**Topic IV: Solar Radiation’s Impact on the Earth System**

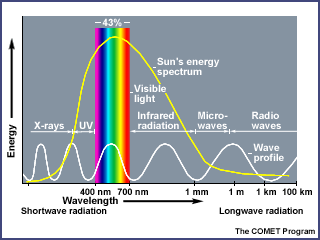
**Earth- I can explain how solar radiation impacts the Earth System.**

Without heat and light from the Sun, life on Earth would not exist. The sun emits huge amounts of electromagnetic radiation which travels in waves of energy through space to Earth.

**Electromagnetic Radiation coming from the sun is predominately:**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation that we can see
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation –heat from the Sun
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation – shorter, high frequency waves, high energy waves.   
   UV-C waves have enough energy to destroy all life on Earth.

**The sun emits many forms of electromagnetic radiation in varying quantities.**

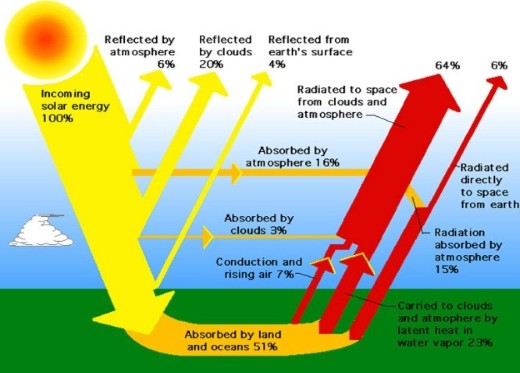


About 43% of the total incoming energy emitted from the sun is in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_­­­ parts of the spectrum. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy which we feel as heat on our skin is about 50%.   
Ultraviolet radiation (UV) is only \_\_\_\_\_\_.  
  
Less than 1% of solar radiation emitted by sun is dangerous, high frequency, short wavelength \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rays and gamma waves.

**Most of the most harmful radiation from the sun is absorbed by the ionosphere or other parts of the atmosphere and does not reach the surface of Earth.**

The Earth is constantly “blanketed” in solar radiation from the sun. About 30% of this energy is reflected back to space by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the atmosphere and the   
different surfaces on the planet while 70% of incoming radiation is absorbed either in the atmosphere or by water or land warming these surfaces.

Fortunately for Earth, incoming radiation is balanced by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_radiation otherwise the planet would heat up and become uninhabitable.

**Distribution of the Sun’s Energy**

**The albedo of a surface** *impacts* *how much energy is reflected by surface or absorbed.* *Albedo refers to the amount of energy ­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by a surface.*

|  |  |
| --- | --- |
| http://climate.ncsu.edu/secc_edu/images/albedo.bmp | Light-coloured surfaces (snow, sand) have a   \_\_\_\_\_\_\_\_\_ albedo and reflect energy.  Dark-coloured surfaces (soil, water) have a  \_\_\_\_\_\_\_\_\_ albedo and absorb energy. |

*Some surfaces heat up and cool down faster than others.  
In the following list, which substances do you feel will heat up the fastest and cool down the fastest? Which will heat slower and retain heat longer?*

**White sand Dark soil Water**

**Complete the following:**

I think that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will heat the slowest and retain heat the longest.

I think that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will heat the fastest and lose heat quickly.

Explain your choices! How does the albedo of a surface affect heat retention?

Why does the equator receive more solar radiation than the poles causing higher temperatures and greater exposure to harmful UV radiation?

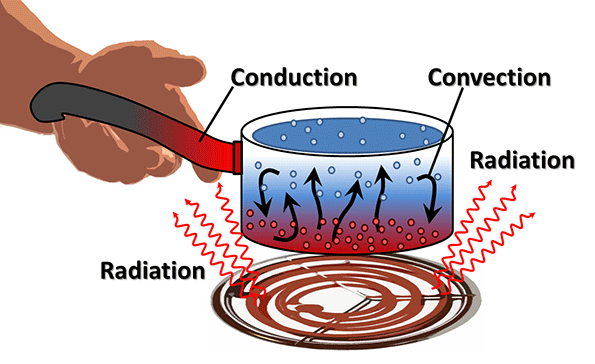
The angle of the Sun’s rays reaching the equator are at \_\_\_\_\_\_degrees so not only are they ­­­­­­­­­­­­more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ so incoming radiation is spread over a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_area but also the thickness of the atmosphere is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the equator, so less radiation is absorbed by the atmosphere before reaching the biosphere.

|  |
| --- |
| http://www.intechopen.com/source/html/42734/media/image2.jpeg |

**Formation of Wind**

* The uneven \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of the Earth Surface results in air over land being heated   
  differently than air over water and the poles being colder than equatorial regions.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transfers heat absorbed by the ground to the particles in the air which heat up, rise and then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ currents transfer this energy throughout the atmosphere.

Diagram

Description automatically generated **Convection Air Current**

* Warm air rises and cools and then drops creating differences in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Air will flow from areas with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ air pressure and cooler more dense air to areas with \_\_\_\_\_\_\_\_\_air pressure containing less dense, warmer air. This movement of air is called \_\_\_\_\_\_\_\_.

*View wind Video*

Diagram

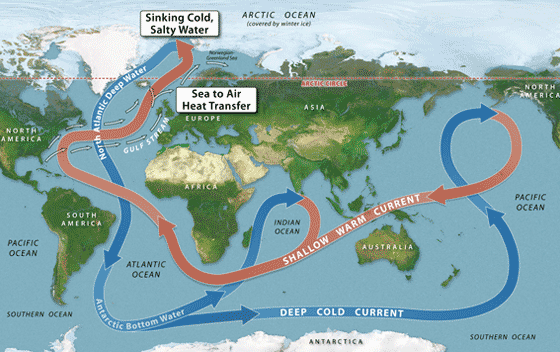
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**Wind Formation**

**Ocean Currents**

Uneven heating of the earth surfaces and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the planet 🡪 global wind patterns

Which impacts downwelling and upwelling of ocean waters between cooler nutrient rich waters and warmer surface waters 🡪 Global movement of ocean water.   
  
This circuit of the ocean waters is called the global \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

  
   
  
 It can take water in the ocean \_\_\_\_\_\_\_ years to   
 complete one circuit.  
  
 Cold surface currents 🡪 \_\_\_\_\_\_\_\_coastal areas

Warm surface currents🡪\_\_\_\_\_\_\_ coastal areas

Other factors such as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will impact flow of ocean currents.  
  
\*\* *Take notes on these factors as you* *watch the video on ocean currents.*

**Earth- I can explain how solar radiation impacts the Earth System.  
 Total: /16**  **Emg Dev Prf Ext**  
 <9 9-11.5 12-14 >14 ***Respond to the following questions on solar radiation interactions with the biosphere/atmosphere/hydrosphere and it’s role in creating Wind and Ocean Currents***

Some websites for Reference:   
<https://derm.net/2019/01/is-infrared-good-or-bad-for-your-skin/>; <https://science.nasa.gov/ems/07_infraredwaves>; <https://spaceplace.nasa.gov/sunburn/en/>  
<http://www.skincancer.org/prevention/uva-and-uvb>   
<http://www.cancerresearchuk.org/about-cancer/causes-of-cancer/sun-uv-and-cancer/how-the-sun-and-uv-cause-cancer>; <https://www.cancerresearchuk.org/about-cancer/causes-of-cancer/sun-uv-and-cancer/the-uv-index-and-sunburn-risk>  
[**https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/sunburn**](https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/sunburn)

1. What effect does infrared radiation exposure from the sun have on human skin? /1
2. Which type of UV radiation is most harmful to life and why? /2
3. How does ozone protect the biosphere from this deadly UV radiation? /1
4. What is sunburn and what type(s) of radiation cause(s) sunburn? /2
5. Describe some factors which reduce/increase the amount of UV-A and B you are exposed to?   
    /3
6. How does the high Albedo of objects like white sand and snow increase the severity of a sunburn? /1
7. What processes, forces and/or factors affect the size, shape, speed, and direction of ocean currents? /3
8. What is wind? How does the wind form? Why are some winds stronger and some winds weaker? /3