

The Earth's Energy Budget: Internet Assignment

The sun is the ultimate source of energy for our planet. The sun provides energy for physical processes such as wind and weather, but it also supplies energy needed for plants, which are the backbone of our food web. In this assignment, you will learn about the ways energy from the Sun reaches the Earth, the physical processes that cause the light energy to penetrate our atmosphere, and what happens to the solar radiation when it enters our atmosphere. To complete this assignment you need to read the attached printouts from various websites and answer the provided questions.

Heat Transfer, Radiation, Conduction, and Convection

Directions: Read the attached printout from The University Corporation for Atmospheric Research's website. Scan down to the section titled "Energy Heat Transfer". Read the rest of the information on the webpage and answer the following questions:

1. Practically all the energy that reaches the earth comes from what?

the sun ✓

2. What are the three ways energy is transferred between the earth's surface and the atmosphere?

Radiation, Conduction, and Convection ✓

3. What is conduction?

the process by which heat energy is transmitted through contact with neighboring molecules ✓

4. What is Convection?

transmits heat by transporting groups of molecules from place to place within a substance ✓

5. Explain how convection causes the Coriolis effect.

Convection transmits heat by transporting groups of molecules from place to place within a substance, such as water or air which move freely, the rising and sinking of air ~~and~~ masses distribute heat and moisture throughout the atmosphere column, forming 2 convection cells. The Earth's rotation causes deflection of the wind. ^{great} ✓

6. What is radiation?

the transfer of heat energy without the involvement of a physical substance in the transmission ✓

Reflection, Refraction and Absorption

Directions: Read the attached printout from How Stuff Works's How Light Works website. You should view the pages titled "absorption, reflection, and refraction."

1. What are the four different things that can happen when light hits an object?
 - 1) The waves can be reflected or scattered off the object. ✓
 - 2) The waves can be absorbed by the object.
 - 3) The waves can be refracted through the object.
 - 4) The waves can pass through the object with no effect.
2. Explain what happens to atoms during absorption.

They speed up, collide with other atoms in the material, and then give up as heat the energy they acquired from the vibrations
3. Do light waves penetrate an object during reflection? Explain why or why not.

No, because the light that hits the material bounces off electrons and are shot back, this is how you see your reflection ✓
4. Explain what refraction is.

The turning or bending of any wave, such as a light or sound wave, when it passes from one medium into another of different optical density ✓
5. The angle of refraction depends on what?

How much material slows down the light. ✓

Solar Radiation

Directions: Read the attached printout from the Physical Geography College of Alameda's website. Read the study guide and answer the "study objectives" questions and define the key terms on a separate piece of paper. Complete the "Earth's energy budget quiz".

Great
Job on
this!

STUDY OBJECTIVES

- ① The fusion of hydrogen into helium, Visible light (41%), ultra violet, X rays, and gamma rays (9%), and short wave infra red energy (50%) ✓
- ② The balancing out of solar and earth radiation. Solar radiation heats Earth's surface while Earth radiation heats the atmosphere. ✓
- ③ The heat energy received by a surface perpendicular to the sun's rays, outside the atmosphere would be a relatively constant 1400 watts per square meter ✓
- ④ Insolation is incoming solar radiation. ✓
 - A) the angle of the sun's rays
 - B) the amount of time a place is exposed to the sun's rays
 - C) the amount of clouds, dust, and water vapor in the atmosphere
- ⑤ 50% of sunlight reaches Earth's surface. Reflection, Scattering, and Absorption ✓
- ⑥ Longwave radiation, sensible heat, and the release of latent heat. ✓
- ⑦ When radiation is temporarily retained in the lower atmosphere by carbon dioxide, and water vapor ✓
- ⑧ At low latitudes, more radiation is emitted to ~~itself~~ itself rather than space, while high latitudes emit more to space than itself. ✓

⑨ Global radiation balance is maintained through the ocean current, and wind ✓

⑩ By changing the chemistry of the atmosphere and the distance of the planet ✓

The Earth's Energy Budget Quiz

Directions: Pick one best answer for each question.

1. What is the source of the sun's energy?
 - a. The fusion of helium into hydrogen
 - b. The fusion of uranium
 - c. The fusion of hydrogen into helium
 - d. The fission of uranium

2. Solar energy is transferred to the earth's surface by:
 - a. Shortwave radiation
 - b. Convection
 - c. Longwave radiation
 - d. Conduction

3. What is insolation?
 - a. Incoming Solar Radiation
 - b. Energy radiated from the earth
 - c. Wind speed
 - d. Made mostly of asbestos

4. As a global average, what percentage of the solar radiation reaching the top of the atmosphere is reflected back to space?
 - a. 10%
 - b. 20%
 - c. 30%
 - d. 40%
 - e. 50%

5. Which one of the following surfaces reflects the most solar radiation?
 - a. Forests
 - b. Sand
 - c. Ocean surfaces
 - d. Fresh snow
 - e. Dark, moist soil

6. Atmospheric gases such as carbon dioxide and water vapor, absorb and reradiate longwave radiation from the earth. This process is called:
 - a. The coriolis effect
 - b. The greenhouse effect
 - c. The thermal effect
 - d. The scattering effect

7. The most important process in heating the atmosphere is:
- a. Heat release from volcanoes
 - b. Absorption of shortwave solar radiation
 - c. Absorption of longwave earth radiation ✓
 - d. Reflection off the surface of the earth
8. Which is NOT one of the ways in which the atmosphere is heated?
- a. Reflection off the surface of the earth ✓
 - b. Conduction
 - c. Longwave radiation from the earth
 - d. Convection
9. On average, how much of the sun's radiation is absorbed by the earth's surface?
- a. 30%
 - b. 50% ✓
 - c. 70%
 - d. 85%
10. Comparing earth radiation with solar radiation, solar radiation is:
- a. Cooler
 - b. Less harmful
 - c. Longer wavelength
 - d. Shorter wavelength ✓