

Chapter 1 - Dynamic Earth

- The Earth is an integrated system consisting of rock, air, water and living things

Rock = **GEOSPHERE**

Air = **ATMOSPHERE**

Water = **HYDROSPHERE**

Biosphere = **All living things**

The Geosphere

The Composition of the Earth

- Earth can be divided into 3 layers
- each layer becomes more **Dense** as you get to the center

1) **CRUST**

- thin outer layer (5-70 km thick)
- made of light elements
- less than 1% of planet's mass

2) **MANTLE**

- around 2900 km thick
- made of medium density rocks
- makes up 64% of Earth's mass

3) **CORE**

- has a radius of 3400 km
- made of the densest elements

The Geosphere

The Structure of the Earth

- Earth can be divided into 5 layers based on physical characteristics

1) **Lithosphere**

- cool rigid layer
- contains crust and upper part of the mantle
- divided into larger tectonic plates

2) **Asthenosphere**

- solid plastic layer of the mantle
- flows very slowly and allow tectonic plates to slide on top

3) **MESOSPHERE**

- the lower part of the mantle

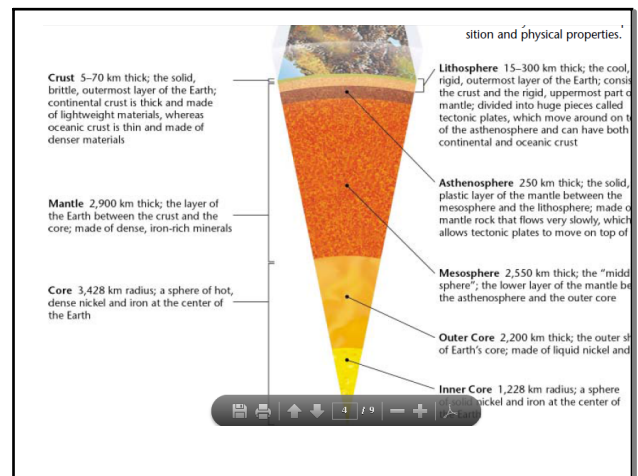
4) **OUTER CORE**

- dense liquid layer made of nickel and iron

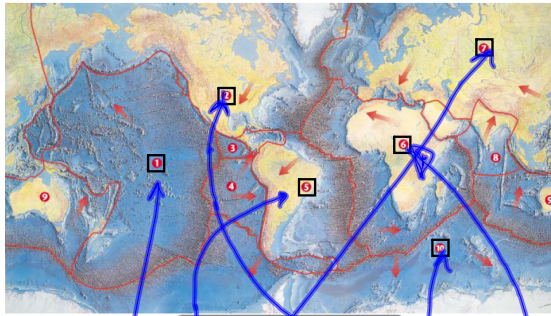
5) **INNER CORE**

- a solid sphere of nickel and iron
- temps of 4000-5000 °C

How can the inner core be so hot yet solid???



Tectonic Plates



There are 10 tectonic plates but 6 major ones

Pacific plate

North American Plate

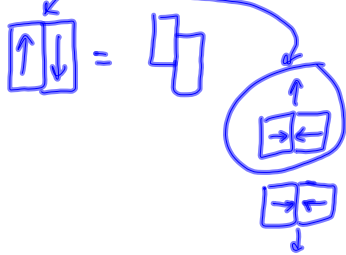
South American plate

African plate

Eurasian plate

Antarctic plate

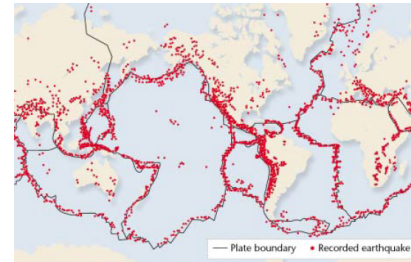
- These plates run into each other, pull apart from one another, and slip past one another. This causes earthquakes, volcanic eruptions, and mountains to form



Earthquakes

- vibrations of the Earth's crust caused by slippage along a fault

a break in the Earth's crust that allows pieces of the crust to slide relative to one another.

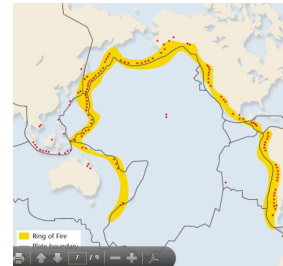


Volcanoes

- a mountain built from magma that rises from the Earth's interior to the surface

melted rock

Ring of Fire - an area that contains 75% of the world's active volcanoes that are on land



Erosion

- the surface of the Earth is constantly battered by wind and water which moves rock and changes its appearance

Erosion - the removal and transport of surface material

- rock will get smoother as time passes

ex. Appalachian mountains vs. Rocky mountains

The Atmosphere

The atmosphere is a cloud of gas and suspended solids extending from the Earth's surface out many thousands of miles, becoming increasingly thinner with distance but always held by the Earth's gravitational pull.

It is the BUBBLE in which we live.

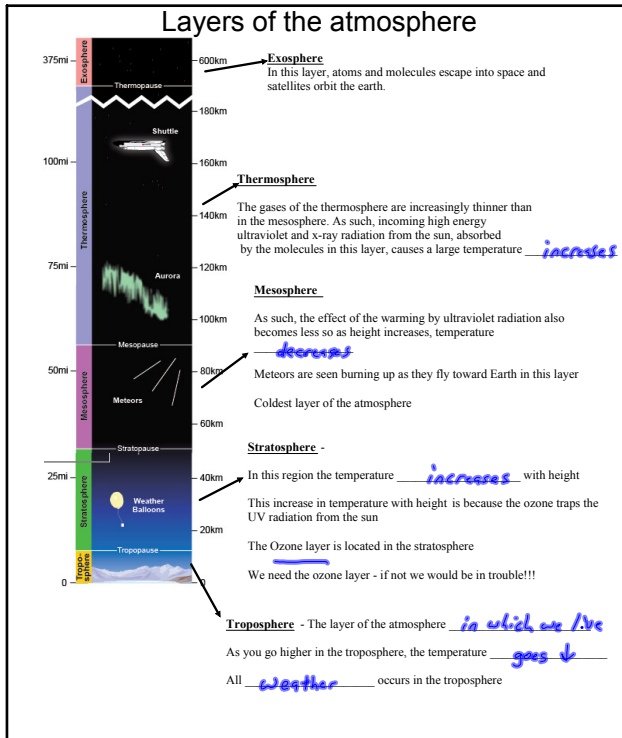
It insulates the Earth and helps keep it at a temperature that supports life

Gases are constantly being added and removed to the atmosphere by a variety of things.

ex. photosynthesis → remove CO₂ → add O₂ cell respiration → remove O₂ → add CO₂

The atmosphere is composed of many gases but 4 are most important

| Gas | Symbol | Content |
|------------------|------------------|-------------------------|
| Nitrogen | N ₂ | 78.084% |
| Oxygen | O ₂ | 20.947% |
| Argon | Ar | 0.934% |
| Carbon dioxide | CO ₂ | 0.033% |
| Neon | Ne | 18.20 parts per million |
| Helium | He | 5.20 parts per million |
| Krypton | Kr | 1.10 parts per million |
| Sulfur dioxide | SO ₂ | 1.00 parts per million |
| Methane | CH ₄ | 2.00 parts per million |
| Hydrogen | H ₂ | 0.50 parts per million |
| Nitrous oxide | N ₂ O | 0.50 parts per million |
| Xenon | Xe | 0.09 parts per million |
| Ozone | O ₃ | 0.07 parts per million |
| Nitrogen dioxide | NO ₂ | 0.02 parts per million |
| Iodine | I ₂ | 0.01 parts per million |
| Carbon monoxide | CO | trace |
| Ammonia | NH ₃ | trace |



Energy in the Atmosphere

Conduction

- Transfer of heat from one substance to another by contact
- molecule to molecule transfer of heat
- the flow of heat goes from the Hot object to the cold object
- good within metals, bad within air

ex. putting hand on stove

Radiation

- transfer of heat through space by electromagnetic radiation
- most of the sun's electromagnetic radiation is in the form of visible light, but may also include UV and infrared

ex. Fire

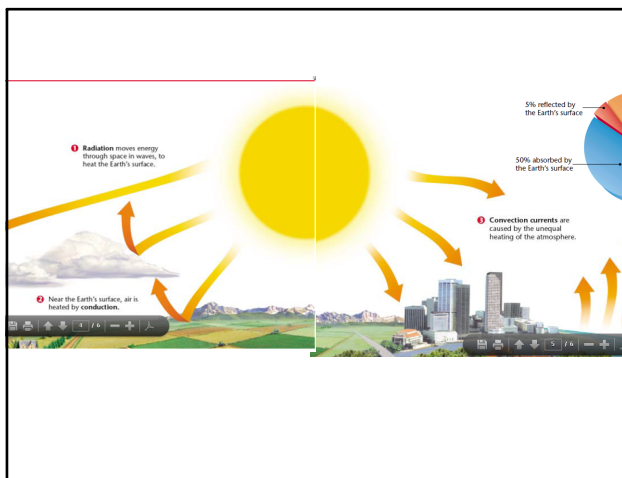
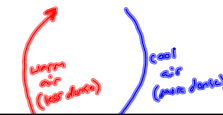
Convection

- the transfer of heat energy in a fluid (atmosphere is fluid)
- deals with density of warm and cool air
- warm air will rise, cool and sink back down (we feel as wind) where will warm again. This creates convection currents

responsible for weather patterns in the troposphere

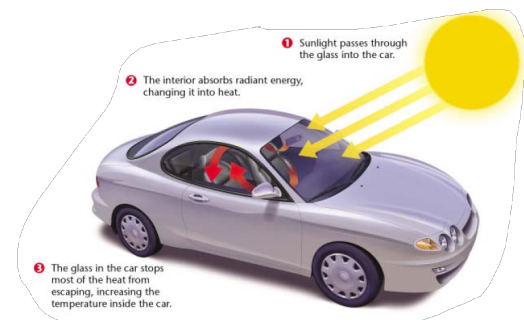
more dense → sink
less dense → float

Cool air → more dense
Warm air → less dense



The Greenhouse Effect

- The process in which greenhouse gases trap heat near the surface of the Earth
↳ CO₂, H₂O
 - Gases in the atmosphere act like the glass in a car
- 1) Sun penetrates the atmosphere and heats the Earth
 - 2) The Earth's surface radiates heat back into the atmosphere
 - 3) Some heat escapes, but some is absorbed by greenhouse gases which heats the air and sends it back to the surface

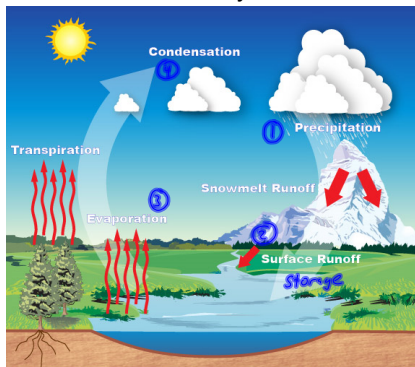


Without the Greenhouse effect the Earth would be too cold to support life

The Hydrosphere

- 98% of the water on Earth is Salt H₂O water from oceans/seas
- 2% is Fresh H₂O water from rivers, lakes, streams, glaciers, ice caps, etc

Water Cycle



- ① Precipitation → H₂O falling from sky
- snow, hail, sleet, rain, etc.
- ② Runoff / Storage
- ③ Evaporation → liquid to gas
H₂O to H₂O vapor
Transpiration → evaporation from plants
- ④ condensation → gas to liquid
H₂O vapor to H₂O

The Biosphere

- The portion of our planet where life can be found
- Apple analogy..... Biosphere would be skin
- The biosphere is made up...
 - 1) the upper most part of the geosphere
 - 2) most of the Hydrosphere
 - 3) lower part of the atmosphere

Life requires 3 things

- 1) liquid water
- 2) temperatures between 10 and 40 °C
- 3) source of energy (cycles)



Energy Flow in the Biosphere

- Energy is constantly being fed into the biosphere by the Sun
- Matter is not added to the biosphere so it must be cycled through
 - ex. if an organism dies it breaks down and the nutrients become available for other organisms to use
- Closed system - Energy enters the environment but matter does not
 - Earth is a closed system
- Open system - both matter and energy are exchanged
 - happened with early Earth and its collisions with comets and meteorites