

Mystery of the Cosmos: Life's Place in the Universe

Student Handout

PRE-PROGRAM EXPLORATIONS

Terms to Define

- amino acid
- asteroid
- comet
- cosmos
- evolution
- galaxy
- greenhouse gases
- inner space
- meteorite
- prebiotic

Topics to Research

- What is the Big Bang and what evidence exists for this model?
- Construct a timeline, drawn to scale, that includes the following information:
 - age of the universe
 - age of the Earth
 - when water first formed on the Earth
 - age of the oldest known bacteria
 - age of the oldest known photosynthetic cells
 - age of the oldest known multi-celled organisms
 - when vertebrates first appeared
 - age of the oldest



Philip M. Condit is Chairman and Chief Executive Officer of The Boeing Company,

the largest aerospace business in the world. In 1997 *Financial World* named him "Chief Executive Officer of the Year." Always fascinated by airplanes and flight, he first earned his flying license at age 18. he first joined Boeing as an aerodynamics engineer in 1965 and worked his way up through the ranks, playing major roles in the development of the 757 and 777 aircraft. He is only the seventh man to lead Boeing in its 80-year history. As the world's largest manufacturer of both military and commercial aircraft, the company generates more than \$48 billion in annual revenues.

Daniel Goldin is the Administrator of NASA, the



known humans

- Describe the process of evolution and how it has resulted in a diversity of life forms.
- Trace the history of the NASA space program, from its inception in 1958 to the present, indicating major missions and areas of research.

Issues to Consider

- Do you believe that life could exist elsewhere in the universe? What is the rationale behind your views?
- If you think that extraterrestrial life does (or could) exist, what do you think are, or would be, its characteristics?
- As we seek to understand the world around us, science and religion often play roles. What, in your view, are the specific realms that each should address?
- Is it possible for the findings of science to be reconciled with religious beliefs? Can one believe in a "higher power" without denying scientific facts?
- How should society determine its priorities for expenditures and commitments? Should exploration be one of those priorities, and if so, what benefits does it bring us?
- The featured guests are described as achievers. Does

National



Aeronautics and Space Administration. After years of research on electric propulsion systems for human interplanetary travel, he led a team of engineers working on the Strategic Defense Initiative. In 1992 he was appointed by President Bush to direct America's space program. He led the agency through a period of dramatic recovery, streamlining its operation to work more swiftly and economically without compromising safety. Under his leadership, NASA has developed two all-new space vehicles and completed the automated Pathfinder mission to Mars. His redesign of the Space Station program succeeded in winning funding for the project from Congress by a 123-vote margin.



[Leon Lederman](#)

is recognized as the world's foremost

experimental physicist, one of the very small group who revolutionized our understanding of the subatomic world. In the late 1950s and early '60s, he participated in the

described as an achiever? Does achievement differ from success, and in what ways? How would you define achievement?

POST-PROGRAM EXPLORATIONS

ACHIEVEMENT EXPLORATIONS

- Achievement Television has defined six components of achievement: vision, preparation, integrity, courage, passion, and perseverance. Choose one of the featured guests and give examples of ways in which he/she embodies these traits.
- Choose one of the individuals listed in the second science exploration, and analyze his contributions, in light of our definition for achievement. Can he be described as an achiever?

SCIENCE EXPLORATIONS

- Conduct research to determine what Thomas Brock discovered in 1967. What other evidence exists to support the feasibility of extraterrestrial life?
- Examine the contribution that each person has made to our current understanding of the universe and how it functions.
 - Nicolaus Copernicus
 - John Dalton
 - Charles Darwin

discovery of the K-meson particle and the non-conservation of parity during muon decay. In 1962, with Melvin Schwartz and Jack Steinberger, he designed and performed an experiment that proved the existence of the muon neutrino, an effort that eventually earned the three scientists the Nobel Prize in Physics. He led the efforts which found the first anti-matter particle in 1965 and the bottom quark in 1977. As Director of the Fermi National Accelerator Laboratory in Batavia, Illinois he laid the groundwork for discovery of the mysterious top quark. Since stepping down as director, he has continued to write and teach, and has campaigned vigorously to improve science education in the United States.

[Story](#)
[Musgrave, M.D.](#) is the oldest astronaut in the U.S. space



program. He has logged more than 850 hours in space, and has more Space Shuttle missions to his credit than any other astronaut. He was the first to perform a space walk from the Shuttle and gained

- Charles Darwin
- Democritus
- Albert Einstein
- Galileo Galilei
- Johannes Kepler
- Antoine Lavoisier
- Gregor Mendel
- Isaac Newton

- Imagine that you are the director of NASA in the year 2010 (Daniel Goldin has retired.) You have scheduled the first manned mission to Mars for the following year. Six crew members will make the trip. You are to determine the optimum make-up of the crew, in terms of expertise and demographics. Provide a justification for each of your recommendations.
- Pretend that you are the Life Optimization Director for the first colonization effort on Mars. You are to submit a report to Congress that addresses the following issues. All of the recommendations that you make to Congress must have supporting documentation to justify your position.

- methods for making Mars habitable
- ways to conserve and protect the environment
- waste management
- how food, water and air will be obtained
- who will be sent
- non-essentials that contribute to the overall quality of life

widespread fame when he performed three spectacular space walks to repair the Hubble Space Telescope. Besides his medical degree from Columbia University, Story Musgrave has bachelor's degrees in mathematics and chemistry, and master's degrees in business, computer programming, biophysics and literature. It should surprise no one to learn that, in his seventh decade, Story Musgrave is studying for yet another graduate degree, and preparing for further missions in space.



[Donna Shirley](#) first began work on Mars exploration at the Jet Propulsion

Laboratory in 1966. Since then she has commanded a wide range of projects for NASA, including exploration studies, automation and robotics, space station programs, mission design and system engineering. She won international recognition as Manager of NASA's Mars Exploration Program. She led the team that built the Sojourner Rover vehicle which explored Mars as part of the 1997 Pathfinder mission.

- duration of stay in the colony

- Each society has many responsibilities to its members, yet money is a finite resource. Assuming that there is not enough money to explore any and all issues, provide a list of the ten most important areas for scientific research, in ranked order. Indicate the reasons that an item is included on the list, as well as the rationale for its ranking.
- Explore the history of women in the space program (or science in general). What contributions have been made, what obstacles exist (or existed), and how can their role be expanded?

HISTORY/SOCIAL STUDIES EXPLORATIONS

- Trace the role of Russia and the Cold War in the development of the space program in the United States.
- Through the ages, science and religion have often been at odds with one another. For each scientific statement listed below, provide supporting evidence for the idea; indicate religious views that are, or were, contrary to the statement; provide rationale for the religious belief; determine if any conflicts arose between the two institutions regarding this issue; list major proponents of each viewpoint; and indicate the effects of the conflict, and any resolution that has been achieved.
 - Matter is composed of atoms.
 - The earth is round.
 - The earth orbits the sun.
 - The universe was created as the result of a massive explosion billions of years ago.
 - Life began, on Earth, over 3.8 billion years ago.
 - All objects fall at the same rate, without regard to their masses.
 - The human species evolved from other, more primitive, life forms over millions of years.

ENGLISH/LANGUAGE ARTS EXPLORATIONS

Most early cultures developed creation myths, which attempted to explain how life and the world began. Religions also provide explanations for the world's beginnings. Explore the creation views of the following cultures or religions. comparing and

views of the following cultures or religions, comparing and contrasting the facets of each.

- Roman
- Greek
- Egyptian
- Chinese
- Native American
- Christian theology
- Hindu
- Buddhist

CURRENT EVENT EXPLORATION

(Web lesson)

John Glenn and the Science of Aging

John Glenn, Mercury astronaut and revered hero of the United States space program, was given another chance to experience space travel. The Space Shuttle Discovery took off with Glenn and six other crew members on October 29, 1998, for an eight-day mission.

In this lesson, you will explore the Web to find out more about John Glenn's mission and its role in contributing to our understanding of the science of aging.

Question for Exploration

How will the results of this mission impact future studies of the aging process?

PROCEDURE

1. Collect background information. In order to formulate an answer to the "Question for Exploration", you'll need to conduct some research to gather pertinent information and data about the topics. Some suggested areas for research are listed below, but you may find that you need to answer additional questions to make an informed response. A list of Web sites is provided, at the end of the procedure section, to help jump-start your search. If you need to gather information from additional resources, be sure to evaluate their validity. Government and university sites generally have more reliable information than personal or commercial sites. Keep a record of the information you use.

commercial sites. Keep a record of the information you've collected, as well as the source of that material. Include both the Web site name and URL address.

- How does the aging process impact the body?
- How does space travel impact the body?
- How does space travel mimic the aging process?
- What aging experiments were conducted on Glenn's mission?
- What information will researchers gain from these experiments?
- Are there additional experiments that need to be conducted in space to research the aging process?
- Are the results of these experiments applicable to the general population?

2. Synthesize the information that you've collected to develop a response to the "Question for Exploration". The format for that response, (written, oral, Web-based, etc.) will be decided upon by your teacher.

Suggested Web sites:

[American Association of Retired Persons](#) (Modern Maturity -> Lifelines -> Medical Web Sites)

[Centers for Disease Control](#) (navigate to the Health Information link)

[CNN Interactive](#) (report on Glenn's mission)

[Human Space Flight \(NASA\)](#)

[Internet Glossary of Statistical Terms](#)

[John Glenn](#)

[MayoClinic Health Oasis](#) (search for aging)

[National Space Society](#)

[NASA Web](#)

[Statistical Significance](#)

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