Greenhouse Effect Study Apparatus*

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This apparatus is designed to illustrate the physics associated with the greenhouse effect. The apparatus consists of a chamber (wood) with a thermocouple mounted in an aluminum absorber (painted with flat black paint) in its center. The chamber is made so that its front and back sides may be changed to different materials. The chamber is also provided with a small port for the purpose of admitting carbon dioxide from a generator (using baking soda and vinegar). The experiment involves placing different window combinations in the front and back of the chamber and measuring the heat trapping potential of the different combinations when the chamber is placed about 1 m from a heat lamp. The temperature rise in the chamber is measured either with a potentiometer or potentiometric recorder connected to the thermocouple. The materials provided for windows are: polished aluminum, clear glass, flat black plexiglass, clear plexiglass, clear polyethylene. The students are asked to try all reasonable combinations and rank them in their ability to trap heat. They are then asked to use the black window in back and the polyethylene window in front and note the effect of admitting carbon dioxide into the cell. The increase in temperature due to the increased trapping of the infrared by the carbon dioxide is easily measured. This study serves well as an introductory experiment on energy balance and the greenhouse effect. Figure 2 shows a diagram of one of our typical cells. We have found that spraying the inside of the cell with 3M flat black paint No. 101-C10 increases the effectiveness of the cell. These cells can be converted to simple radiometers by using diode thermal detectors as described later.

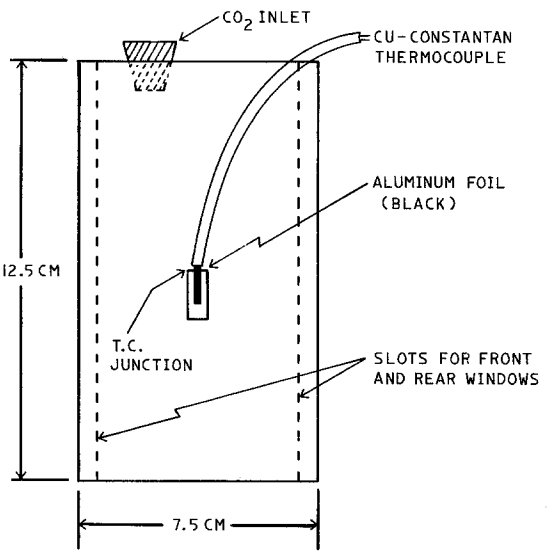

FIG. 2. Greenhouse effect cell.

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A Simple Radiometer Using Diodes As Thermal Detectors*

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The study of thermal radiation is important in many environmental science projects or experiments. We have constructed several different radiometers based on the ideas suggested by Suomi.[1] The sensing thermal detector in each of these radiometers is a solid state diode or a series combination of such diodes. It has been previously pointed out that the temperature sensitivity of a *P–N* junction voltage–current relationship has great potential as a thermal detector.[2] One such junction is approximately equal to 60 Cu-Constantan junctions. We have experimented with four junction diodes such as the GE stabistors (1N 5179) and our preliminary data indicate that their response time is approximately the same as