

ABLATION:—erosion from vaporization or friction

ADAMS, JOHN COUCH (1819 - 92):—While still a student in Cambridge, England, Adams worked during his vacation to complete calculations proving Neptune's existence but his professors ignored him. Only when Jean Leverrier's similar conclusions came to light was Adams given credit; but by then he was in no mood to accept the knighthood and Astronomer Royal position he was offered.

ALDRIN, BUZZ (1930 - ):—Aldrin earned his pilot wings in the Air Force, flew as a fighter pilot, and joined NASA in 1963. In the 1966 Gemini 12 mission, he walked in space; then in 1969, he and Neil Armstrong became the first humans to walk on the moon.

ALPHA REGIO:—a prominent region of low mountains near the equator of Venus

ALSEP:—The Apollo Lunar Science Experiment Package was part of the U. S. Apollo missions to the Moon from 1969-1972. ALSEP, an automated lab to measure moonquakes, solar wind and other data about the Moon, was shut off in 1978.

ALVAREZ, WALTER LUIS (1911- 88):—Alvarez spent most of his career working on radar and the atomic bomb, later discovering the irregular iridium layer in 1980 at Chicxulub crater which proved that an object from space had created the site. He proposed that this object was the reason dinosaurs became extinct.

AMALTHEA:—one of Jupiter's 16 satellites

AMINO ACIDS:—organic acids necessary for building protein

ANOMALY:—an angle used to describe the motion of a body in an elliptical orbit.

ANTARCTIC METEORITES:—More than half of the meteorites found on Earth have come from Antarctica. These meteorites are well protected by ice from weather and erosion.

ANTIPODAL VOLCANISM:—This recently publicized theory suggests that a monumental asteroid impact created an eruption at the opposite side of Earth, spreading volcanic ash across the globe.

APENNINES:—one of the mountainous areas visited by the last three Apollo flights

APHELION:—In a planet's orbit, the aphelion is the point lying farthest from the Sun.

APHRODITE TERRA:—an equatorial continent the size of Africa located on Venus

APOLLO:—A series of 17 American spacecraft sent to the Moon between 1966 and 1972. The first manned mission arrived in 1969, and a total of 12 men eventually visited the Moon.

ARMSTRONG, NEIL (1930- ):—Armstrong was an airplane pilot by age 16 who joined NASA in 1955 and became the first man to set foot upon the moon in 1969. He made the often-repeated statement, "That's one small step for man, one giant leap for mankind."

ARTEMIS CORONA:—the largest volcanic feature on Venus

ASTEROID:—Most asteroids lie in a belt between the orbits of Mars and Jupiter, orbiting around the Sun. These rocky bodies range in size from one to over 900 kilometers wide.

ASTEROID BELT:—a region between the orbits of Mars and Jupiter where most asteroids orbit the Sun

ASTROLOGY:—Astrology attempts to create character profiles and fortunes based on planetary and stellar patterns. How reliable is it? Depends on how accurate you think your horoscope is.

ASTRONOMICAL UNIT:—One AU equals the average distance of the Earth from the Sun; or, to be more exact, about 93 million miles.—

ATMOSPHERE:—the gases surrounding a planet, star, or other space body

BACH, JOHANN SEBASTIAN (1685-1750):—German Baroque composer

BAR: One bar equals about 10 tons per square meter; bars measure atmospheric pressure.

BASALT:—volcanic rock composed of minerals

BETA REGIO:—a large area of shield type volcanism, which results from eruption more gentle than cone-shaped volcanoes, with rounder and flatter forms

BIG BANG THEORY:—the idea that all matter and energy in the universe resulted from an explosion occurring 10-20 thousand million years ago

BLOB TECTONICS:—Stresses below the surface usually result in quakes and volcanoes, but these forces are sometimes insufficient to drive the crust sideways. In this case, blob tectonics names the movements resulting from these weaker forces, which usually result in a lifting of land masses. The Tharsis bulge, a large lifted continent on Mars, provides one example of blob tectonics.

BRADBURY, RAY (1920- ):—popular American author of science fiction including Fahrenheit 451 and The Martian Chronicles

BRAHE, TYCHO (1546-1601):—Brahe, a Danish astronomer, met Johannes Kepler in 1597 and later hired Kepler as his assistant. Kepler inherited all of Brahe's careful observations and tables, which had set a new standard for astronomical accuracy and led to revisions in our calendar. Kepler used Brahe's data to write his three laws of planetary motion.

BROWN DWARF:—When gas contracts to form an object with a mass too small to sustain nuclear reactions, the object is called a brown dwarf. Brown dwarfs are stars that don't quite make the grade: they cannot maintain enough energy to radiate light.

CALDERAS:—Unlike craters formed by impacts from other objects, calderas are volcanic craters atop mountains, particularly on Mars and on Venus' Olympus Mons.

CALLISTO:—the faintest of the four jovian satellites discovered by Galileo and named by Simon Marius

CAMBRIAN:—the evolutionary period on Earth beginning 570 million years ago, when the earliest fish began to appear

CAPTURE THEORY:—One of three theories about where the Moon originated. In this scenario, the Moon formed elsewhere in the solar system and was subsequently captured into orbit around the Earth. This theory, however, is not commonly supported.

CARBONACEOUS CHONDRITE:—This type of meteorite is a rare find on Earth, because it is so fragile. Primarily consisting of water and carbon-rich material, these meteorites are part of a class formed by asteroid collisions ten million years ago.

CASSINI, JEAN:—This French astronomer discovered four of Saturn's moons in the late 1600s; the famous "gap" in Saturn's rings is named after him (Cassini's Division).

CASSINI PROGRAM:—A proposed space probe that would explore Saturn and Titan, launching in October 1997 from Cape Canaveral, Florida.

CERES:—The largest asteroid in the solar system, discovered in 1801 and measuring just under 1000 kilometers in diameter.

CFCS (CHLOROFLOUROCARBONS):—Seemingly harmless substances like hair spray and coolant also used to contain these chemicals, which are currently being phased out internationally.—Recent data by NASA spacecraft have confirmed that CFCs are indeed harmful to the ozone layer.—

CHARON:—the only known satellite of Pluto, discovered in 1978

CHICXULUB CRATER:—One of the largest known impact craters on Earth, this site lies above the Yucatan peninsula in what is today southern Mexico.—Many experts believe that the asteroid or comet that created this 180-kilometer crater caused climate changes which caused the dinosaurs to die off 65 million years ago.—(It was either that or trying to pronounce "Chicxulub".)

CHONDRITE:—These common stony meteorites are close to 4.5 billion years old, indicating formation around the same time the solar system began.

CHONDRULE:—congealed droplets dating from the formation of these chondrite meteorites in the solar nebula

CHRYSE PLANITIA:—a 3-billion-year-old lava plain on Mars whose name means "the Plains of Gold"—

CIRRUS CLOUD:—wispy white cloud of minute ice crystals, between 20,000 and 40,000 feet up

COMET:—A comet is comprised of a small, solid nucleus; an atmosphere of gas forming the head; and a tail of dust.—Comets orbit the Sun in a wide ellipse, with one passing within viewing range every decade or so.

COMET BIELA:—Biela kept astronomers on their toes throughout the 1800s.—After its discovery in 1826, it proceeded to split in two 20 years later; disappear for another 14 years; and finally reappear as a meteor shower in 1872.—

COMET HALLEY:—Edmund Halley never got to see the comet he discovered in his lifetime.—By studying the Great Comets of 1531, 1607, and 1682, he concluded that these were actually the same comet which would reappear in 1758.—Halley's Comet has since entered our field of vision every 76 years.

COMET SWIFT-TUTTLE:—Although not the most spectacular comet, Swift-Tuttle is the most dependable, producing a meteor shower that can be seen every year in August. The comet itself has a period of 133 years.

CONIC SECTION:—Johannes Kepler discovered that the orbits of bodies in space are not perfectly circular, but ellipses. More generally, orbits can be circles, ellipses, parabolae, or hyperbolae. These four shapes, formed when a plane intersects a cone, are classified as conic sections.

CONSTELLATION:—In 1930, the International Astronomical Union divided the sky into 88 areas, each with a Latin name but generally called constellations. Most of the constellations can be traced to antiquity.

CONTINENTAL DRIFT:—Alfred Wegener posited this theory that land on Earth was originally one mass divided into plates which slowly broke apart into continents, and that these continents are still moving.

CONVECTION CURRENTS:—Convection currents are a way of transporting energy across regions. Convection occurs when hot matter flows into a cooler area, and it plays a key role in climate conditions on a planet.

COPERNICUS CRATER:—a lunar crater close to one billion years old, measuring nearly 100 kilometers across

COPERNICUS, NICOLAS (1473-1543):—The Polish astronomer worked for years to complete a planetary model centered on the Sun; it was published just before his death in 1543. The heliocentric (Sun-centered) theory finally explained why Mars appeared to move backwards: with both Earth and Mars moving around the Sun, Earth occasionally overtakes Mars and creates the backwards, or retrograde, effect.

CORONAE:—These circular features, prevalent on Venus, occur when material rises from the mantle, or inner crust, of the planet; instead of becoming a volcano, it becomes a corona. The result is a slightly raised plateau surrounded by a low circular ridge and a moat.

COSMOLOGY:—study of the origin and evolution of the Universe

CRATER:—A crater is the circular feature resulting from an external object's impact with a planet.—

CRETACEOUS:—the evolutionary period between 98 and 144 million years ago, when the dinosaurs were on the rise

CRYO-VOLCANISM:—low-temperature volcanism present on small satellites of Uranus and Saturn

DARWIN, GEORGE HOWARD (1845-1912):—To avoid the shadow of his famous evolutionist father (Charles Darwin, b.d.), George entered the field of astronomy and achieved distinction with his analysis of tidal irregularities and the slowing of Earth's rotation, also positing the daughter theory of the Moon's origin.

DAUGHTER THEORY:—George Howard Darwin developed this idea of where the Moon came from. He theorized that the Earth spun so rapidly as to split in two, but modern discoveries about the Moon do not support this concept.

DECCAN PLATEAU:—a vast plain created from volcanic lava flow over an area in southern India

DEIMOS:—one of two Martian satellites, the other being Phobos

DENDRITIC:—branch like

DESCARTES HIGHLANDS:—An area on the Moon visited by the last three Apollo spacecraft, noted for its gentle, rounded contours.

DIFFERENTIATION:—The process by which melted material solidifies into layers of varying composition and density.

DINOSAURS:—The scientific community is not in agreement on how precisely this species became extinct; but the most popular theories asserts that either an asteroid impact or volcanic destruction created climate changes which made dinosaur life impossible. A new theory publicized in late 1994, the antipodal volcanism theory, suggests that this asteroid impact also led to volcanic activity on the opposite side of Earth, accomodating both the asteroid and volcano theories of extinction.

DNA:—genetic coding material in living cells which forms the basis for all life on Earth

E. COLI:—a type of bacteria

EARTH:—The third planet from the Sun, Earth (as far as we know) is the only planet currently able to sustain life.

EARTHQUAKE:—What can often be catastrophic and frightening for humans on Earth's surface is actually a relatively small movement deep in the planet's crust. Earthquakes result when two crustal plates shift slightly, carrying the attached land with them.

ELECTROMAGNETIC RADIATION:—A form of energy consisting of oscillating

magnetic and electric fields, electromagnetic radiation is measured in waves and separated into different types of radiation, one of which is visible light. These types comprise the entire electromagnetic spectrum. Radio waves, for instance, are at one end of the spectrum; visible light is toward the middle; and gamma rays lie at the opposite end.

ELECTROMAGNETIC SPECTRUM:—See Spectrum, electromagnetic.

ELLIPSE:—Classified along with the circle, parabola, and hyperbola as a conic section, this stretched-out circle is a common orbital path for bodies in space.

ENCELADUS:—The second-closest satellite to Saturn, also the most geologically active.

EUCRITES:—Eucrites are igneous meteorites, which means they are made of material that has changed physically during the meteorite's formation. Eucrites have been linked to the large asteroid Vesta, making them one of the few types with a convincing link to an individual parent asteroid.

EUROPA:—One of the four jovian satellites discovered by Galileo and named by Simon Marius, Europa is the only one smaller than our Moon.

EUROPEAN RENAISSANCE:—See Renaissance astronomy.

EUROPEAN SPACE AGENCY:—ESA is an assembly of 14 countries established in 1973 to administer Europe's space program. Headquartered in Paris, the agency also has research and exploration facilities located in other member countries.

F RING:—This ring of Saturn is very slender and lies outside the span of the main rings.

FACE ON MARS:—This alleged Martian feature has been touted by some groups as proof that life on Mars did and could exist.

FRACTIONATION:—Like picking players for a team, this process allows some elements to be selected as part of a planet's formation while others are rejected.

FRANCIS XAVIER (SAINT) (1506-1552):—Jesuit missionary to the Orient, known as "Apostle of the Indies"

FUJI VOLCANO:—the highest mountain in Japan, at 12,388 feet.

GALAXY:—A galaxy is a giant group of stars, dust, and gas in space. When

capitalized, Galaxy refers to Earth's own star system, the Milky Way.

GALILEAN SATELLITES:—Discovered by Galileo in 1610, these four satellites revolve around Jupiter. One of Galileo's contemporaries, Simon Marius, tried to take credit for the discovery; he did not succeed, but he did get to name them: Io, Callisto, Ganymede, and Europa.

GALILEO GALILEI (1564-1642):—The young Italian's parents wanted him to study medicine because doctors made more money than mathematicians, but fortunately Galileo's wishes prevailed and he went on to become a renowned astronomer and physicist. He made groundbreaking studies of force and motion, and turned to astronomy when, in 1609, he heard about the invention of the telescope and decided to build his own. Within six months, he was using his telescope to make famous discoveries such as the four jovian satellites Io, Callisto, Ganymede, and Europa.

GALILEO PROGRAM:—The Galileo program targets Jupiter for its data collection, part of which has included the first close-up image of an asteroid, Gaspra.

GALLE, JOHANNE (1812-1910):—Galle was a German astronomer and director of the Berlin Observatory who was the first to see the planet Neptune and recognize it, although the planet's existence and location had already been calculated by John Couch Adams and Urbain Jean Leverrier.

GANYMEDE:—the brightest and largest of the four jovian satellites discovered by Galileo and named by Simon Marius

GASPPA:—The space probe Galileo photographed this asteroid near Jupiter, providing the first close-range look at such an object.

GEOCENTRIC:—a concept of the solar system centered around the Earth, popular before the Renaissance period and its acceptance of heliocentrism

GEORGIUM SIDUS:—The discoverer of Uranus, William Herschel, proposed this name (meaning "George's Star") for the new planet, in honor of the reigning king of England. Unfortunately for George, astronomers preferred Uranus; but Herschel was awarded a lifetime research position with the court.

GEYSER:—a spring spouting intermittent jets of heated water and steam

GILBERT, GROVE:—Gilbert was the head of the U. S. Geological Survey in the 1890s who argued against the idea that all craters are volcanic.

GIOTTO PROGRAM:—Launched by the European Space Agency, the Giotto probe studied Comet Halley in 1986.



GLOBAL WARMING:—This rise in temperature occurs when radiation lingers in a planet's environment, usually as a result of high concentrations of heat-trapping gases in the atmosphere.— On Venus, incoming radiation causes the crust to release carbon, which in turn traps more heat and creates an extreme heating cycle.— A newer, more accurate system for measuring changes in global sea level could soon provide incontrovertible evidence of higher sea levels caused by melting polar ice and the expansion of liquid water.

GRAND CANYON:—This tourist attracting feature provides a dramatic example of water erosion's potential effects.

GRAND COULEE:—Terrestrial floods carved this channel in eastern Washington during the last ice age.

GRAVITATION:—Isaac Newton published his theory of gravitation, or gravity, in 1687.— The theory explained the mutual attraction between objects, varying based on the distance between and masses of the objects.

GREAT DARK SPOT:—an atmospheric disturbance on Neptune similar to the Great Red Spot on Jupiter

GREAT RED SPOT:—Aptly named, this feature on the surface of Jupiter is actually a perpetual storm spanning 30,000 kilometers.

GREENHOUSE EFFECT:—Many experts fear that increased amounts of heat-trapping gas from human activity combined with holes in our protective ozone layer could have an insulating effect which would eventually make life on Earth difficult if not impossible.— The rate and intensity of this effect has been a subject of debate over the last few years.

GULA MONS:—One of the biggest shield volcanoes on Venus, rounder and flatter than cone-shaped volcanoes.

HALLEY, EDMUND (1656-1742):—An English astronomer, Halley began his career by recording stars of the southern hemisphere and later discovered the comet for which he is named, correctly predicting its appearance in a year following his death.— He was also friends with Isaac Newton and helped publish Newton's famous gravitation principles in 1687.

HAWAII VOLCANOES:—Because Hawaii lies over an active area of the Earth's crust, its islands have a high concentration of volcanic activity, seen most prominently in Mauna Loa.

HELIOCENTRIC:—a concept of the solar system developed by Copernicus and

centered around the Sun

HERSCHEL, WILLIAM (1738-1822):—The German-English Herschel was a well-known organist and music teacher before he took up astronomy as a hobby. His sister Caroline shared his new interest, and the siblings produced the the best telescopes around in 1773. He named his planet discovery "George's Star" for the English king, but astronomers of the day preferred Uranus.

HIGHLANDS:—see lunar highlands

HILDR CHANNEL:—a lava river 7,000 kilometers long, located on Venus

HIMALAYAN MOUNTAINS:—This range provides an example of the surface features that can result from shifts deep in Earth's crust. The Himalayas resulted when the Indian subcontinent bumped against the Asian plate.

HUYGENS, CHRISTIAN (1629-1695):—Huygens, a Dutch astronomer who was helping his brother build an improved telescope, used the better view they created to his advantage. Aside from finding and naming Titan, he was the first to note surface markings on Mars and the first to attempt calculations of Earth's distance from the stars—though he was off by a few trillion miles.

HYDROGEN (REDUCING) CHEMISTRY:—In the outer solar system, hydrogen is so prevalent that other elements tend to form compounds containing it. This process is called reducing. The inner solar system contains more oxygen, however; so while the outer solar system is mainly reduced compounds, Earth's region contains oxidized gases.

IAPETUS:—the farthest outward of Saturn's icy satellites

IGNEOUS ROCK:—Igneous material forms when molten matter cools and solidifies.

IMBRIUM BASIN:—This crater on the Moon is a mountain-ringed, circular feature about the size of Texas.

IMPACT HAZARD:—Some experts, including this book's author, believe we should be investigating detection and protection devices to guard against potential disaster resulting from an asteroid or comet impact. The immediate likelihood of such an impact is not great, but certainly possible for the future.

INFRARED ASTRONOMY SATELLITE (IRAS):—In 1983 IRAS carried out an all-sky survey from Earth orbit, covering 98 percent of the sky but finding no dark planets. If there is a tenth planet, it would have to lie within the two

percent of sky IRAS missed.

INFRARED HEAT:—This type of energy lies between the visible red and radio-wave bands of the electromagnetic spectrum. Astronomers analyze infrared radiation in space to learn more about different objects.

INTERPLANETARY DUST:—This material trails from comets, creating the glow we see when one passes Earth's field of vision; it also sometimes falls toward earth in the form of meteoroids.

IO:—the innermost of the four jovian satellites discovered by Galileo and named by Simon Marius

ISHTAR TERRA:—one of two large continents on Venus, the site of that planet's highest mountain range

ISOTOPES:—nearly identical atoms of an element which differ in mass and physical properties

JEFFERSON, THOMAS (1743-1826):—third president of the United States, 1801-1809

JUPITER:—the largest planet in the solar system, with 16 satellites and the well-known Great Red Spot marking

KELVIN, WILLIAM THOMSON (1824-1907):—The Scottish physicist proposed his temperature scale in 1848, an alternative measure based on absolute zero (-273.15 degrees Celsius), which is the temperature at which gas molecules' energy level is zero.

KEPLER, JOHANNES (1571 - 1630):—Not everyone accepted Kepler's ideas right away, but he must have been doing something right: his famous contemporary Galileo admired him enough to send him a homemade telescope. Astronomia Nova, published in 1609, contained Kepler's first two laws of planetary motion; the third was published in 1619's Harmonices Mundi.

KEPLER'S LAWS: Johannes Kepler's published three important laws of planetary motion in the early 1600s. The first refuted the myth that all orbits were perfect circles, showing instead that most planets travel in ellipses; the second related to how fast a planet moves, showing an increased speed nearer the Sun; and the third, also called the harmonic law, related a planet's distance from the Sun to the duration of its orbit.

LAKSHMI:—a broad plateau on the continent of Ishtar on Venus

LEVERRIER, URBAIN JEAN JOSEPH (1811-77):—The French Leverrier was a chemist until he got a great job offer: teaching astronomy at the Ecole Polytechnique. He began his work studying Mercury in 1836, later taking credit with John Couch Adams for calculations leading to Neptune's discovery. Leverrier named the planet after the god of the sea because of its green color.

LIGHT POLLUTION:—This term refers to street lights and other man-made disturbances which prevent a clear, unhindered view the night sky.

LOKI VOLCANO:—A "hot spot" of volcanic activity and the site of a lava lake on one of Jupiter's satellites, Io.

LOWELL, PERCIVAL (1855-1916):—His studies of Mars took place at Lowell Observatory in Arizona, which he established in 1894. He also searched for a ninth planet he called Planet X, but Lowell was not proven right until after his death, when Lowell Observatory researcher Clyde Tombaugh found and named Pluto.

LUNAR HIGHLANDS:—Lying above the smooth, dark lunar maria region of the Moon, the highlands appear brighter and have the a high concentration of craters.

LUNAR MARIA:—The maria are areas of solidified lava which flowed into large craters, creating dark and circular plains.

LUTHER, MARTIN (1483-1546):—The German religious reformer preached the heretical idea of salvation by faith, not works.

MAAT MONS:—One of the largest shield volcanoes on Venus, rounder and flatter than cone-shaped volcanoes.

MAGELLAN PROGRAM:—This NASA probe mapped more than 98 percent of the surface of Venus between 1990 and 1992.

MAGNETIC FIELD:—A planet's magnetic field originates from electric currents at the planet's core, creating a magnetosphere of influence on other objects.

MAGNETOSPHERE:—A magnetosphere is the region around a planet where its own magnetic pull dominates the Sun's and can trap electrons and ions.

MANTLE:—The layer between Earth's core and its crustal plates

MARIA: (see lunar maria)

MARINER PROGRAM:—NASA launched this series of probes between 1962-

and 1973. They collected data primarily about Mars, Venus, and finally Mercury in the first bi-planet mission (to Mars and Venus in 1973).

MARIUS, SIMON (1573-1624):—Marius, a German astronomer, tried to steal Galileo's thunder by claiming to have seen the jovian satellites first; he never proved this claim, but he did name and chart the satellites Io, Ganymede, Europa, and Callisto.

MARS:—Many have tried to prove that life exists on Mars' orange-red surface, but no one has succeeded. Mars is the fourth planet from the Sun.

MASURSKY, HAROLD (1923-1990):—Masursky joined the U. S. Geological Survey in 1947, later heading the team that first mapped the planet Mars. He was involved in selecting landing sites for the Apollo, Viking, and Voyager missions and gained approval for the Magellan mission to map the surface of Venus.

MAUNA KEA:—Kea is inactive, but one of the two largest volcanoes in Hawaii.

MAUNA LOA:—Loa is an active volcano and one of the two largest in Hawaii.

MAXWELL MOUNTAINS:—the highest mountain range on Venus

MEAD CRATER:—At 280 kilometers in diameter, Mead is the largest crater on Venus.

MERCURY:—The innermost and second-smallest planet in the solar system, best known for the extremely high temperatures caused by its proximity to the Sun.

METEOR CRATER:—The best-known impact crater on Earth, Meteor Crater was formed approximately 50,000 years ago in what is now northern Arizona. It stretches one kilometer.

METEOR SHOWER:—Though not truly a storm, a meteor shower gets its name from the concentrated appearance of bright dust we see when Earth passes close enough to a comet's trail.

METEORITES:—Formed from original solar system debris or from comets or asteroids, meteorites are small rocks from space which fail to burn out in Earth's atmosphere but reach our surface instead.

METEORIDS:—fragments of asteroids, comets, or material from the solar nebula which become either meteorites (those that strike a planet's surface) or meteors (those that burn out in a planet's atmosphere)

METEORS:—Meteors can originate from asteroids, comets, or original solar system material; when they strike Earth's atmosphere, they burn out and appear as "shooting stars."

MICHELANGELO (1475-1564):—This Italian painter of the Sistine Chapel, among other works, is recognized as one of the Renaissance period's foremost artists.

MICROSCOPE:—an optical instrument used to magnify and view tiny objects

MILKY WAY:—The Milky Way refers to both the band of stars we see at night and the star system that is our Galaxy. The system is disc-shaped with a bulge in the middle, with the Sun lying toward the outer part of the disc. The Milky Way we see from the sky is the view of a slice of this disc.

MOON:—Earth's only natural satellite, Moon has a heavily cratered surface. It does not generate its own light, but rather reflects that of the Sun's.

MOON NATIONAL MONUMENT:—Located in Idaho, this area actually consists of fresh lava flows and cinder cones creating a landscape not seen on the Moon.

MT. EVEREST:—With a summit five and one-half miles above sea level, Everest is the highest point on Earth.

NASA:—The National Aeronautics and Space Administration was established in 1958 as a civilian agency responsible for all nonmilitary aspects of the United States space program. It launched the Apollo Moon missions, the Voyager probe, and other American exploratory spacecraft.

NEAR-EARTH ASTEROID (NEA):—NEAs are asteroids that deviate from a general stream of asteroids further away from Earth. As a result of gravitational perturbations, these strays wander into the inner solar system.

NEBULA:—a cloud of interstellar gas and dust that may reflect light and appear as a bright cloud, or may be a dark nebula hiding objects behind it

NEBULA, SOLAR:—see Solar Nebula

NEPTUNE:—Neptune, the eighth planet, is the most distant of the four giant planets.

NEWTON, ISAAC (1642-1727):—The apple story about Newton is not a myth: he really did begin investigating the concept of gravity when he saw an apple fall to the ground. Was the Moon subject to the same pull of the Earth as the apple? he wondered. However, Newton's first claim to fame in the

1660s was not his laws of motion, published in 1687, but his optical experiments showing that white light could be separated into a rainbow, or spectrum.

NEWTON'S LAWS:—Isaac Newton's ideas of gravitation and inertia, published primarily in his Principia of 1687, revolutionized science, including astronomy. In particular, his theory of gravity explained the mutual attraction between objects, varying with the distance and masses of the objects.

NICHOLSON, SETH (1891-1963):—From 1915–1957, Nicholson worked at Mount Wilson Observatory in Pasadena. In addition to finding four jovian satellites, he studied and measured astronomical temperatures.

OLYMPUS MONS:—Mons, located on Mars, is the largest volcano in the solar system at 700 kilometers in diameter.

OORT, JAN HENDRIK (1900- 88):—This Dutch astronomer's work led to increased understanding of the Galaxy's structure, as well as of the origins of comets.

OORT COMET CLOUD:—Jan Oort proposed this cloud, located far beyond the known planets, as the origin of the comets passing Earth in the solar system.

ORIENTALE BASIN:—one of the largest basins, or craters, on the Moon

ORION:—one of the sky's 88 constellations, named for a Greek mythical figure

OXYGEN (OXIDIZING) CHEMISTRY:—This chemistry prevails in the inner solar system, where oxygen is abundant and causes other elements to oxidize, or form compounds with oxygen.—

OZONE AND OZONE DEPLETION:—Many scientists believe that human manufacture of certain chemicals has contributed to gaps in the layer of this compound that lies above Earth and protects us from harmful radiation.— Recently, NASA data has confirmed chloroflourocarbons' link to ozone layer destruction.

PANCAKE DOMES:—a circular, flat dome with steep sides resulting from volcanism on Venus

PANDORA:—This satellite of Saturn lies next to one of Saturn's furthest rings, the F Ring.

PARTIAL MELTING:—A phase of the Moon's history during which the more

easily melted minerals in the mantle rose to the surface as lava.

PERMIAN:—the last period of the Paleozoic era, 286 million years ago

PERSEID METEOR SHOWER:—This stream of debris associated with Comet Swift-Tuttle appears every year between August 9 and August 13.

PETER THE GREAT (1672-1725):—Petr Alekseevich founded St. Petersburg during his reign as Tsar of Russia. He introduced western civilization to Russia and raised it to recognition.

PHOBOS:—one of two satellites revolving around Mars along with Deimos

PHOTOSYNTHESIS:—the process of using sunlight to form chemical compounds

PINATUBO VOLCANO:—The Pinatubo is a cone-shaped volcano in the Phillipines.

PIONEER PROGRAM:—NASA launched 13 Pioneer probes (11 Pioneer plus 2 Pioneer Venus) into the solar system between 1958 and 1978. Pioneer 10 and Pioneer 11 bypassed Jupiter.

PIONEER VENUS PROGRAM:—These last two spacecraft in the Pioneer series were a Venus orbiter and an atmospheric probe.

PLANET X:—Before Pluto had been discovered, Percival Lowell believed in the ninth planet's existence and called it Planet X. The term is still used to signify undiscovered planets.

PLANETESIMAL:—If the planets formed in a snowball like process by accumulating matter over time the planetesimal would be the original snowball.

PLATE TECTONICS:—This theory divides Earth into crustal plates which travel independently above the planet's core. As these plates shift, they carry the above land masses with them, resulting in volcanism and earthquakes.

PLATO (427-347 B.C.):—Although his real name was Aristocles, the Greek philosopher's wide shoulders earned him the nickname Platon (meaning broad). He spent most of his life at the Academy, a school he founded in Athens in 387. He conceptualized the heavens as a physical model of mathematic theory, where all orbits are exactly circular. This idea, though inaccurate, is less far fetched than the popular belief in his time that the planets made music as they turned.



PLUTO:—the ninth and smallest planet, discovered in 1930 by Lowell researcher Clyde Tombaugh

POLAR CAPS:—Planets and satellites tend to form areas of ice at the northern and southern tips called polar caps.

POPE, ALEXANDER (1688-1744):—A popular English poet and essayist, Pope strongly supported the principle of Reason seen embodied in science and nature.

PRIMITIVE BODIES:—objects that have not been chemically altered since the original formation of the solar system

PRIMORDIAL HEAT:—leftover energy from the formation of a planet

PROMETHEUS:—a small satellite of Saturn lying on one side of Saturn's F-Ring; Pandora lies on the other side

PTOLEMAIC SYSTEM:—Claudius Ptolemy developed this concept in the second century, mapping a planetary system in which all matter revolves around the Earth.—Nicolas Copernicus and others later proved the invalidity of this theory centuries later.

PTOLEMY, CLAUDIUS ((100-170 A.D.):—Claudius Ptolemaeus of Alexandria completed his planetary system model in second century Greece.—This model assumed that Mercury, Venus, Mars, Jupiter, Saturn, Moon, and Sun revolved around the Earth.—The Copernican system, published in 1543 and structured around the Sun, later replaced Ptolemy's model.

RADAR IMAGING:—Like infrared astronomy, radar aids in planet analysis by measuring the radiation emitted or reflected from the surface.—Radar imaging can map a planet based on reflected radio waves.

RADIOACTIVITY:—spontaneous emission of energy from disintegrating atomic nuclei

REDUCING:—See Hydrogen chemistry.

REFORMATION:—This 16th-century movement rejected Roman Catholicism and established Protestantism.

RENAISSANCE ASTRONOMY:—This period, spanning the 14th through the 17th centuries, marked a flowering of both the arts and modern science.—Copernicus initiated the revolution of astronomy in 1543 by creating a model with planets revolving around the Sun instead of Earth.

RETROGRADE APPARENT MOTION:—Certain planets, like Mars, have "apparent" retrograde orbits (east to west) because as Earth overtakes them in space, they move backwards from our vantage point.

RIFT ZONE:—Below Earth's surface at the crust, the boundaries between plates are called rift zones. Land masses lying above these zones have a higher incidence of earthquakes as the plates shift below.

RING OF FIRE:—Ring of Fire describes the zone circling the Pacific from Alaska to the Philippines which is marked by volcanism and earthquakes.

RINGS:—Although Saturn's rings are the most visible, all four giant planets—Neptune, Jupiter, Saturn, and Uranus—possess rings of small particles which encircle the planets.

RNA:—RNA, or ribonucleic acid, carries and transfers genetic coding information from deoxyribonucleic acid (DNA) to the protein-building ribosomes.

ROSETTA STONE:—The Rosetta Stone is an artifact found in 1799 which provided the first key to deciphering Egyptian hieroglyphics.

SAGAN, CARL (1934- ):—An American astronomer whose popular TV series and book Cosmos made him a household name, Sagan has played a key role in demystifying and popularizing science. He is a chief proponent of space exploration and the search for extraterrestrial life.

SAN ANDREAS FAULT:—Faults are zones where the crustal plates neither separate nor converge but slide along relative to one another. The San Andreas fault is in California.

SATELLITES:—Although we often use this word in reference to manmade spacecraft, in this context satellites are natural objects which orbit around a planet. Currently, we know of 61 satellites, or moons, in the solar system.

SATURN:—the sixth major planet and the second largest, Saturn has 18 satellites.

SCHIAPARELLI, GIOVANNI (1835-1910):—The Italian astronomer first reported canals on Mars in 1877, a discovery that was later used to support the theory that Mars sustained life. Schiaparelli also discovered that meteor showers follow the same orbits as comets.

SCHMITT, JACK (1935 - ):—Schmitt, who joined NASA in 1965, became the last man to walk on the Moon during the Apollo 17 mission in 1972. Apollo 17 was not only the last but the longest manned lunar flight.

SEISMOMETER:—instrument for measuring ground movements

SHEPHERD SATELLITES:—These small satellites orbit on either side of a planet's ring, preventing the ring particles from straying beyond their boundaries.

SHIELD VOLCANOES:—Unlike cone-shaped volcanoes, these features are broad and shallow and result from gentle eruptions of highly fluid lavas.

SIF MONS:—one of the largest shield volcanoes on Venus, rounder and flatter than cone-shaped volcanoes

SISTER THEORY:—One of three theories about where the Moon originated; the idea is that Earth and its satellite both formed from a cloud of spinning dust, but the differences between the two refute this theory.

SNC METEORITES:—The name of this meteorite class is an abbreviation of technical terms related to where the meteorites were found.—SNCs, found mostly in Antarctica, might have originated on Mars.

SOLAR NEBULA:—the cloud of dust and gas long thought to be the origin of the solar system but now just a part of several theories on the system's beginnings.

SOLAR SYSTEM:—a group of objects in space consisting of the sun and the objects which orbit around the sun, including the nine known planets, 61 known satellites, asteroids, comets, and meteors

SPATIAL RESOLUTION:—Resolution measures a telescope's ability to convey clear images, and spatial resolution is the smallest angle between the telescope and viewing subject which will produce fine detail in an image.—

SPECTROSCOPY:—Spectroscopes provide the main source of information for studying celestial bodies by identifying which atoms are present.—The measuring device used for this data collection is called a spectrometer.

SPECTRUM, ELECTROMAGNETIC:—The electromagnetic spectrum consists of all types of light—such as visible light, gamma rays, X rays, and radio waves.

STAR:—A luminous, gaseous body—composed primarily of hydrogen and helium—that derives its energy from nuclear fusion reactions at its core.

STRATOSPHERE:—The stratosphere extends from the end of the troposphere (anywhere from 8 to 18 kilometers above sea level) to about 50 kilometers, below the mesosphere.—The stratosphere contains the ozone layer, which

protects us from dangerous solar radiation.

STROMATOLITES:—The development of this life form, a bacteria which lives in sea colonies, contributed to a more oxidized environment on Earth allowing increased diversity of life.

SUBDUCTION ZONE:—an area where one plate of the Earth's crust plunges under another plate, resulting in earthquakes or volcanic activity

SUBTROPICAL:—any area bordering on the tropical zone near the Equator

SUN:—the central body of the solar system and the nearest star to Earth

SUPERSONIC:—speeds greater than the speed of sound (760 miles per hour in air)

TAURUS MOUNTAINS:—The last three Apollo space missions explored this and other mountainous areas on the Moon.

TECTONICS:—See Plate tectonics.

TELESCOPE:—an optical instrument used to observe distant objects

TERMINAL BOMBARDMENT:—a period around four billion years ago during which the Moon underwent an extremely high rate of impact from outer objects

THARSIS:—an elevated area of volcanic activity on Mars

THERMOCOUPLE:—a temperature measuring device made with two wires of different metals which works by measuring the difference in potential energy between the wires

TITAN:—discovered in 1655, Saturn's largest satellite

TOMBAUGH, CLYDE (1906-):—Tombaugh started as an assistant at the Lowell Observatory in Arizona in 1929 and discovered Pluto the following year, naming it both for the god of darkness and for predecessor Percival Lowell, whose initials introduce the name.

TRITON:—Neptune's largest satellite

TROJAN ASTEROIDS:—small asteroids trapped in the orbit of Jupiter, but 120 degrees separated from Jupiter

TROPICAL:—any area within 23.5 degrees north or south of the Equator

TROPOSPHERE:—This layer of Earth's atmosphere extends from sea level to anywhere from 8 to 18 kilometers, leading to the stratosphere.

TSAR PETER THE GREAT:—See Peter the Great.

TYCHO CRATER:—A relatively recent lunar crater formed about 100 million years ago, Tycho spans 85 kilometers.

ULTRAVIOLET RADIATION:—on the spectrum of electromagnetic energy, ultraviolet lies between X rays and visible light. Its wavelength is between 3000 and 300 Angstroms.

UNITED STATES GEOLOGICAL SURVEY:—The USGS, founded in 1879, collects information necessary for managing this country's global environment.

URANUS:—The seventh planet from the Sun, Uranus has 15 known satellites and a ring system.

UTOPIA PLANITIA:—a smooth plain on Mars where the American spaceprobe Viking 2 landed in 1976

VALLES MARINERIS:—a vast system of canyons on Mars photographed by Mariner 9

VAN ALLEN RADIATION BELTS:—James Van Allen discovered these belts in 1958. The belts represent two regions where charged particles become trapped in Earth's magnetic grip and move back and forth across the magnetosphere, or the area in which Earth exerts magnetic influence.

VAPORIZED:—dissipated

VEGA PROGRAM:—two spacecraft from the former Soviet Union used to probe Venus in 1985 and to encounter Halley's Comet in 1986

VENERA PROGRAM:—The first successful landing of this former Soviet Union program was Venera 7 in 1970. Nine others followed, all of them providing images and data of Venus.

VENUS:—The second planet outward from the Sun, Venus is the closest planet to Earth.

VESALIUS, ANDREA (1514-1564), a Flemish anatomist, wrote the first accurate and well illustrated book about human anatomy:—De Corporis Humani Fabrica (On the Structure of the Human Body)—was part of the Renaissance resurrection of scientific exploration.

VESTA:—a large asteroid known as the possible parent asteroid for the eucrite class of meteorites; also unique for its basaltic composition which is similar to the Earth and Moon.

VESUVIUS VOLCANO:—a cone-shaped volcano in Italy

VIKING PROGRAM:—The United States' Viking orbiter and lander sent to Mars reached the planet in 1976, when they analyzed the atmosphere, took pictures, and measured ground tremors.

VOLCANISM:—the process of molten material rising through a planet's crust to the surface

VOYAGER PROGRAM:—The United States launched these two probes to the outer planets in 1977. In 1979, Voyager 1 flew by Jupiter, photographing clouds and satellites; in 1980 it passed Saturn, covering the planet's satellites. Then Voyager 2 finished the mission with Uranus in 1986 and Neptune in 1989.

VREDEFORT COMPLEX:—one of the largest impact craters on Earth, with Chicxulub

WAR OF THE WORLDS:—H. G. Wells' fictional story about Martians invading Earth fueled speculation that life existed on the neighboring planet.

WAVELENGTH:—the length of one oscillating motion in a band of energy, seen on paper as the distance between the crests of each wave

WEGENER, ALFRED (1880-1930):—Wegener, a German geologist, originated the continental drift theory. Earth, he said, was originally one continent, "Pangaea" (all earth) and one body of water, "Panthalassa" (all sea). Plate tectonics later caused the land mass to break into the continents we know today.

WELLS, HERBERT GEORGE (1866-1946): An English writer of science fiction-fantasy and romance, Wells' best known titles include War of the Worlds and The Time Machine.

WHITE OVALS:—three storm-like disturbances formed on Jupiter around 1940

