

Chapter 2- Solar Radiation and the Seasons

Understanding Weather and Climate
Aguado and Burt

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The Definition of Energy

- The ability to do work
- Types
 - Kinetic – the energy of motion
 - Potential – stored energy

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Energy Transfer

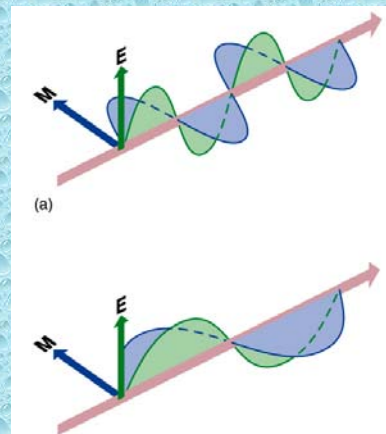
- Conduction
 - Movement of heat without movement of molecules in the direction of heat transfer
- Convection
 - Transfer of heat by mixing of a fluid
- Radiation
 - Transfer of energy by electronic and magnetic waves

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Radiation Quality and Quantity

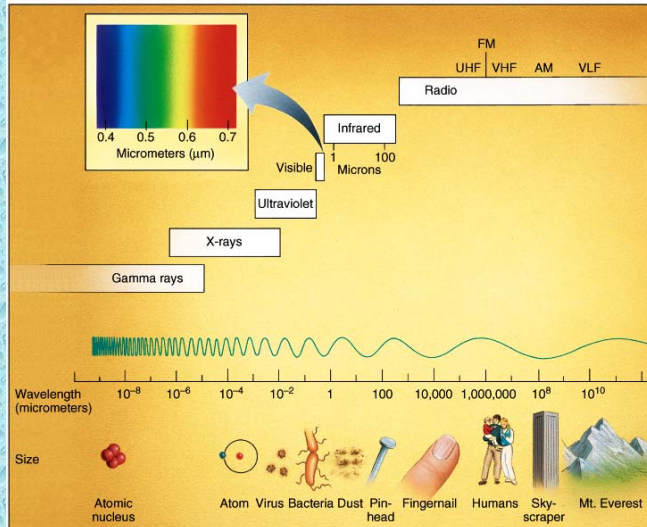
- The amplitude corresponds to the energy carried
- The wavelength corresponds to the type



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Electromagnetic Energy Spectrum



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Emitted Radiation

- Stefan-Boltzman Law

$$I = \sigma T^4$$

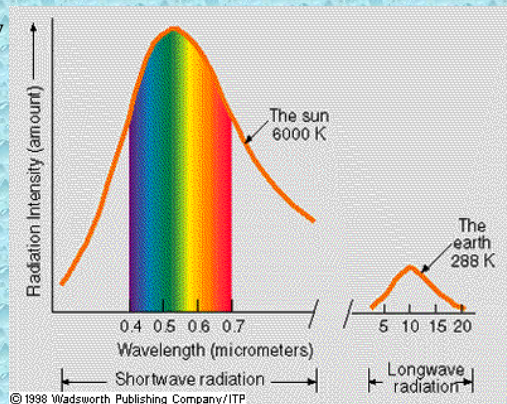
$$I = \epsilon \sigma T^4$$

- Governs how much energy is radiated

- Wien's Law

$$\lambda_{\max} = \text{constant} / T$$

- Governs wavelength radiated at greatest intensity



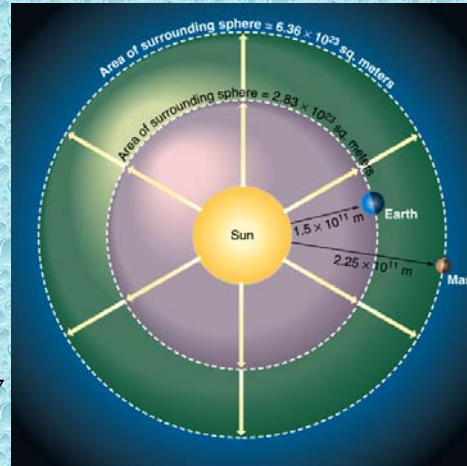
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The Solar Constant

- Inverse Square Law
- Solar Energy = Solar emission / $4\pi R^2$
 - Solar Emission = 3.865×10^{26} W
 - R = radius of surrounding sphere
 - Solar constant = 1367 W/m^2 (EARTH)



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Revolution of the Earth

- The Earth revolves around the sun in an elliptical path.
- The Earth is actually closest to the sun on January 3 (perihelion).
- The Earth is actually farthest from the sun on July 3 (aphelion).

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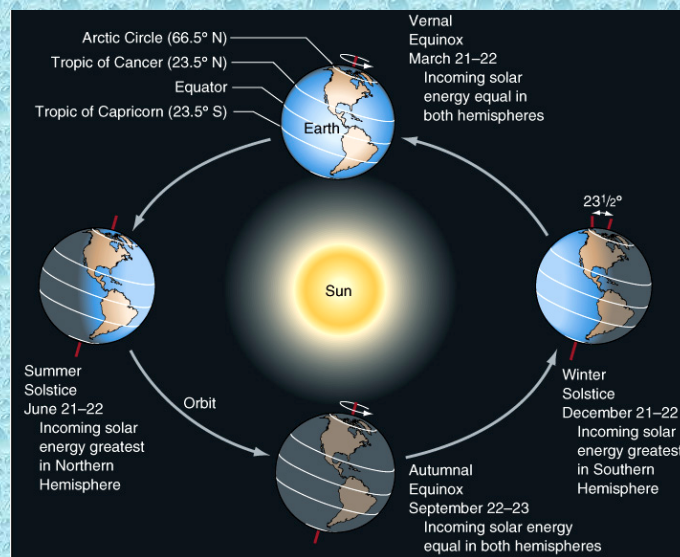
Rotation of the Earth

- The earth rotates (like a top) every 24 hours.
- The Earth is tilted at 23.5° towards Polaris (the North Star).

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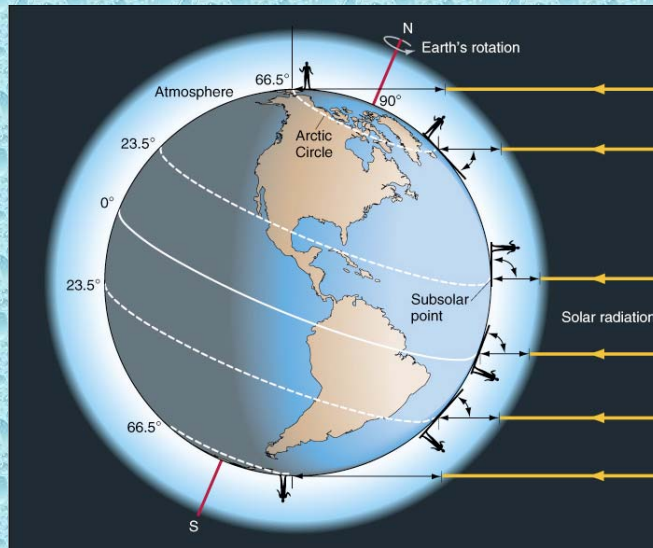
The Seasons



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Subsolar Points



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Picture is for
Summer
Solstice



Effects of Changing Orientation of the Earth

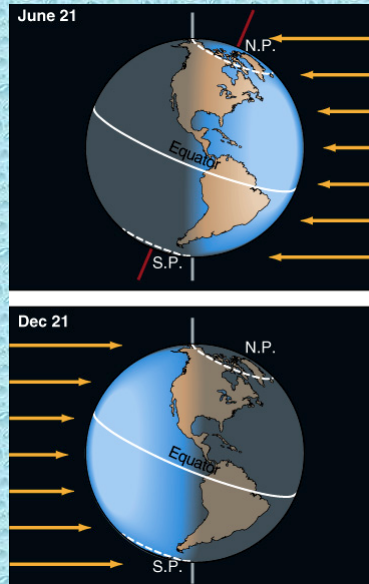
- Length of daylight
- Angle at which the sunlight hits the surface
- The amount of atmosphere the Sun's radiation must penetrate to reach the Earth's surface.

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Period of Daylight

- Arctic Circle – 66.5° N Latitude
- Antarctic Circle – 66.5° S Latitude

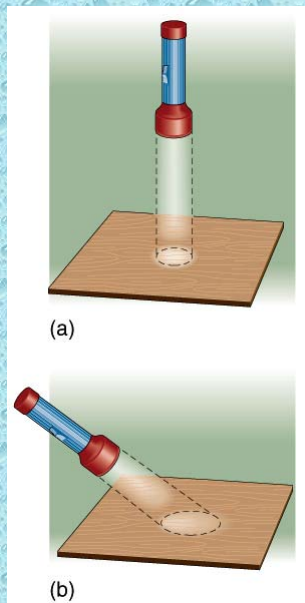


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Solar Angle

- Beam Spreading – increase in surface area over which the radiation is distributed in response to a decrease in solar angle.

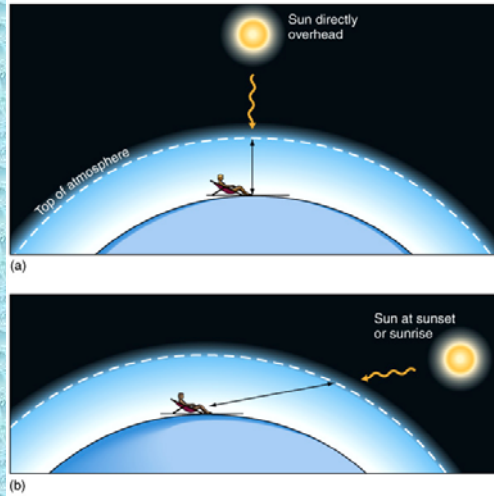


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Beam Depletion

- The amount of atmosphere the sunlight must penetrate to reach the Earth's surface.



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