

# Interactive Physics Lesson Plan

## Infrared Radiation and the Warming of the Atmosphere

**Name:** Janet Siegel

**Grade level/Subject:** Environmental Science (9/10)

**Objectives:**

- **Explain** how Earth's atmosphere is like the glass in a greenhouse.
  
- **Explain** how absorption of infrared radiation by greenhouse gases like CO<sub>2</sub> causes more collisions between atmospheric gases and a resulting rise in temperature

**The Mathematical Concept or "key idea" that this activity will be used to teach:**

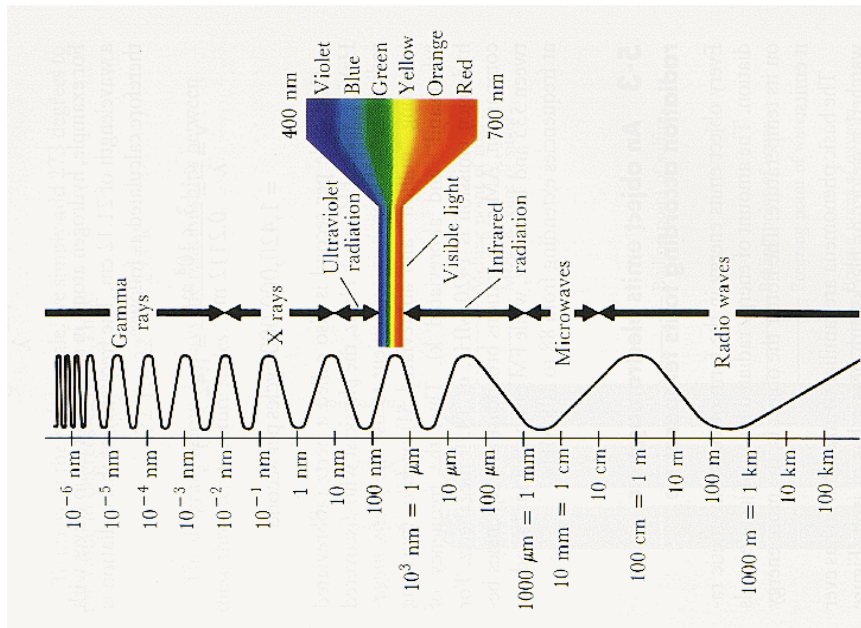
- Standard 1: Students will use mathematical analysis and scientific inquiry to pose questions, seek answers, and develop solutions.

**The Science Concept or "key idea" that this activity will be used to teach:**

- Key Idea 7 (The Living Environment): Human decisions and activities have had a profound impact on the physical and living environment.
- Key Idea 5 (Physical Setting): Energy and matter interact through forces that result in changes in motion

As part of an in-depth study examining climate change and global warming, students will enter the room and be seated in groups of four. On the board will be a question: How is heat generated? What causes temperature to rise? Each group will brainstorm for 5 minutes and come up with a brief demonstration for the class in which some heat is generated without using matches or any other combustible fuel. Following their presentations, the class will de-brief about what the demonstrations have in common. In most cases, there will be some sort of friction involved and we can define temperature as the average kinetic energy of molecules.

Students will examine the following graphic:

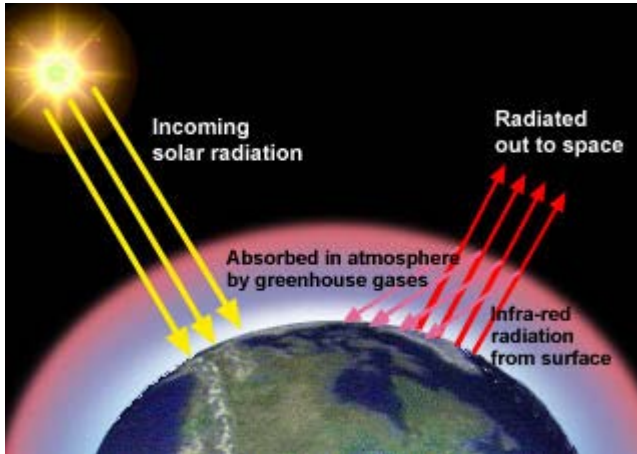


Without going beyond the scope of the course, the class will construct a K-W-L chart. A volunteer will fill in the chart as students contribute what they know about the various forms of radiation. The chart will look like this:

Know	Want to Know	Learned

The “Learned” part of the chart will be left blank for now and will be filled in at the end of the lesson. Some students may realize that Infrared radiation is also known as heat.

The following graphic will be displayed:



How does the absorption of infrared radiation by greenhouse gases cause a rise in atmospheric temperature? The secret is collisions. Students will be shown a demonstration using Interactive Physics software showing one way this might happen. (see attachment). Attention will be paid to setting up the plots so that collisions can be monitored and the resulting increase in kinetic energy can be visualized.

This will not be the first time they've seen this tool being used and they will have some familiarity with how to set up the parameters. Their assignment will be to work in two's or three's using the simulation and change some of the variables so that they can get the maximum increase in kinetic energy of the atmospheric molecules through collisions triggered by the absorption of infrared radiation by carbon dioxide gas. The group that meets this challenge will get a prize!!