



Glossary

SETI INSTITUTE

Astronaut. A person who trains for space travel.

Carbohydrate. A type of chemical composed of carbon, hydrogen, and oxygen atoms joined in a 1:2:1 ratio. Sugars, starches, and cellulose are common carbohydrates found in living organisms. The presence of carbohydrates is a sign of life. In this guide, students test for life with a carbohydrate test using iodine. A positive (+) result on the iodine test indicates that there is (or was) life present.

Control. In a well-designed experiment, an experimental group is compared to a control group. The experimental group will have one variable factor. The control group is identical to the experimental group in all respects except for this variable factor. For example, in this guide, the experimental Petri dish is exposed to the air, while the control dish is not; all other factors (medium, temperature, etc.) are the same for both dishes. By comparing the experimental dish with the control, one can determine the effect of the variable.

Dormant. An organism that is alive but not currently active (not obviously active and moving, though there will be some metabolism). Seeds, spores, fertilized eggs, and hibernating animals are examples of dormant life.

Dry ice. Frozen carbon dioxide CO_2 (one carbon atom bound to two oxygen atoms). This solid looks like frozen water, but it sublimates instead of melting (it goes directly from a solid to a gas without becoming a liquid). On Mars, frozen water would behave like dry ice on Earth. On Mars, the northern ice cap includes both frozen water and dry ice. The southern ice cap is just CO_2 .

Earth. In our solar system, the third planet from the Sun. Our home world!

Gravity (Earth = 1): 1
Mean Distance from the Sun (millions of km): 149.6
Mean Distance from the Sun (AU): 1
Period of Revolution: 365.26 days
Period of Rotation: 23hr., 56 min., 4 sec.
Axial Tilt: $23^\circ 27'$
Equatorial Diameter (km): 12,756
Volume (Earth = 1): 1
Main Component(s) of Atmosphere: Nitrogen, Oxygen

Experimental. In a well-designed experiment, an experimental group is compared to a control group. The experimental group will have one variable factor. The control group is

identical to the experimental group in all respects except for this variable factor. For example, in this guide, the experimental Petri dish is exposed to the air, while the control dish is not; all other factors (medium, temperature, etc.) are the same for both dishes. By comparing the experimental dish with the control, one can determine the effect of the variable.

Exobiologist. A scientist who studies life outside or beyond Earth or the possibility of life outside or beyond Earth. The prefix *exo-* comes from Greek meaning “outside of, external, or beyond”; the prefix *bio-* comes from the Greek word “bios,” which means “life”; and the suffix *-ology* means “the study of.”

Extraterrestrial. Any living organism not of or from Earth. Often, this term assumes intelligence. Currently, we know of no extraterrestrials, intelligent or otherwise. This term is often applied to fictional “space aliens.” In mission 4 of this guide, students see our solar system, including Earth, through the eyes of an extraterrestrial.

Gas Exchange (GEX) experiment. One of the three life detection tests performed on the *Viking* mission. This test measured changes in gas composition above a sample of Martian soil after the addition of a warm liquid nutrient.

Hypothesis. A tentative explanation of an observation; an educated guess. A hypothesis must be testable. When enough experimental results confirm a hypothesis to the point that the scientific community generally accepts its validity, a hypothesis becomes a theory. A theory is considered to be true and factual, the best-available scientific explanation.

Inorganic. Chemicals that do not contain the element carbon.

Labeled Release (LR) experiment. One of the three life detection tests performed on the *Viking* mission. This test measured the release of tagged carbon compounds above a sample of Martian soil after the addition of a warm liquid nutrient that contained tagged carbon atoms.

Lander. The portion of a spacecraft that is designed to land on a planet's surface. This can sometimes be the entire spacecraft.

Life. There is no simple definition for life. Living things have specific structures and metabolism; living things respond to stimuli and reproduce themselves. On Earth, all life is cellular and has DNA and/or RNA (except viruses, which are not considered to be alive).

Life Trap. A term used in this guide to describe a Petri dish filled with a nutrient medium that is exposed to the air for a brief time to determine if there are living microorganisms in the air. Any microscopic single cells that land in the Life Trap will grow into colonies that can be seen with the naked eye.

Macroworld. In this guide, this term is used to describe “the world that we cannot see with our own eyes because it is too large or far away.” It is the world that is larger than the one that we see from our everyday vantage point. The Macroworld begins at a scale of about $8 \text{ cm} = 10^4 \text{ meters}$. It must be viewed from a distance, with instruments such as telescopes. See also Powers of 10.

Magellan mission. A NASA mission that sent a spacecraft into orbit around Venus. The Magellan used radar to penetrate the cloud cover and send back images of nearly the entire surface of Venus. The Magellan was not equipped with special life detection tests, but the data it has sent back has been used to create our current understanding of Venus. It was launched in 1989, and it arrived in orbit around Venus in August 1990. Its radar can resolve images 120 meters across, showing detail 10 times finer than any previous images.

Mars. In our solar system, the fourth planet from the sun.

Gravity (Earth = 1): .38
Mean Distance from the Sun (millions of km): 227.9
Mean Distance from the Sun (AU): 1.524
Period of Revolution: 687 days
Period of Rotation: -24 hr., 37 min, 23 sec.
Axial Tilt: $23^{\circ} 59'$
Equatorial Diameter (km): 6,787
Volume (Earth = 1): .15
Main Component(s) of Atmosphere: Carbon dioxide

Mars Jar. A term used in this guide to describe a closed Erlenmeyer flask with its contents at low pressure. A Mars Jar is kept in a refrigerator to simulate conditions found on Mars. This experiment tests if the Earth microbe *Penicillium notatum* can survive such harsh conditions.

Microbe. Any microscopic, single-celled organism. A microorganism. In this guide, microbes include bacteria (Monera kingdom), fungi (Fungi kingdom), and even certain small algae (Plantae kingdom).

Microworld. In this guide, this term is used to describe “the world that we cannot see with our own eyes because it is too small.” The Microworld begins at a scale of about $8 \text{ cm} = 10^{-4} \text{ meters}$. It must be viewed with instruments such as microscopes. See also Powers of 10.

Orbit. The path an object follows around another object, such as the path of a planet around the Sun, the path of a moon around its planet, or the path of a satellite or spacecraft around a moon, planet, or the Sun.

Orbiter. The portion of a spacecraft that is designed to orbit a planet.

Organic. Any complex chemical that contains carbon. Organic chemistry includes biochemistry, the study of the metabolic reactions of living organisms. At one time it was believed that organic chemicals were only produced by living things, but it is now realized that they may be synthesized from inorganic chemicals in a laboratory.

***Penicillium notatum*.** One species of microorganism. This is the fungus that is the source of penicillin. In this guide, it is the microbe in the soil of the Mars Jars and the Venus Plates. Use caution when working with *Penicillium notatum* as some students may have an allergic reaction to this organism.

Plate out. A term used in microbiology to describe putting a microbe into a Petri dish.

Planet. A large body that is held in orbit around a star, such as Earth, Mars, or Venus (which orbit around the Sun). Planets do not shine by their own light but only reflect the light of a nearby star.

Planetology. The study of planets. Comparative planetologists explore and compare the planets to learn of their composition, formation, and the dynamics responsible for their major features. These questions are important to our understanding of life in our solar system.

Powers of 10. Exponential scales. In this guide, powers of 10 are depicted in ZOOM! Cards Each card is either 10 times larger or 10 times smaller than the previous card in the series. For instance, if one card shows the view at a scale of $8 \text{ cm} = 10^{-4} \text{ meters}$, then the next card will show the same site at a scale of either $8 \text{ cm} = \text{meters}$ or $8 \text{ cm} = \text{meters}$. See also Microworld; Macroworld.

Protein. A complex type of chemical or macromolecule composed of a chain of amino acids. Our bodies are largely made of proteins and run by special proteins called enzymes. Proteins are complex organic molecules. Though amino acids, the building blocks of proteins, can form from nonliving reactions, proteins are too complex to form and persist in most natural situations. The presence of protein is good evidence that life is, or was, present, because it must have been produced by a living organism. In this guide, students test for life with a protein test using Ninhydrin. A positive (+) result on the Ninhydrin test indicates that there is (or was) life present.

Pyrolytic Release (PR) experiment. One of the three life detection tests performed on the Viking mission. This test measured the release of tagged carbon compounds above a sample of roasted Martian soil after it was exposed to tagged compounds in the air.

Satellite. An object in orbit around another object. Satellites can be natural (Earth's moon) or artificial (a telecommunications satellite).

SETI. The Search for Extraterrestrial Intelligence. This search is being conducted by the SETI Institute in Mountain View, California, and by other organizations and researchers

around the world. They are using radio telescopes to search for radio signals coming from technological civilizations living on planets orbiting around sun-like stars.

Spacecraft. A vehicle designed for orbital or interplanetary travel. In this guide, the term is used to describe the portion of the vehicle that travels through space, as opposed to the lander, which is sent down to a planet's surface. Sometimes one vehicle can take on both roles.

Star. A hot, glowing mass; a large sphere of gas that generates energy (light and heat) from nuclear fusion reactions in its core. The gravitational attraction between a planet and a star holds the planet in its orbit. Stars could not support life on their surfaces.

Starch. Starch is a complex carbohydrate. Though simple carbohydrates such as glucose can form from nonliving reactions, starch is too complex to form and persist in most natural situations. The presence of starch is good evidence that life is, or was, present, because it must have been produced by a living organism. In this guide, students test for life with a starch test using iodine. A positive (+) result on the iodine test indicates that there is (or was) life present.

Sun. The star around which Earth orbits. Our star is named Sol. It is a very typical star. It only appears to be unique because we are so close to it and so far away from other stars.

Venus. In our solar system, the second planet from the Sun.

Gravity (Earth = 1): 90.891
Mean Distance from the Sun (millions of km): 108.2
Mean Distance from the Sun (AU): 0.723
Period of Revolution: 224.7 days
Period of Rotation: -243 days (Retrograde)
Axial Tilt: 3°
Equatorial Diameter (km): 12,104
Volume (Earth = 1): .88
Main Component(s) of Atmosphere: Carbon dioxide

Venus Plates. A term used in this guide to describe a Petri dish plated with soil that has been baked in an oven to simulate the hot conditions found on Venus. This experiment tests if the Earth microbe *Penicillium notatum* can survive in such harsh conditions.

Viking missions. In 1976, NASA landed two spacecraft on Mars. These were called the *Viking I* and *Viking II*. Each consisted of an orbiter and a lander. Three life detection tests were performed on random soil samples taken at two different sites by the landers. The experiments were the Gas Exchange (GEX) experiment, the Pyrolytic Release (PR) experiment, and the Labeled Release (LR) experiment.