

8.3 The Sun and the Earth's Climate System

Climate System: composition of factors (including air, water, ice and organisms) that work together to create Earth's climate

- Earth's global climate system is powered by the sun which creates climate zones

Balancing Energy on Earth

- Nearly all energy on Earth from the sun
- Sun emits UV radiation, visible light and infrared radiation

Energy Absorbed

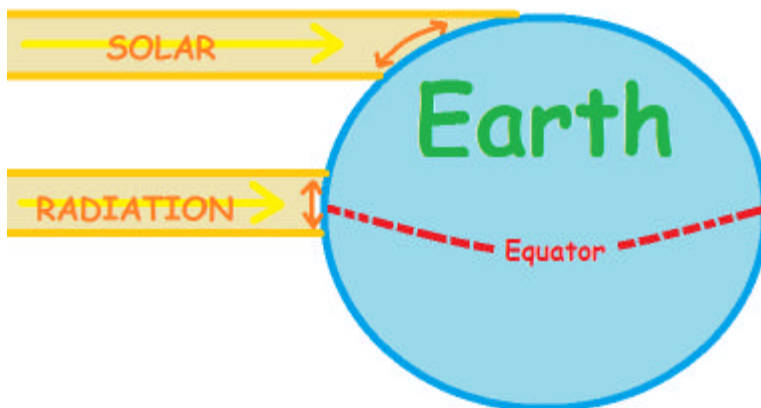
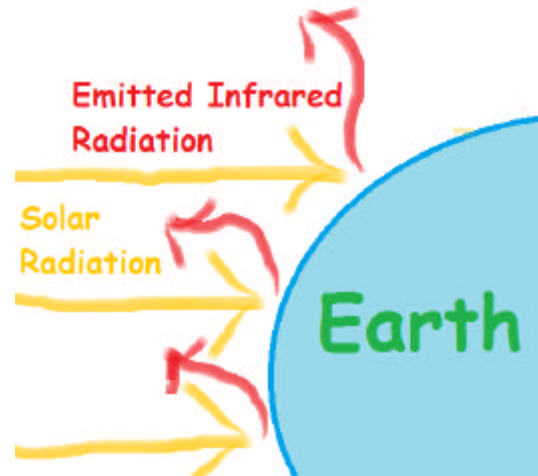
- When radiation comes in contact with particles of matter, it may...
 - 1.) Be absorbed (particles gain energy)
 - 2.) Transmit through particles, or
 - 3.) Reflect off particles
- 30% of radiation that reaches Earth is reflected by particles in the atmosphere (ex: clouds) and the Earth's surface
- 70% absorbed by gases, clouds and the Earth's surface (less than 1% of this is used for photosynthesis, rest absorbed by rocks, water etc., as surface heats so does the air above)

Maintaining a Balance

- Earth continually absorbing energy from the sun
- Energy may be changed from one form to another
- As energy is absorbed, Earth gains thermal energy
- Warm surface of Earth emits infrared radiation back
- Energy absorbed by Earth = energy radiated by Earth
- Balance keeps global temperatures stable

Effects of Latitude on Climate Zones

- Climate warmer at lower latitude, colder near poles
- At equator, sun's rays spread out over small area (directly overhead)
- At poles, sun's rays spread out over larger area (not direct)
- Sun's rays strike higher latitudes at an angle, allowing rays to pass more atmosphere (more absorption and reflection, less comes in contact with the surface)



- At lower latitudes, sun's rays have a more direct angle, pass less atmosphere (less absorption and reflection, more comes in contact with the surface)

Review Questions

- 1) How are large water bodies affected by the sun's radiation?

- 2) Why does the energy absorbed by the Earth and the energy emitted need to be balanced?

- 3) What happens to solar radiation once it reached the Earth?

- 4) What happens to the energy absorbed by the Earth?

- 5) What do you think would happen to global temperatures if...
 - a) The energy emitted by the Earth was less than the energy absorbed?

 - b) The energy emitted by the Earth was more than the energy absorbed?

- 6) Why are climates near the equator warmer than those closer to the poles?

Answers

- 1) Large water bodies absorb the sun's radiation. The water's temperature rises, heating the air above it.
- 2) The energy absorbed by the Earth must be equal to the energy emitted in order to keep the temperatures on Earth constant.
- 3) Once solar radiation reaches the Earth, it may either be reflected (by particles in the atmosphere and the Earth's surface) or absorbed (by gases, clouds or the Earth's surface).
- 4) The energy absorbed by the Earth heats up the Earth's surface. The Earth then converts this energy to infrared energy and radiates it back out.
- 5) a) If the energy emitted by the Earth was less than the energy absorbed then the Earth would increase in temperature.
b) If the energy emitted by the Earth was more than the energy absorbed then the Earth would decrease in temperature.
- 6) The sun's rays are directly overhead the equator allowing the rays to be more concentrated on a smaller area. On the other hand, the sun's rays are not as direct on the areas near the poles hence the sun's rays need to spread out over a larger area. In these areas, the sun's rays are at angle. Since the rays go through more of the atmosphere, they may either be reflected or absorbed. In contrast, the rays at the lower latitude areas are at a more direct angle, allowing the heat to be more intense.