theory is proven and that no theory is above modification. **How does your group feel about the reliability of claims of knowledge proposed by those using the scientific method?**

## II. EXPLORATION OF OUR SOLAR SYSTEM

The Voyager mission to the outer planets was a "pure science" mission. In 12 years, Voyagers 1 and 2 visited the jovian planets of the outer Solar System. That mission cost about $3 per U.S. citizen for the entire mission. **Did anyone in your group write about a "spin-off" from the Voyager mission? Discuss any.**

Does your group feel that the nation received its money’s worth for the Voyager mission? Why or why not?

Taking turns each group member should tell the group about the spin-off they wrote about in the preparation assignment. Which one does your group feel had the greatest impact? Why?

Mars and Venus offer examples of planets with runaway climate problems that Earth could one day face. Studies of Mars have provided improved chemical data for computer models important in understanding the Earth’s atmosphere. Improved communication techniques developed for the space program affect our lives everyday. New materials, computer technologies, imaging techniques, and solar collectors developed for use in space are being used on the Earth and in the study of Earth from space. **Does your group feel that as a nation we are getting a fair return on our investment in Solar System exploration? Explain your position.**
The argument that is often made is that this nation should use the money spent on space exploration
and pure science to work toward solving problems here on Earth. The U. S. spent $20 billion over
the 10 year Apollo program’s manned exploration of the Moon. This expenditure averaged about
2% of the federal budget. During the buildup of the military and the deficit, NASA’s budget in the
1980s dropped below 1%. Examine the recent federal budget information sheet. How does
NASA’s budget compare to other spending areas?

How does your group feel about the amount of money spent by NASA? Is it too much,
not enough, or about right compared to other items? Support your position.

III. THE FUTURE

Will humans ever return to the Moon to establish a lunar base or visit Mars during your lifetime?
The U.S. no longer has rockets capable of journeying to the Moon. It has been estimated that a
manned expedition to Mars could come no sooner than 2020 - 2030. A lunar base or a Martian visit
aren’t priorities. Should they be? Discuss.

There are many things to consider. How could people colonize Mars or the Moon without further
depleting the Earth of its resources? Where would they get the water, oxygen, temperature control,
and food for survival? Of course, for a colony to exist on the Moon or Mars, you would need an
enclosed environment - a bubble. Studies of lunar and Martian material have shown that the raw
materials for survival are there. Chemicals like oxygen and hydrogen could be extracted from rocks.
Water and carbon dioxide lie frozen on Mars. The ingredients necessary for life are there already.
Technology would need to be developed to release the raw materials and certainly recycling would
have to take place on a very large scale. Recycling, purification of atmospheric gases and water,
extracting raw materials from rocks, growing plants in an ultraviolet excess, harnessing solar energy
for climate control–DO YOU SEE ANY WAYS IN WHICH SUCH A TECHNOLOGY
MIGHT BE APPLIED TO SOME OF THE PROBLEMS FACING EARTH RIGHT
NOW? EXPLAIN.
A favorite argument for justifying exploration of the unknown is the "curiosity" argument. Our species is quite successful—our numbers are increasing, our life span has been extended, our presence is felt worldwide, etc. Humans have obtained an advantage over other species primarily due to our use of tools, especially the use of fire. Our ancestors were curious as to how things work, followed by why do they work in that particular way. That curiosity led to exploration over the surface of the Earth and under the seas and up to the heavens. If we cease to be curious about our surrounding universe, will our species be able to survive and progress further? **HOW DOES YOUR GROUP RESPOND TO THIS LAST QUESTION AND THE "CURIOSITY" ARGUMENT? DISCUSS.**

**WHAT WILL BE YOUR COMMITTEE’S RECOMMENDATION TO CONGRESS?**
As a group decide what the focus of space exploration should be for the next decade. Design one program/project given a somewhat limited budget. Be sure to list your justifications for this project.