

# Chapter 5

## The Earth's Atmosphere

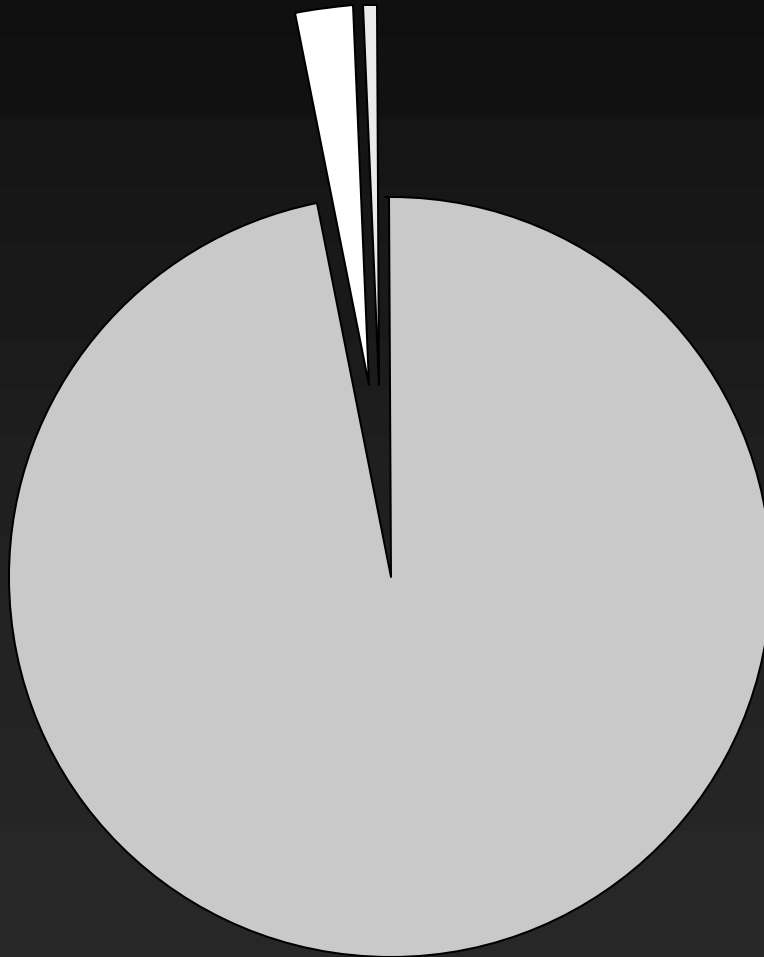
# Layers of the Earth

- Earth largest of the inner planets
- Gravity strong enough to hold gases.
- Lots of spheres
- Equator divided the Earth into two hemispheres
- Lithosphere- solid surface
- land areas of the Earth
  - 30 % as continents
  - 70% beneath oceans

# Hydrosphere

- Hydro= water
- Includes oceans, lakes, rivers, streams, other bodies of water
- and ice caps and glaciers
- 97 % of water is salt water
- 3% fresh water
- 85% of fresh water is locked in ice caps.
- Not evenly distributed

# Hydrosphere



- Salt water
- Ice caps
- Fresh water

# Atmosphere

- The envelope of gases that surround the Earth
- Protects the Earth
- Provides material necessary for life.
- Has changed greatly over time

# Past Atmosphere

- When Earth formed 4 billion years ago—mainly two deadly gases- methane and ammonia
- Methane –  $\text{CH}_4$  is natural gas
- Ammonia-  $\text{NH}_3$
- Also contained water vapor.
- 3.8 billion years ago sunlight powered chemical reactions
- Ammonia broke down into nitrogen and hydrogen

# Past Atmosphere

- Methane broke down and made carbon dioxide and hydrogen
- Lightweight hydrogen escaped into space
- Leaving lots of nitrogen, some carbon dioxide and water.
- First life- organisms deep in the ocean protected from UV
- Blue-green bacteria began photosynthesis
- Turn carbon dioxide to oxygen

# Atmosphere changes

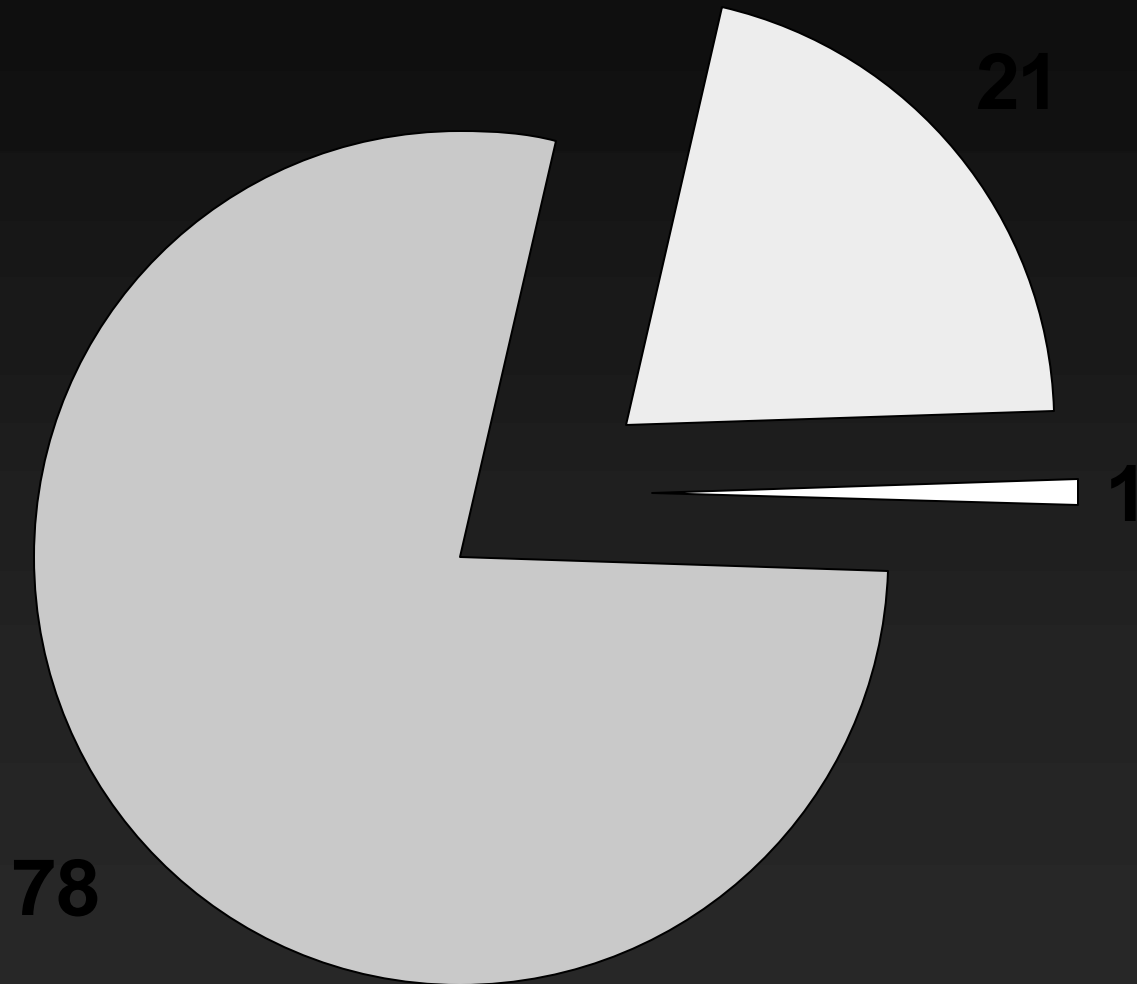
- Oxygen rose to upper atmosphere
- Changed to ozone (O<sub>3</sub>)
- Ozone layer 30 km up
- Absorbs UV, protecting the Earth, making life possible
- Green plants greatly increased the amount of oxygen
- About 600 million years ago amounts of carbon dioxide and oxygen leveled off






# Present Atmosphere

- 78 % Nitrogen
- 21 % hydrogen
- 1 % other
  - Carbon dioxide
  - Water vapor
  - Argon
  - Trace gases
    - Neon
    - Helium
    - Krypton
    - Xenon

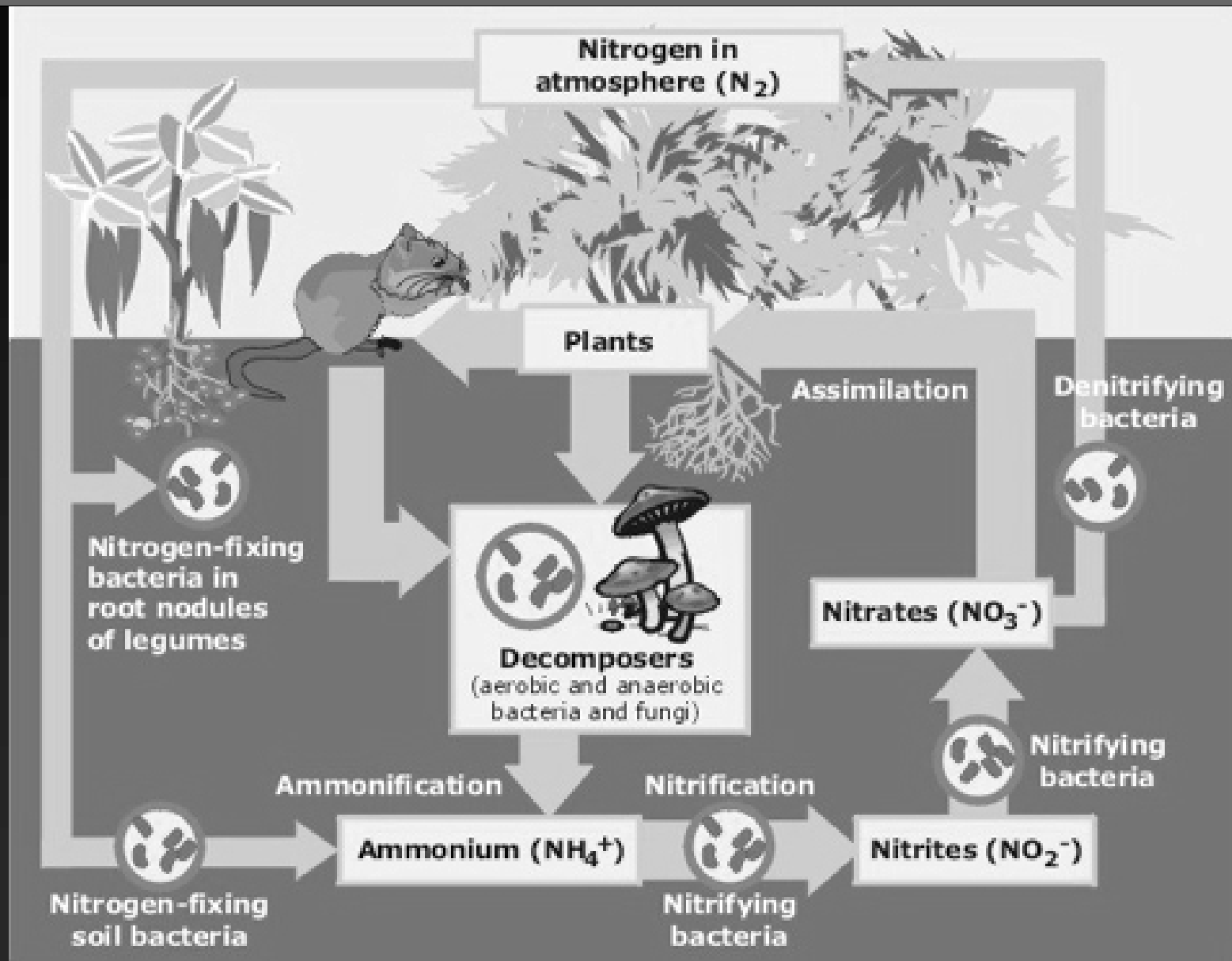
# Present Atmosphere



-  Nitrogen
-  Oxygen
-  Other

# Nitrogen

- Most abundant
- Needed for proteins
- Needed for plant and animal growth
- Unreactive, only certain bacteria can change it to nitrates
- Some plants can turn nitrates to proteins
- Animals eat the plants
- Dead things decay back to nitrogen
- Nitrogen cycle



# Oxygen

- Used directly by most plants and animals
- Essential for respiration- combine with oxygen to produce energy
- Necessary for combustion

# Carbon dioxide

- Used by plants to make food during photosynthesis
- Produced during respiration, decay, and combustion
- Burning fossil fuels releases so much it behaves like a greenhouse gas, raising global temperature

# Water Vapor

- Plays an important role in weather
- Heating and cooling of the atmosphere
- Energy used to evaporate water keeps ocean air cooler
- Solid particles
  - Salt from ocean water
  - Dust from volcanoes
  - From burning fuels

# Layers of the Atmosphere

- Atmosphere varies as you increase the height
  - In composition
  - In Temperature
  - In Pressure
- Separated into layers by temperature
- Push of gravity on air causes air pressure



# Troposphere

- Layer closest to Earth
  - At equator- 17 km thick
  - At poles 6 - 8 km thick
- Sunlight heats the ground
- Then the ground heats the air.
- Warm air rises and cold air sinks
- Form convection currents which carry heat up into atmosphere

# Troposphere

- Temperature decreases  $6.5^{\circ}\text{C}$  for every kilometer
- Until you get to 12 km, then temperature is constant
- Layer is called the tropopause
- Separates from next layer

# Stratosphere

- From the Troposphere to 50 km
- Lower stratosphere very cold near  $-60^{\circ}\text{C}$
- In lower stratosphere strong (320 km/hr) eastward blows winds called the jet stream
- A special layer of ozone forms in the stratosphere
- Protects Earth from ultraviolet which harms living things and causes skin cancer and sunburns

# Stratosphere

- Upper atmosphere warms as it absorbs ultraviolet
- Warms to 18 °C
- Highest temperature region is called the stratopause
- Separates from next layer

# Mesosphere

- Above stratosphere temperature drops to about  $-100\text{ }^{\circ}\text{C}$
- From 50-80 km above Earth
- Coldest region of the atmosphere
- Protects from meteoroids.
- This is where most burn up

# Thermosphere

- From 80 km up
- Very thin atmosphere
- High temperatures up to 2000 °C
- From absorbing Ultraviolet light
- The high temperature would not be felt because particles are so far apart.
- Thermosphere broken into layers

# Ionosphere

- Lowest layer of the thermosphere
- 80-550 km
- Gas particles absorb x-rays and ultraviolet and become electrically charged ions
- AM radio signals bounce off this layer, so they can travel a long distance
- Solar flare disturb this layer and cause static in radio signals

# The Exosphere

- Upper Thermosphere –550 km up to thousands of km
- Air is very very thin
- Where artificial satellites orbit