Student Name
Lab Report 13
Physics 111
11/11/15

Examples of the Influence of Light and Thermal Phenomena on Global Climate

For this topic students were asked first to think about what they knew, or had heard about the greenhouse effect. We were also asked to consider what we feel when we get into a car that has been left out in the heat too long. Students then began experiments to help us understand more about the greenhouse effect and to explain the phenomena we may or may not have witnessed.

Identifying Resources

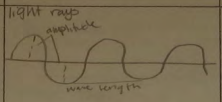
As students began to think about the greenhouse effect we were asked to consider what happens when a car is parked in the sun on a hot day. We made guesses as to why this would get warm including that the seats in a car might be good insulators and would hold onto the heat and would warm the car. Essentially students could all agree that regardless of the reason, of which we were still unsure, we knew that if a car is left outside on a hot day with the windows up it will be very hot inside of the car.

Developing Powerful Ideas Relevant to Global Climate

In table 13, shown below, students developed powerful ideas about light and the influence on thermal phenomena on a Global Climate. These ideas included a new way of thinking of light, as a wave traveling in a straight line of direction.

Table 13

Powerful Ideas about Influence of Light and Thermal Phenomena on Global Climate

URL/Sketch of set up	Evidence	Powerful Idea	Relevant Vocabulary
http://missionscience.nasa.gov/ems/01_intro.html and http://science-edu.larc.nasa.gov/EDDOCS/Wavelengths_for_Colors.html		Visible light can be represented as a wave and is part of a broad spectrum of such waves.	
http://www.youtube.com/watch?v=2--0q0XlQJ0 (Dr. Thaller)	Infrared Camera can see the heat 	Hot objects emit energy as infrared radiation.	Emissivity
http://www.youtube.com/watch?v=2--0q0XlQJ0 (Dr. Thaller)	In video infared could pass thrugh clothes etc. but not through glass	Materials differ in how much visible light and infrared radiation can pass through the material or are blocked.	Properties of materials: reflectivity absorptivity transmissivity
	Think of a car in the sun. light comes in and is emmited as infrared radiation which cannot be transfered back through glass	Energy transfer occurs through a variety of processes.	Radiation Reflection Absorption *Emission of infrared radiation Transmission Conduction Convection Changes in State
http://earthobservatory.nasa.gov/Features/EnergyBalance/page4.php	seen in rise of temps over years.	The Earth's energy budget is the flow of incoming and outgoing energy.	

Visible light can be represented as a wave and is part of a broad spectrum of such waves. Visible light up to this point has been thought about as traveling in particles and in straight lines called rays. However students learned that light can also be envisioned as traveling in wave that is part of a very broad spectrum of such waves. Some waves are very long such as radio waves, whereas other waves are very short such as gamma rays. The rays are also determined by their amplitude, the height from midpoint to crest of trough, and the wave length which is the distance from one crest or trough to the identical point on the neighboring wave. Frequency refers to the number of cycles per second, or number of waves per second is another way to think of it.

The according to http://missionscience.nasa.gov/ems/01_intro.html the electromagnetic spectrum refers to wave lengths that create electromagnetic electricity. This includes radio waves, microwaves and visible light rays as well as many more. There are also infrared waves which are just beyond the visible light spectrum.

Hot objects emit energy as infrared radiation. In class students watched a movie from Dr. Michelle Thaller (http://www.youtube.com/watch?v=2--0q0XlQJ0) who spoke about infrared radiation which is detected by night vision cameras. Many objects give off infrared heat or

radiation, especially animals and many of the plants and animals on the surface of the earth. Many substances take in light and absorb it and then emit infrared radiation back out into the environment.

Materials differ in whether visible light and infrared radiation can pass through the material or are blocked. Some materials such as clothing allows infrared radiation to pass through it. However, there are other materials such as Glass that do not allow infrared radiation to pass through. In our atmosphere there are certain gasses as well as clouds that can prevent infrared radiation from passing through and back out of the atmosphere. These substances instead absorb the infrared radiation and push it back towards the surface of the earth.

Emily Van Zee 11/14/15 8:33 PM
Comment: Careful! 'push' is a technical word in physics associated with 'force', also a technical word. Recommend "emit" here

Energy transfer occurs through a variety of processes. Throughout this class students have learned that there are a variety of ways that energy is transferred from one substance to another. One way is through direct contact as students saw with placing their hands onto plates of wood, metal, and Styrofoam. Another way that energy is transferred is through transmission of light such as when we had lamps pointed on cups filled with water and sand and students were able to see the temperature change in both as the water and sand absorbed energy from the light and were heated. Radiation from the sun works in much the same way. Light from the sun is traveling towards earth and some of the light is absorbed and emitted out in the form of infrared radiation.

The Earth's energy budget is the flow of incoming and outgoing energy. The earth's energy budget refers to the balance or imbalance of energy traveling in and out of earth's atmosphere. Energy travels into Earth's atmosphere in the form of light from the sun. Some of this energy is released back out of the atmosphere later, however some is kept. Part of this energy is used to make plants grow and to warm the earth. However, when the amount of energy leaving the atmosphere is substantially lower than the amount of energy staying on the surface of the earth and in the atmosphere we begin to have an imbalance of the Earth's energy budget. When this happens the temperature of the surface of the Earth will rise as it is heated by this retained energy.

Using Powerful Ideas to Develop Explanations of Intriguing Phenomena

Greenhouse effect.

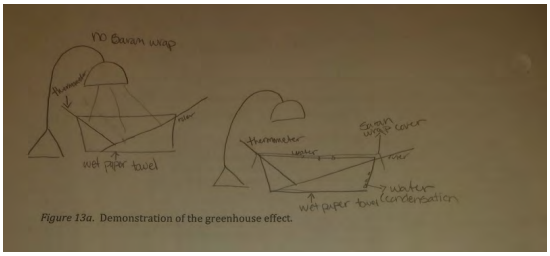


Figure 13a. Demonstration of the greenhouse effect.

Figure 13a depicts an experiment done in class by the students to study greenhouse effects. Students looked at two different plastic tubs, each with a wet paper towel in the bottom of the tub. In each tub a ruler was placed with a thermometer on top of the ruler to measure the temperature of the ruler in the tub. One tub had saran wrap placed over it tightly, and a light was placed over each tub. After about a half hour students returned to look at the tubs. The one that had been wrapped had condensation on the top and sides of the tub. Also the temperature in said tub was about ten degrees Celsius higher than the uncovered tub.

Below is figure 13b in which I have drawn a diagram of the greenhouse effect. Essentially light is leaving the Sun and traveling towards earth. Much of the light travels through the Earth's atmosphere and some infrared radiation. The light and radiation are absorbed by the Earth, and infrared radiation is released back out of the earth. However, when greenhouse gasses are trapped within the atmosphere in clouds they will often absorb this infrared radiation and keep it or push it back towards the earth. This in turn transfers more energy to the surface of the Earth and raises the Earth's Energy Budget which in turn raises the temperatures experienced on Earth on a yearly basis.

Emily Van Zee 11/14/15 8:36 PM
Comment: Re-emit it

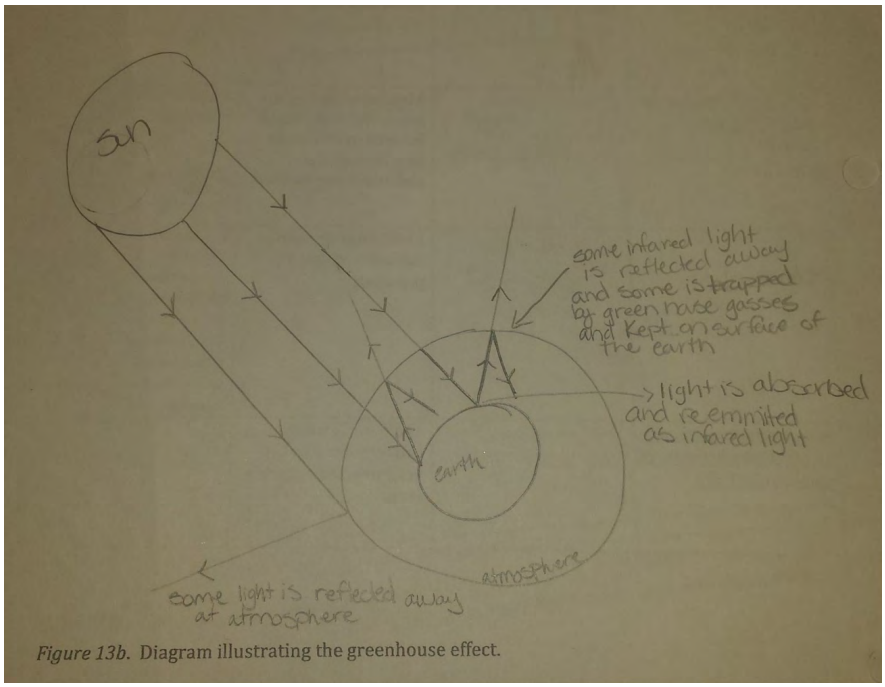


Figure 13b. Diagram illustrating the greenhouse effect.

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Rubric for Lab Report 13		
	Possible Points	Score
Discusses relevant resources;	0-1	1
Discusses development of powerful ideas in Table 13	0-1	1
Discusses Figure 13a and demonstration of greenhouse effect	0-1	1
Discusses Figure 13b, a diagram of the greenhouse effect	0-1	1
Correct format, grammar and spelling	0-1	1
Total	5	5