

The Outer Space Environment



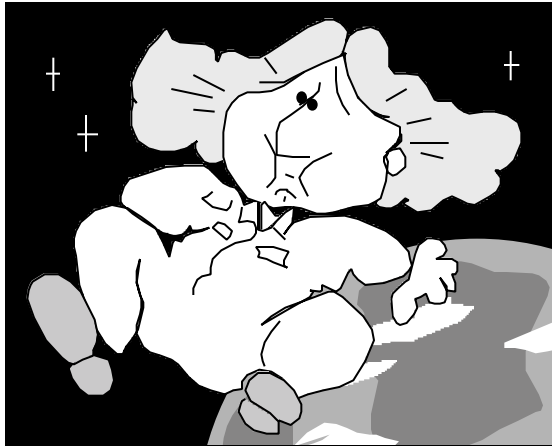
Outer space is just what its name implies. It is the void that lies beyond the uppermost reaches of the atmosphere of Earth and between all other objects in the universe. Although it is a void, outer space may be thought of as an environment. Radiation and objects pass through it freely. An unprotected human or other living being placed in the outer space environment would perish in a few brief, agonizing moments.

The principal environmental characteristic of outer space is the vacuum, or nearly total absence of

gas molecules. The gravitational attraction of large bodies in space, such as planets and stars, pulls gas molecules close to their surfaces leaving the space between virtually empty. Some stray gas molecules are found between these bodies, but their density is so low that they can be thought of as practically nonexistent.

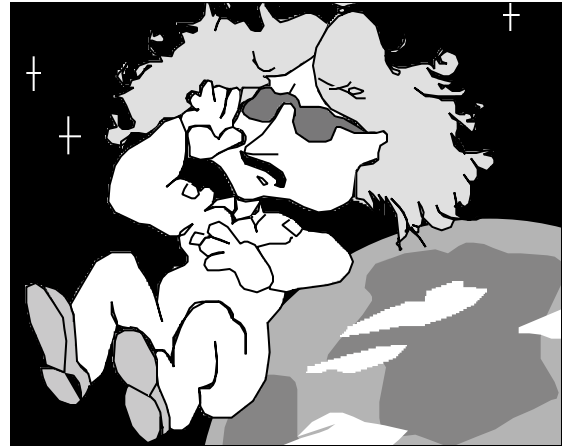
On Earth, the atmosphere exerts pressure in all directions. At sea level, that pressure is 101 kilopascals. In space, the pressure is nearly zero. With virtually no pressure from the outside, air inside an unprotected human's lungs would immediately rush





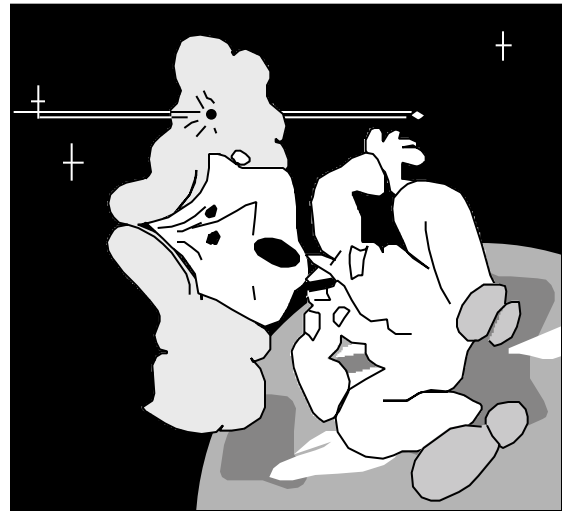
out in the vacuum of space. Dissolved gases in body fluids would expand, pushing solids and liquids apart. The skin would expand much like an inflating balloon. Bubbles would form in the bloodstream and render blood ineffective as a transporter of oxygen and nutrients to the body's cells. Furthermore, the sudden absence of external pressure balancing the internal pressure of body fluids and gases would rupture fragile tissues such as eardrums and capillaries. The net effect on the body would be swelling, tissue damage, and a deprivation of oxygen to the brain that would result in unconsciousness in less than 15 seconds.

The temperature range found in outer space provides a second major obstacle. The sunlit side of objects in space at Earth's distance from the Sun



can climb to over 120° Celsius while the shaded side can plummet to lower than minus 100° Celsius. Maintaining a comfortable temperature range becomes a significant problem.

Other environmental factors encountered in outer space include: microgravity, radiation of electrically charged particles from the Sun, ultraviolet radi-



ation, and meteoroids. Meteoroids are very small bits of rock and metal left over from the formation of the solar system and from the collisions of comets and asteroids. Though usually small in mass, these particles travel at very high velocities and can easily penetrate human skin and thin metal. Equally dangerous is debris from previous space missions. A tiny paint chip traveling at thousands of kilometers per hour can do substantial damage.

