HEATING THE ATMOSPHERE
17.2 NOTES

Aug. 2014
Heat vs Temperature

- **Heat** is the energy transferred from one object to another because of a difference in their temperature.
- **Temperature** is a measure of the average kinetic energy in a substance.
- Three mechanisms of energy transfer as heat are **conduction**, **convection**, and **radiation**.
  - All three processes happen simultaneously in the atmosphere.
Mechanisms of Heat Transfer

- Heat is **conducted** through materials **traveling** from the **higher** temperature to the **lower** temperature — that’s why the handle of a pan can feel hot sometimes.

- **Convection** is the **circular** motion of matter carrying **hot** matter to the **top** and **cool** matter to the **bottom**.

- **Radiation** travels out in **all** directions from its source. Can travel through the vacuum of space.
When radiation strikes an object, there usually are **three** different results.

- Some energy is **absorbed** by the object.
- Substances such as water and air are **transparent** to certain wavelengths of radiation (Transmitted).
- Some radiation may **bounce** off the object without being absorbed or transmitted. (Reflection & Scattering)
Reflection is the process whereby light bounces back from an object at the same angle at which it encounters a surface and with the same intensity.

Scattering is the redirecting (in all directions) of light by small particles and gas molecules in the atmosphere. The result is more light rays with weaker intensity.
Solar Radiation Continued

- 100% of Solar Radiation
  - 5% scattered back into space by the atmosphere
  - 20% reflected by clouds
  - 20% absorbed by the atmosphere (CO₂) and clouds (water vapor)
  - 50% absorbed by the land and sea
  - 5% reflected from the land and sea surface
Solar radiation

30% lost to space by reflection and scattering

5% backscattered to space by the atmosphere

20% reflected from clouds

20% of radiation absorbed by atmosphere and clouds

50% of direct and diffused radiation absorbed by land and sea

5% reflected from land-sea surface
TEMPERATURE CONTROLS

17.3 NOTES

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Major Spheres

The Earth is divided into 4 major spheres:

- **Hydrosphere** – water
- **Atmosphere** – air
- **Geosphere** – Earth (land)
- **Biosphere** – Life
Causes of Temperature Change

- There are 6 factors that affect temperature
  - Differences in the receipt of solar radiation
    - Variations in the angle of the sun’s rays and length of daylight depend on latitude
  - Heating of land and water
  - Altitude
  - Geographic position
  - Cloud cover
  - Ocean currents
Land and Water

- Land heats more rapidly and to higher temperatures than water.
- Land also cools more rapidly and to lower temperatures than water.
- Therefore, temperature variations are considerably greater over land than over water.
Mean Monthly Temperatures for Vancouver and Winnipeg
Geographic Position & Altitude

- The geographic setting can greatly influence temperatures experienced at a specific location.

Examples:
- Areas located nearer a body of water experience cooling from that water.
- Mountains act as barriers — hence why we tend to be warmer.

- The higher in altitude, the lower the temperatures.
Mean Monthly Temperatures for Eureka and New York City
Mean Monthly Temperatures for Guayaquil and Quito
Cloud Cover

- During the **day**, clouds act as a **reflecting** device keeping the temperatures **lower**
  - **Albedo** is the fraction of total radiation that is reflected by **any** surface.

- During the **evening**, clouds act as a **blanket** by absorbing radiated heat from the Earth and re-radiating it back toward the **surface** keeping the temperatures from lowering too much
Clouds Reflect and Absorb Radiation
Isotherms are lines that connect points that have the same temperature.