Which layer of the atmosphere are satellites in

The exosphere is the uppermost region of Earth's atmosphere as it gradually fades into the vacuum of space. The air in the exosphere is extremely thin - in many ways it is almost the same as the airless void of outer space.The layer directly below the exosphere is the thermosphere; the boundary between the two is called the thermopause. The bottom of the exosphere is sometimes also referred to as the exobase. The altitude of the lower boundary of the exosphere varies. When the Sun is active around the peak of the sunspot cycle, X-rays and ultraviolet radiation from the Sun heat and "puff up" the thermosphere - raising the altitude of the thermopause to heights around 1,000 km (620 miles) above Earth's surface. When the Sun is less active during the low point of the sunspot cycle, solar radiation is less intense and the thermopause recedes to within about 500 km (310 miles) of Earth's surface.Not all scientists agree that the exosphere is really a part of the atmosphere. Some scientists consider the thermosphere the uppermost part of Earth's atmosphere, and think that the exosphere is really just part of space. However, other scientists do consider the exosphere part of our planet's atmosphere.Since the exosphere gradually fades into outer space, there is no clear upper boundary of this layer. One definition of the outermost limit of the exosphere places the uppermost edge of Earth's atmosphere around 190,000 km (120,000 miles), about halfway to the Moon. At this distance, radiation pressure from sunlight exerts more force on hydrogen atoms than does the pull of Earth's gravity. A faint glow of ultraviolet radiation scattered by hydrogen atoms in the uppermost atmosphere has been detected at heights of 100,000 km (62,000 miles) by satellites. This region of UV glow is called the geocorona.Below the exosphere, molecules and atoms of atmospheric gases constantly collide with each other. However, the air in the exosphere is so thin that such collisions are very rare. Gas atoms and molecules in the exosphere move along "ballistic trajectories", reminiscent of the arcing flight of a thrown ball (or shot cannonball!) as it gradually curves back towards Earth under the pull of gravity. Most gas particles in the exosphere zoom along curved paths without ever hitting another atom or molecule, eventually arcing back down into the lower atmosphere due to the pull of gravity. However, some of the faster-moving particles don't return to Earth - they fly off into space instead! A small portion of our atmosphere "leaks" away into space each year in this way.Although the exosphere is technically part of Earth's atmosphere, in many ways it is part of outer space. Many satellites, including the International Space Station (ISS), orbit within the exosphere or below. For example, the average altitude of the ISS is about 330 km (205 miles), placing it in the thermosphere below the exosphere! Although the atmosphere is very, very thin in the thermosphere and exosphere, there is still enough air to cause a slight amount of drag force on satellites that orbit within these layers. This drag force gradually slows the spacecraft in their orbits, so that they eventually would fall out of orbit and burn up as they re-entered the atmosphere unless something is done to boost them back upwards. The ISS loses about 2 km (1.2 miles) in altitude each month to such "orbital decay", and must periodically be given an upward boost by rocket engines to keep it in orbit. Updated April 23, 2018 By Marty Simmons You can consider most satellites to be in space, but in terms of the Earth's atmosphere, they occupy regions called the thermosphere and the exosphere. The layer through which a satellite orbits depends on the satellite's function and the kind of orbit it has. Since the launch of Sputnik in the 1950s, spacefaring countries have put thousands of satellites into orbit around the Earth and even other planets. They serve many different purposes, from complex space stations like the International Space Station to the Global Positioning System that helps you find your way home. The thermosphere is a region of very high temperature that extends from the top of the mesosphere at around 85 kilometers (53 miles) up to 640 kilometers (400 miles) above the Earth's surface. It is called the thermosphere because temperatures can reach up to 1,500 degrees Celsius (2,732 degrees Fahrenheit). However, despite the high temperatures, the pressure is very low, so satellites don't suffer heat damage. Above the thermosphere sits a final layer called the exosphere, which extends up to 10,000 kilometers (6,200 miles) above the Earth, depending on how it is defined. Some definitions of the exosphere include all space up until the point where atoms get knocked away by solar wind. No distinct upper boundary exists since the exosphere has no pressure and molecules float freely here. Eventually, the exosphere gives way to space outside of the Earth's influence. The lowest-orbiting satellites occupy Low Earth Orbit, or LEO, which includes any orbit below 2,000 kilometers (1,243 miles). Satellites at this altitude circle the Earth very quickly and their orbits degrade faster, which means they eventually fall back to Earth if not kept up by thrusters. The International Space Station is in LEO and most satellites in LEO fly through the thermosphere, though those at the upper limit of LEO reach into the exosphere. Scientific research satellites are typically put into LEO so they can more closely monitor activities on Earth. Satellites above LEO all orbit through the exosphere and can maintain their orbits for decades without adjustment. Weather and communication satellites occupy higher orbits because they need longer views of a given area of the planet to either carry transmissions or record data. At the top of High Earth Orbit is geosynchronous orbit. Any satellite here will have an orbital period the same as the Earth's. A special type of geosynchronous orbit is the geostationary orbit, which runs along the equator. This keeps the satellite at the same point in the sky throughout the entire orbit. Layers of the atmosphere: troposphere, stratosphere, mesosphere and thermosphere.Credit: Randy Russell, UCAREarth's atmosphere has a series of layers, each with its own specific traits. Moving upward from ground level, these layers are named the troposphere, stratosphere, mesosphere, thermosphere and exosphere. The exosphere gradually fades away into the realm of interplanetary space.TroposphereThe troposphere is the lowest layer of our atmosphere. Starting at ground level, it extends upward to about 10 km (6.2 miles or about 33,000 feet) above sea level. We humans live in the troposphere, and nearly all weather occurs in this lowest layer. Most clouds appear here, mainly because 99% of the water vapor in the atmosphere is found in the troposphere. Air pressure drops, and temperatures get colder, as you climb higher in the troposphere.StratosphereThe next layer up is called the stratosphere. The stratosphere extends from the top of the troposphere to about 50 km (31 miles) above the ground. The infamous ozone layer is found within the stratosphere. Ozone molecules in this layer absorb high-energy ultraviolet (UV) light from the Sun, converting the UV energy into heat. Unlike the troposphere, the stratosphere actually gets warmer the higher you go! That trend of rising temperatures with altitude means that air in the stratosphere lacks the turbulence and updrafts of the troposphere beneath. Commercial passenger jets fly in the lower stratosphere, partly because this less-turbulent layer provides a smoother ride. The jet stream flows near the border between the troposphere and the stratosphere.MesosphereAbove the stratosphere is the mesosphere. It extends upward to a height of about 85 km (53 miles) above our planet. Most meteors burn up in the mesosphere. Unlike the stratosphere, temperatures once again grow colder as you rise up through the mesosphere. The coldest temperatures in Earth's atmosphere, about -90° C (-130° F), are found near the top of this layer. The air in the mesosphere is far too thin to breathe; air pressure at the bottom of the layer is well below 1% of the pressure at sea level, and continues dropping as you go higher.ThermosphereThe layer of very rare air above the mesosphere is called the thermosphere. High-energy X-rays and UV radiation from the Sun are absorbed in the thermosphere, raising its temperature to hundreds or at times thousands of degrees. However, the air in this layer is so thin that it would feel freezing cold to us! In many ways, the thermosphere is more like outer space than a part of the atmosphere. Many satellites actually orbit Earth within the thermosphere! Variations in the amount of energy coming from the Sun exert a powerful influence on both the height of the top of this layer and the temperature within it. Because of this, the top of the thermosphere can be found anywhere between 500 and 1,000 km (311 to 621 miles) above the ground. Temperatures in the upper thermosphere can range from about 500° C (932° F) to 2,000° C (3,632° F) or higher. The aurora, the Northern Lights and Southern Lights, occur in the thermosphere.ExosphereAlthough some experts consider the thermosphere to be the uppermost layer of our atmosphere, others consider the exosphere to be the actual "final frontier" of Earth's gaseous envelope. As you might imagine, the "air" in the exosphere is very, very, very thin, making this layer even more space-like than the thermosphere. In fact, the air in the exosphere is constantly - though very gradually - "leaking" out of Earth's atmosphere into outer space. There is no clear-cut upper boundary where the exosphere finally fades away into space. Different definitions place the top of the exosphere somewhere between 100,000 km (62,000 miles) and 190,000 km (120,000 miles) above the surface of Earth. The latter value is about halfway to the Moon!IonosphereThe ionosphere is not a distinct layer like the others mentioned above. Instead, the ionosphere is a series of regions in parts of the mesosphere and thermosphere where high-energy radiation from the Sun has knocked electrons loose from their parent atoms and molecules. The electrically charged atoms and molecules that are formed in this way are called ions, giving the ionosphere its name and endowing this region with some special properties.

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