What is Your Cosmic Connection to the Elements?

About the Poster

This poster illustrates the cosmic processes and events which give rise to the chemical elements. Each of the processes - the Big Bang, fusion in small and large stars, supernovae, and fragmentation by cosmic rays - form the elements in our bodies and all around us. The poster illustrates this by pointing out objects on or around the grid and identifying the primary element that comprises these. Those elements are then connected to the cosmic process that created them. (Note that the colors of the elements correspond to the colors of the name of the cosmic processes.) The large-print panels on the back of the poster further describe the processes and events that create the elements. Each grid table in the background is likewise color-coded to match the elements to their cosmic origin. The full periodic table is reproduced below.

Some elements come from more than one process. If a second process contributes more than 30% to the abundance of the element in the universe, we have included it.

Introduction

Scientists have been studying the origins of the universe for much of history. Our recent classroom study has focused on this, by taking a critical look at the origins and "life cycle" of matter. This project is designed to give you the opportunity to showcase what you know about where we come from.

Assignment

Carl Sagan once said, "To make an apple pie from scratch you must first invent the universe." Your group's assignment is to create a presentation that illustrates the meaning of this statement. You will pick an element that can be found in good old American apple pie and trace its evolutionary history back to the birth of the universe itself. Your discussion should address briefly the constant recycling of elements here on Earth, as well as the formation of elements in the cores of active stars and supernovae. You must describe the way in which these elements were dispersed from the star through space and ultimately to the Earth. You will also share your vision of the environment in which that element may find itself 5 or so billion years from now after the Earth is long gone.

Both your tracing of the element back through time and your creative vision of that element in the future should show a solid understanding of the "life cycle" of matter. Each presentation should also include an artistic element - an original song, an illustration, a poem, a video, etc. that better explains the scientific concepts you are trying to illustrate.

Project Parameters

- Every member of the group must participate in the presentation or contribute to design of the artistic element.
- The group must address all parts of the assignment in their presentation.
- Each presentation should be less than 15 minutes in length.
- Each presentation must contain an artistic element that complements the material being discussed.
- Each presentation must show a solid understanding of the scientific concepts being discussed.

Supernovae

The explosive power of supernovae creates and disperses a wide range of elements. The gold used in jewelry and the titanium used in light-weight eyeglass frames were formed in supernovae. Supernovae also provide the iron in your blood.

Grandma’s Apple Pie

STUDENT HANDOUT

Big Bang

The Big Bang created all the matter and energy in the Universe. Most of the hydrogen and helium in the Universe were created in the moments after the Big Bang. Heavier elements came later.

Small Stars

Small stars fuse hydrogen into helium, and then fuse helium into carbon and nitrogen. Carbon is a basic building block of life and nitrogen is a part of all proteins – essential to life.

Cosmic Rays

The nuclei of the elements formed in the big bang, stars, and supernovae rain down on us from space in the form of cosmic rays. Lithium, used in watch batteries, comes partly from cosmic rays.

Large Stars

Large stars make heavy elements as well as light elements through the process of fusion in their cores. For example, large stars create the calcium in your bones and the oxygen in your lungs, the silicon in the soil, and the sulfur that's in your body.

Note to the Teacher

This poster may be used to supplement your chemistry, earth science, physics, or astronomy classes. Refer to the panel "What's in the Universe?" for a description of the image.

Additional Resources

See the "What is Your Cosmic Connection to the Elements?" Information & Activity Booklet for more detailed information and more classroom activities. Access the booklet and activities at http://ehb2.gsfc.nasa.gov/edcats/educational_wallsheet.

Supplemental information on the formation and detection of elements and a wide variety of other activities are available in the "Cosmic Element" activity on the Imagine Project site:
http://serc.carleton.edu/faculty-resources/edcats/educational_wallsheet.html

More resources for you and your students may be found at:
http://serc.carleton.edu/ - Properties of each of the elements, with information about their discovery.
http://serc.carleton.edu/faculty-resources/edcats/educational_wallsheet.html - The "Universe" section of the site for the William Microwave Anisotropy Probe provides information on the Big Bang and early universe.
http://serc.carleton.edu/faculty-resources/edcats/educational_wallsheet.html - An overview of the life cycles of stars, with classroom activities.
http://www.fulsive.cssd.tuwien.ac.at/ - Cosmic Evolution From the Big Bang to Hard X-Ray
http://serc.carleton.edu/faculty-resources/edcats/educational_wallsheet.html - An education web site devoted to cosmic rays.

http://cassfos02.ucsd.edu/public/tutorial/Nukes.html - Additional presentations and activities.
http://ehb2.gsfc.nasa.gov/edcats/educational_wallsheet/ - Additional presentations and activities.