Lesson 4 - Energy from the Sun

Energy from Sun

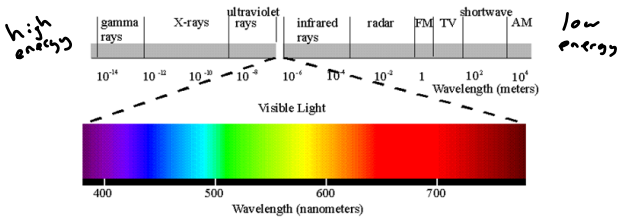
- Most (99%) of the energy on Earth initially comes from the **sun**.

- Energy from the sun is called **solar energy**.

- What happens to most solar energy?
  - o **Converted to thermal energy (heat)**

- Solar energy is **radiant energy (radiation)**. Define radiant energy?
  - o **Energy that is transmitted as electromagnetic waves**

Electromagnetic radiation spectrum



- **Insolation** is the amount of solar energy received by a region of the Earth's surface.

incoming solar radiation

a. Not all regions of the earth receive the same amount of solar energy (insolation).

b. The main factor in determining how much insolation is receieved by a location is **latitude**
   - **other factors include albedo and cloud cover**

Albedo

- o **Albedo** is the percent of solar radiation that strikes a surface that is reflected.
  - § A more reflective surface has a **high** albedo
  - § A less reflective surface has a **low** albedo
  - § The average albedo for the earth's surface is **30 %**.
  - § Substances/materials that have high/low albedo

High Albedo	Low Albedo
Snow Ice Volcanic ash	Black dirt Trees, grass Ashphalt

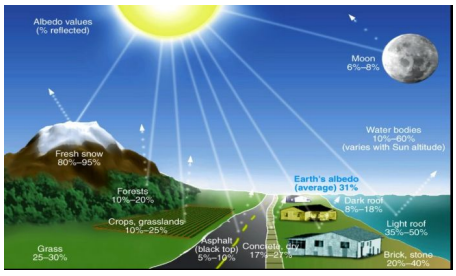
Complete the following sentences.

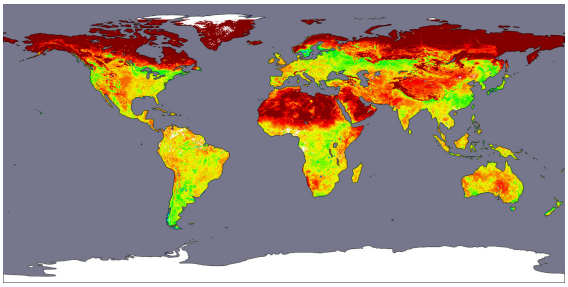
1. Snow takes long to melt because it has a **high (90%)** albedo.
2. The albedo of the icecaps is **higher** than the albedo of Alberta's forests.
3. The albedo of the ground in Athabasca is **lower** in the summer than in the winter when snow covers the ground.

How does albedo affect the temperature of a location?

high albedo = low temp

low albedo = high temp





Absorption and Reflection

- Absorption and reflection of solar energy occur in all 3 components of the biosphere.

- When particles **reflect** energy, they change the ray's **direction**.

  - Reflected energy goes back into **space**.

- When energy is absorbed by a substance, the **temperature** of that substance will increase.

  - Absorbed energy warms the atmosphere. It also drives the hydrologic cycle and the movement of **air as wind**.

- Plants absorb solar energy (visible light) in order to produce **chemical** energy by the process of **photosynthesis** .

- The layers of the atmosphere contain different mixtures of gases that each absorb different wavelength of the solar radiation.

  i. Oxygen and nitrogen gas absorbs **X-rays** and **gamma rays**.

  ii. Ozone absorbs most **UV radiation**.

  iii. Carbon dioxide, water vapor and methane absorb **infared radiation**.

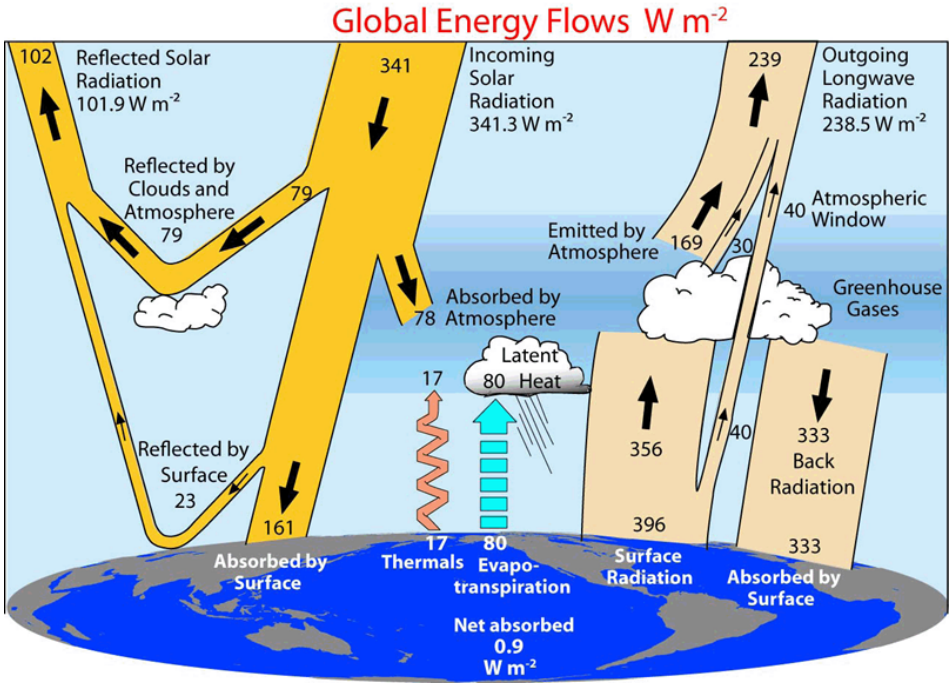
  iv. **Visible** light and **radio** waves are absorbed only a small amount.

- Clouds and atmospheric reflect some incoming solar radiation back into space.

  - Causes air temperature to be cooler on a cloudy day.

- Clouds and atmospheric dust can trap radiation between the earth's surface and the clouds or dust.

- Natural and man-made events like forest fires and volcano eruptions can have effects on the climate of earth



Practice Questions

1. How does cloud cover influence the amount of solar radiation that reaches the Earth's surface?

2. What is the electromagnetic spectrum?

3. What type of EMR has more energy?
   a. blue light or red light
   b. X -rays or radio waves
   c. yellow light or infared radiation

3. Compare the albedo of an area that is covered with snow to an area covered with dark soil.

4. What determines the albedo of a material?