Formation of atmospheric terrestrial planets

Primary atmospheres: The primary atmosphere for each terrestrial world was composed mainly of light gases formed during the initial formation. These gases are similar to the primordial gas mixture found in the Sun and Jupiter. This is 94.2% H, 5.7% It and everything else less than 0.1%. However, this primary atmosphere was lost on terrestrial planets. Why? combination of surface temperature, atoms mass and planetary evacuation rate. What determines whether a certain aod is retained by the planet's gravitational field? If the atom moves less than the speed of the planet's escape, it remains. If it moves faster than the speed of escaping, it goes out into outer space. We know from kinetic gas theory that the average speed of the atoms heap is determined by the temperature of the planet's surface. Remember our microscopic description of macroscopic quantities, such as pressure and temperature. Higher temperatures turn into higher atoms at speeds. Now consider the combination of elements in the atmosphere. Some atoms / molecules are low mass (H, It) some are heavy (CO_2, H_2O, etc.). Light elements move faster than heavy elements and can reach the evacuation rate. The second variable is the planet's surface temperature. The inner worlds are closer to the Sun, making it warmer. On the contrary, it is true for the northern planets, farther away from the Sun, making it colder. Combining the variables of escape rate (mass, planet radius) and surface temperature (distance from sun and atmospheric heating effects) is given in the following diagram. For the main elements, the lines are a draw to show where the element escapes from the planet. If the planet is below that line, that element will run away. So note that for the more difficult Jovian worlds, all primary, initial atmosphere takes place. But in the inner worlds, most of the original H and He were lost. Then these inner worlds will form a secondary atmosphere consisting of tectonic activities. Secondary atmosphere: Light, gaseous elements (H, He) are lost to warmer land worlds. The remaining elements are grouped into rocky materials (iron, olivin, pyroxen) and icy materials (H_2O, CO_2, CH_4, NH_3, SO_2). Glacial materials are more common in the Solar Operating System and are delivered to the internal Solar System in the form of commeters (see subsequent lecture). Rocky and glacial materials are mixed in the early crust and mantic. If the planet cools quickly, there is little or no tectonic activity, and the glacial materials are trapped in the mantia (see, for example, the moons of Galilee). If the planet has a large mass (which means a lot of trapped heat from the formation), then there is a lot of tectonic activity - > volcanic. Glacial materials in the warm mantia turn into gas and return to the surface of the planet to form a secondary atmosphere. Venus, Earth and Mars atmospheric (and, to some extent Titan) are secondary The composition of exhaust emissions is similar to Venus, Earth and Mars and consists of 58% H_2O, 23% CO_2, 13% SO_2, 5% N_2 and inert gas traces (No, Do, Kr). The latter evolution of this gas release is primarily determined by the temperature and chemistry of the planet's surface. Carefully remove this table, because all three planets had a similar secondary atmosphere, which evolved in very different ways. Note that H_2O is the main catalyst for secondary atmospheric evolution. On earth, the temperature was suitable for the formation of liquid water = oceans. CO_2 emissions are dissolved in liquid water for the production of carbonate rocks. Thus, the Earth had a depressing atmosphere. There was no liquid water in Venus (too hot) and therefore there was no room for CO_2 to dissolve. If the atmosphere is thickened and not lower-ranking elements become relevant when CO_2 disappears. For Earth, this meant that the atmosphere became primarily N_2-based, and later additions to O_2 from life forms. In Venus, CO_2 did not decrease and remained the main component of their atmosphere. On Mars, very soon after the formation there was a period of liquid water. However, there was not enough temperature to keep this water as a liquid, so it froze leaving CO_2 as the main component of the atmosphere. Also note how intia gas is a good trace of the amount of evolution experienced by the atmosphere. Inert gases do not react with other elements (they are inert). The atmosphere, which is thin and undergoes sudden changes in mass, has a high percentage of the gas insan gas. In this case, the martian atmosphere was frozen in the form of H_2O and CO_2 ice, leaving a large amount of gas in the intake. Thick atmospheres, such as Venus, have a small amount of inert gas, since most of the material that replaces remains on the planet's surface. Earth oxygen: Note that most O_2 released outgassing is locked in liquid H_2O. Since O_2 is very reactive, it needs to be constantly added. Some are released photodisintegration with H_2O vapors in the upper atmosphere. However, most O_2 in today's atmosphere is from the photosynthesis process associated with life forms. This occurred about 1 billion years after the Earth formed. The original secondary atmosphere of the Earth lacked much of O_2 and was rich in N_2 and CO_2. Plants are needed to replenish O_2, without plants all oxygen after a few 100 years turned into rocks. Greenhouse changes: The greenhouse effect is controlled by greenhouse gas emissions (mass) in the atmosphere. These gases are primarily H_2O, CO_2, CH_4, NH_3. In the secondary atmosphere of Venus, Earth and Mars, only CO_2 contributes significantly to the greenhouse effect (although note that the increase in CH_4 on Earth is due to animal and agricultural waste). The greenhouse effect currently raises the temperature of Venus, Earth and Mars in the following quantities: Mars -> +5 degrees Earth -> Degrees of Venus > +500 degrees Please note that the greenhouse effect on earth is only enough, so that we do not have an eternal ice age (a little greenhouse effect is right for you). Since Venus, the severe runaway greenhouse effect makes it the hottest place in the Solar System. Also note that Mars probably had a stronger greenhouse effect in the distant past. However, large amounts of CO_2 were turned into rocks in the early oceans of Mars. The atmosphere quickly sned the greenhouse effect, and the liquid H_2O turned into ice (cold death). The lesson to be learned here is that Mars and Venus are completely opposed to their evolution and the result of the greenhouse effect. The dynamics of the planetary atmosphere are unstable and complex, so that changes in the Earth's atmosphere, even small ones, are a very serious thing for those of us who need a place to live. Titan's atmosphere: One of the thickest atmospheres in the Solar System (2nd only Venus) is Titan. Titanium's current atmosphere is 90% N_2 and 7% CH_4 (methane). Because Titan has formed in the outer solar system, where it is much cooler, it contains more icy materials such as NH_3 (ammonia) and CH_4. NH_3 is easily separated into N_2 and H_2 by sunlight. N_2 retains titanium gravity (see diagram above), but H_2 escapes. So, over time, Titan created an N_2 atmosphere like Earth from the original secondary atmosphere that was much of NH_3. Note that the interaction between sunlight and CH_4 causes chemical reactions that produce hydrocarbons such as ethane, acetylene, propane; all of them were detected in titanium atmosphere. Hydrocarbons can merge into long molecular chains, called polymers. Polymer droplets can remain suspended in the atmosphere to form an aerosol (heavy smog), while others will drown to form a thick layer of resin on the surface. Titanium's secondary atmosphere is powered by cryovolcans, pumping methane and ammonia from the moon's mannea. Composition of the secondary atmosphere: in summary, the atmospheric composition of the terrestrial planet will be determined as follows: Distance from the Sun (planetary surface temperature) Mass and planetary radius = surface gravity = evacuation speed chemical reactions = different molecules are created and destroyed in various environments, higher temperatures mean faster reactions Geological activity = exhaust gas emissions, more activity = more outgassing = thicker atmospheric organisms = change composition through their waste products Why are the planets land small and rocky? The primary atmosphere boiled behind leaving a rocky core. Why did this happen? Distance from the Sun to the original worlds, the distance from the warm land moons of Jupiter or Saturn. Terrestrial planets are Earth-like planets consisting of rocks or metals with a hard surface. Terrestrial planets also have molten heavy metal cores, few moons and topological features such as valleys, volcanoes and craters. Our sun there are four terrestrial planets that are also the four closest to the sun: Mercury, Venus, Earth and Mars. During the formation of the solar system, it is likely that there were more terrestrial planetoids, but they either merged with each other or were destroyed. The definition of the planet of the International Astronomical Union is controversial. IAU defines the planet as the celestial body that is in orbit around the sun, has an almost round shape and has mostly cleared its orbital neighborhood of debris. Scientists are divided primarily on the third point, some say it's hard to define how much clearing the planet does, while others say how Pluto's world would be clear less than a world like Earth. This means that some astronomers claim that the dwarf planet Pluto should be classified as a planet, along with various other dwarf planets scattered throughout the Solar System. Terrestrial planets or our solar system: Mercury, Venus, Earth & Mars (Image Credit: Public Domain)MercuryMercury is the smallest terrestrial planet in the solar system, about one-third the size of Earth. It has a thin atmosphere, as a result of which it rotates between the burning and freezing temperature. Mercury is also a dense planet, which consists mainly of iron and nickel with an iron core. Its magnetic field is only about 1 percent of that Earth, and the planet has no known moons. The surface of mercury has many deep craters and is covered with a thin layer of small particles of silicates. In 2012, scientists found ample evidence of organic matter - building blocks of life - as well as water ice in craters colored from the sun. Mercury's thin atmosphere and proximity to the sun means that it is impossible for the planet to accept life as we know it. See also: Venus, which is about the same size as Earth, has a thick, toxic carbon monoxide-dominated atmosphere that holds heat, making it the hottest planet in the solar system. Venus has no known moons. A large part of the planet's surface is marked by volcanoes and deep canyons. The largest canyon in Venus stretches over the surface 4,000 miles (nearly 6,500 kilometers). And it is possible that at least some volcanoes on the planet are still active. Few spacecraft have ever penetrated Venus's thick atmosphere and survived. And it's not just spacecraft that have trouble getting through the atmosphere - there are fewer craters impacting Venus than other planets, because only the largest meteorites can make it. The planet is hostile to life as we know it. See also: EarthOf four terrestrial planets, Earth is the largest, and only one with large regions of liquid water. Water is essential for life, as we know it, and life is abundant on Earth - from the deepest oceans to the highest mountains. Like other terrestrial planets, the Earth has a rocky surface with mountains and canyons and a core of heavy metals. There is water vapor in the earth's atmosphere that helps to maintain moderation Temperature. The planet has regular seasons its surface; regions, esquater tend to stay warm, and spots closer to the poles are cooler and winter, icy. However, the Earth's climate is warming up due to climate change linked to man-made greenhouse gases that act as traps to escape the heat. The earth has a northern magnetic pole, which wanders heavily for tens of miles a year; some scientists say this may be an early sign of north and south magnetic poles flipping. The last big flip was 780,000 years ago. Earth has one large moon that astronauts visited in the 1960s and 1970s. See also: MarsMars is the largest mountain in the solar system, rising 78,000 feet (nearly 24 miles) above the surface. A large part of the surface is very old and filled with craters, but there are also geologically newer areas of the planet. At the martian poles are polar ice caps that retreat in size during martian spring and summer. Mars is less dense than Earth and has a smaller magnetic field that shows a solid core rather than a liquid one. While scientists have not yet found any evidence of life, Mars is known to be water ice and organic - some of the ingredients of living things. Evidence of methane was also found in some parts of the surface. Methane is produced from both live and dead processes. There are two small moons on Mars, Phobos and Deimos. The Red Planet is also a popular destination for spacecraft, given that the planet was able to live in ancient times. See also: In addition to the solar systemAction with your life, NASA's Kepler Space Observatory has discovered more than 2,300 approved alien planets and thousands more opportunities since January 2019. Kepler ran out of fuel in 2018, but many possible planet discoveries still need to be confirmed by further observations from other telescopes. Using telescope data, scientists estimate that there could be billions of earth-like planets in the Milky Way galaxy. [Infographic: A sky full of alien planets] launched in 2018 as a successor mission in Kepler called TESS (Transiting Exoplanet Survey Satellite). The spacecraft is designed to search for Earth-sized planets that are just a few light years away from our planet, allowing for quick observations of other telescopes on Earth. Since early 2019, TESS has already discovered a handful of planets; its first confirmed find was in September 2018. See also:Not terrestrial planetsNot all planets are terrestrial. In our solar system, Jupiter, Saturn, Uranium and Neptune are gas giants, also known as the Jovian planets. It is not clear what dividing line is between the rocky planet and the terrestrial planet; some super-Earths may have a liquid surface, for example. In our solar system, gas giants are much larger than terrestrial planets, and they have thick atmospheres full of hydrogen and helium. In Jupiter and Saturn, hydrogen and helium make up most of the planet, while the elements of Uranium and Neptune are Envelope. These planets are also unwelsing for life, as we know it, although in this region of the Solar System there are icy moons that can have habitable oceans. This article was updated Space.com Elizabeth Howell on February 8, 2019. Howell.