Answers to Unit 1 homework questions

Describe, in your own words, how energy from the Sun is transmitted to the Earth.

The sun radiates electromagnetic energy in all directions. This energy is primarily in the form of visible, infrared, and ultraviolet radiation. As this energy radiates through space, it is intercepted by objects in its path, including Earth.

In class, you were shown how Earth is in energy balance with the Sun, meaning that Earth's outgoing energy is equal to the incoming energy from the Sun. Based on this, you saw that the temperature of the earth could be estimated as: $T_{earth} = 41.9 * \sqrt[4]{S}$. *Using this calculation, and your estimate of solar irradiance from Question 2, what is your estimate of Earth's temperature in K? What about in °C (to convert between the two, subtract 273.15° from your K value to get °C.)*

Students' values for Question 2 may vary, but should be approximately 1361 Wm^{-2}. Applying that to the equation above should give a T_{earth} = 254.5 K, -18.7 °C, and -1.7°F. This should be surprising to the students!

In the above question, you calculated earth's effective temperature based on energy received from the Sun. Does anything about your answer seem surprising to you? No correct answer

Think about the how the temperature graph your group produced compared to the graph of the whole time period (Figure 2, next page). Was the trend in your graph the same as that for the entire time period? Is 10 years of data enough to determine a trend in global temperature?

(Answers will vary depending on time frame examined in Part 1) The decadal trend observed by my group was different than the trend observed over the entire dataset. Over a given 10-year period, temperatures may have increased, decreased, or remained constant. The complete dataset since 1880, however, shows a clear pattern of increasing temperatures. This suggests that more than 10 years are needed to discern a long-term shift in temperatures.

Describe a way in which the temperature trend of the last 50 years may have affected the natural world (living or non-living)

(Answers will vary, but may include any of the following.) Rising temperatures over the past 50 years may have:

- Changed which species of plants or animals can exist in a given location
- Changed the distribution of precipitation
- Changed the amount and distribution of glaciers
- Increased sea level through glacier melt
- Altered water resources by shifting snow towards rain in some regions

Describe a way in which the temperature trend of the last 50 years may have affected humanity.

(Answers will vary, but may include any of the following.) Rising temperatures over the past 50 years may have:

- Changed the ability of traditional crops to grow in a given location
- Changed the location of preferred fishing grounds
- Changed the distribution of insect-borne disease
- Changed the suitability of coastlines for habitation (whether through changes in sea level or storm frequency)

What was something you found surprising about this activity? No correct answer
What part of this activity was most unclear or confusing to you? No correct answer