

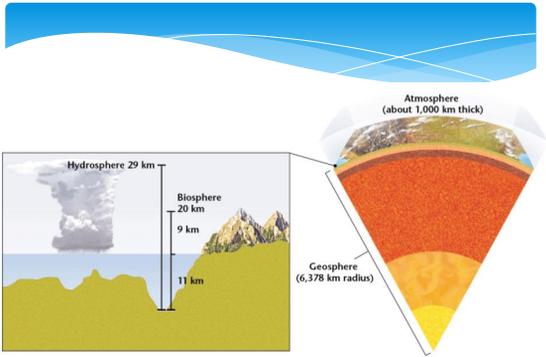
The Atmosphere

Composition and Structure

The Atmosphere

- * All energy on Earth ultimately derives from the sun
- * Energy is intense, though, and could cook Earth
- * Atmosphere is a thin layer of air that protects the Earth's surface from extreme temperatures and harmful sun rays

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Atmospheric Composition

- * Early atmosphere was much different than today
- * Volcanoes produced nitrogen and carbon dioxide, but little oxygen
- * More than 2 billion years ago, early organisms began producing oxygen
- * Eventually, oxygen formed an ozone layer that protected Earth from harmful rays
- * Green plants and diverse life forms developed

Atmospheric Gases

- * Nitrogen - 78%
- * Oxygen - 21%
- * Water Vapor - 0 to 4%
 - * Used for clouds and precipitation
- * Carbon Dioxide - .037%
 - * Keeps Earth warm and is used by plants to make food
- * Argon - .93%
- * Traces of neon, helium, methane, krypton, xenon, hydrogen, and ozone

The Layers

- * Four official layers
- * One extra, space-y layer
- * Divided primarily by temperature

Altitude (km) / Altitude (mi)

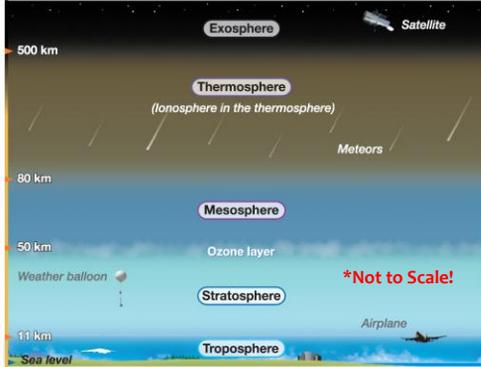
Temperature (°C) / Temperature (°F)

Layers: THERMOSPHERE, MESOSPHERE, STRATOSPHERE, TROPOSPHERE

Boundaries: Tropopause, Stratopause, Mesopause

Other: Ozone maximum

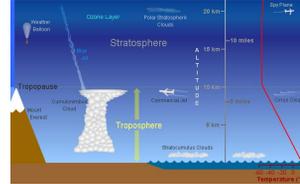
Layers in the Atmosphere



Troposphere

Lowest layer – extends up to 10km; contains 99% of the water vapor and 75% of the atmospheric gases

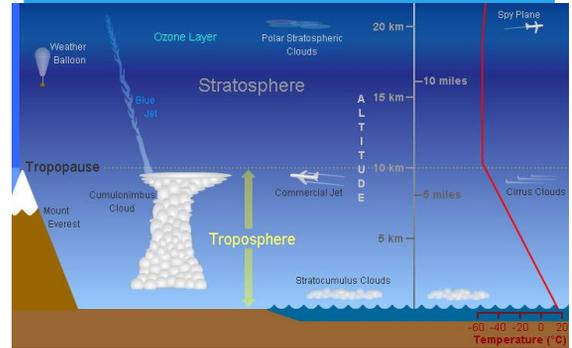
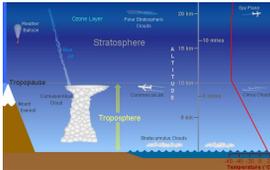
- * Weather here
- * Most of the layer's heat is from Earth
- * Temperature cools about 6.5 degrees Celsius per kilometer of altitude.



Stratosphere

Directly above troposphere, extending from 10 km to about 50 km above Earth's surface

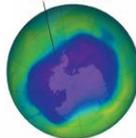
- * Portion of the upper layer contains high levels of a gas called ozone
- * Many jet aircrafts fly in the stratosphere because it is very stable. Also, the ozone layer absorbs harmful rays from the Sun.



The Ozone Layer

- * About 19 km to 48 km above Earth in the stratosphere (90%) and troposphere (10%).
- * Layer of 3-atom molecules that protects the Earth from the Sun's harmful ultraviolet radiation
- * Life depends on the ozone layer!
- * Pollutants called chlorofluorocarbons (CFCs) are destroying the ozone
- * Ozone layers has a large hole over Antarctica and a smaller one over the North Pole

The largest hole in the ozone layer ever observed. (September 24, 2009)



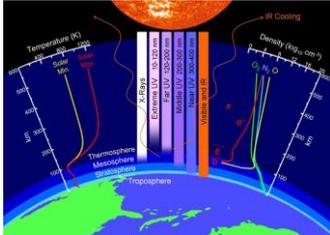
Mesosphere

- * Extends from the top of the stratosphere to about 85 km above Earth
- * Coldest layer with little ozone
- * Meteors or rock fragments burn up in the mesosphere.
- * Small portion of Ionosphere here – layer of charged particles that influence atmospheric magnetism and radio communications



Thermosphere

- * Thickest atmospheric layer found between 85 km and 500 km above Earth's surface
- * The thermosphere is a layer with auroras, known for its high temperatures.
- * Warmed as it filters out X-rays and gamma rays from the Sun
- * Ionosphere here, too



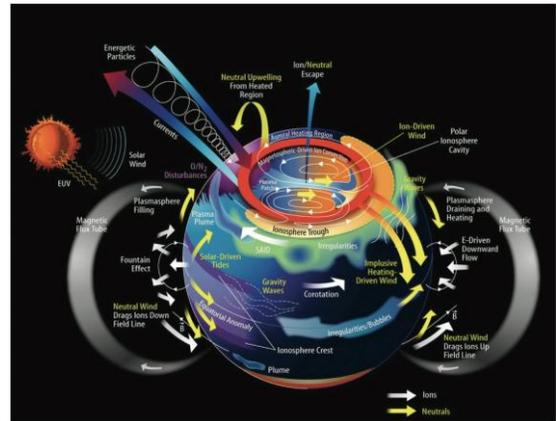
Exosphere

- * Where the atmosphere merges into space in the extremely thin outermost atmosphere.
- * Upper limit of our atmosphere—some scientists debate whether or not it is properly “atmospheric” because it’s virtually empty
- * Where space shuttle orbits, final tiny part of ionosphere



Temperature in atmospheric layers

- * The troposphere is warmed primarily by the Earth's surface; temperature **decreases** as altitude increases in this layer.
- * Temperatures **increase** as altitude increases in the stratosphere, particularly in the upper portion – ozone
- * Temperatures **decrease** with altitude in the mesosphere
- * Thermosphere and exosphere are the first to receive Sun's rays, so they are very **hot**



Heat

Energy that flows from an object with a higher temperature to an object with a lower temperature

- * Heat is transferred through the atmosphere by radiation, convection, conduction
- * Molecules move closer together, making air more dense, and air pressure increases
- * Cold air sinks, pushing up warm air, which then cools and sinks, pushing up more warm air

