Radiation Key Terms

Absorption is when a photon is taken in by matter, such as by the electron shell change of an atom, molecular spin, and molecular vibration. The electromagnetic energy is transformed into internal energy of the absorber.

Albedo is the reflectance of solar radiation from a surface, often a planetary surface; however, this term may refer to the reflectance of any incoming radiation.

Blackbody radiation is the theoretical broad spectrum electromagnetic radiation emitted from any object with a temperature above absolute zero (0 K or 273.15ºC). Blackbodies are perfect emitters and perfect absorbers, which doesn't actually occur in nature. But they have helped scientists model maximum power spectrum that can be emitted from objects. For real-world objects, we call it *thermal radiation*.

Electromagnetic spectrum is the range of wavelengths / frequencies of the electromagnetic radiation found in nature. 1 nm = 10^{-9} m

> **Gamma Rays** have wavelengths < $6x10^{-12}$ m (0.006 nm).
>
> **X-Rays** have wavelengths between 0.006 nm to 8 nm.
>
> **Ultraviolet** has wavelengths between 8 and 380 nm.
>
> **Visible Light** has wavelengths between 380 and 760 nm.
>
> **Infrared** has wavelengths between 760 and 1,000,000 nm (1 mm or 0.001 m).
>
> **Microwaves** have wavelengths between 1 mm and 0.3 m.
>
> **Radio Waves** have wavelengths > 0.3 m.
>
> From http://science.jrank.org/pages/2368/Electromagnetic-Spectrum.html

Emission of a photon from atom, molecule or subatomic particle. Reduces the energy of the material that emits the photon.

Frequency of a wave, which includes how electromagnetic radiation moves, is the number of oscillations in a second. Frequency is inversely related to wavelength - higher frequencies have shorter wavelengths.

Greenhouse effect is the capturing of the sun's heating in a planet's lower atmosphere due to the greater transparency of the atmosphere to shorter wavelength radiation (visible light and near infrared) from the Sun than to longer wavelength radiation (mid and far infrared) emitted from the warmed planet's surface.

Greenhouse gas (**GHG**) is a gas that contributes to the greenhouse effect by absorbing mid and far infrared radiation.

Heat is the transfer of thermal energy that is associated with the speed of movement (temperature) and number of atoms and molecules in any material. The higher the temperature of a material, the faster the atoms are moving, and hence the greater the amount of thermal energy present for the same amount of matter. If equal temperature but more matter, then that object has more thermal energy compared to the smaller amount with the same temperature.

Photon: a massless packet of electromagnetic energy that is the fundamental component of radiation.

Power Spectrum is the distribution of blackbody radiation emitted from objects based on their temperature relative to wavelengths.

Radiation Budget is the rate of radiation absorbed of an object compared to the rate of radiation reflected.

> **Incoming Radiation** is what is being absorbed by the object. For opaque material, this is equal to (1-%reflectance) * incident radiation. Incident radiation is the light shining on the object.
>
> **Outgoing Radiation** is what is emitted by the object.
>
> **Deficit**: When the rate of outgoing radiation exceeds incoming radiation.
>
> **Balanced**: When the rates of outgoing and incoming radiation are equal.
>
> **Surplus**: When the rate of outgoing radiation is less than the incoming radiation.

Reflection is when a photo bounces off the surface of an object

Temperature is the measure of the average kinetic energy of the random motions of atoms/molecules in an object.

Thermal radiation is electromagnetic radiation generated by the thermal motion of charged particles in matter. All matter with a temperature greater than absolute zero emits **thermal radiation**.

Transmission is when a photon passes through an object.

Wavelength is the distance between two successive peaks or troughs of the wave. Electromagnetic radiation travels in waves, and the distance between crests/troughs can be smaller than the size of an atom to 100s of kilometers.