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Class Activities and Projects

In this section, a variety of class activities and projects are presented for enhanced and hands-on learning. Here students can stretch their "wings" and learn how solar engineers think, design, and operate solar systems and its major components.

Class Activity – Solar Water Tank Heaters

In this section we shall discuss some classroom projects to reinforce understanding of solar water-heating concepts.

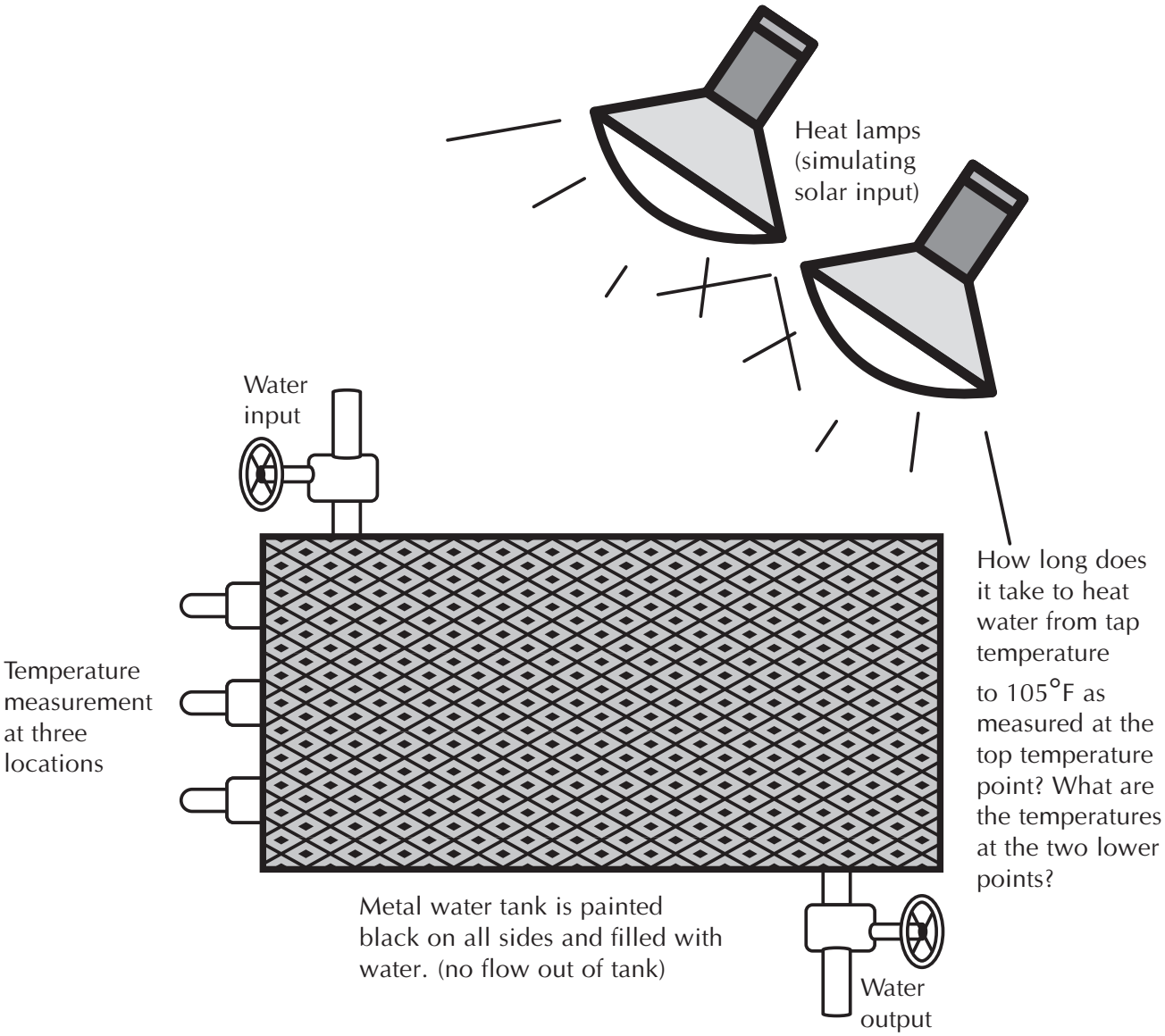
Some of the most simple solar water heaters were just black metal tanks on the roofs of summer homes or bungalows used to provide some cleanup water after a day at the beach or hiking. Many of these simple solar water heaters came into being in the 1920s and 30s. This concept combines the solar panel and the storage tank into one unit with a limited amount of water available for such uses as washing or showering.

In fact, you can buy camping equipment today that contains a black plastic bag to be heated by the Sun and used to provide some on-site hot water, so the concept lives on in modern times. In developing countries and desert areas, such technology is still in use today.

For our classroom experiments and projects, we are going to construct a simple metal tank and expose it to some simulated solar input (heat lamps) and see how we can gain measurable solar heat for hot water. Figure 7 shows a black metal tank with three measuring points we can use to determine how long it takes to achieve a certain water temperature (105°F) at the top thermometer, or temperature probe.

Using the same tank and uprighting it as shown in Figure 8, we can repeat this experiment and again determine the time necessary to achieve 105°F at the top temperature point. All this will give us an idea about how tank geometry could affect the capture of solar energy. Think about these questions:

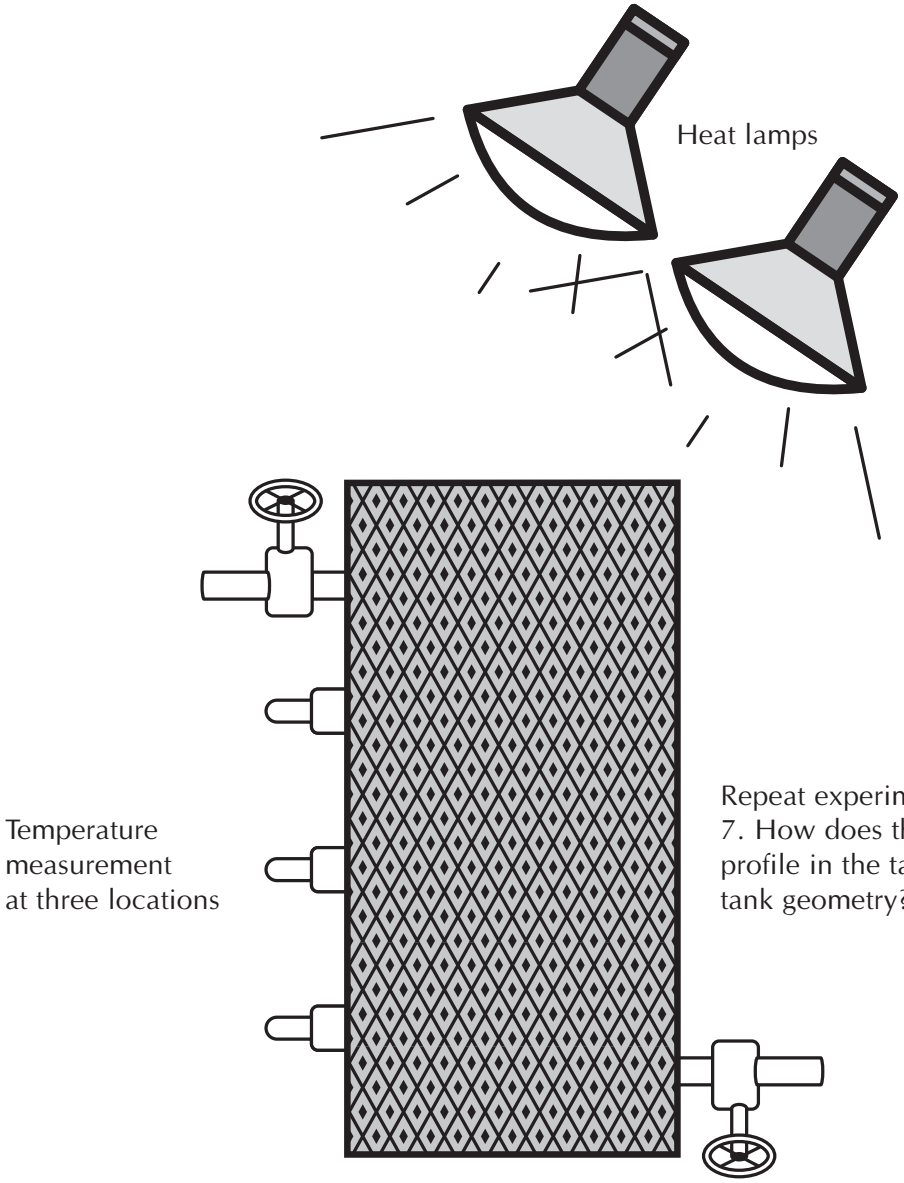
- How could we achieve this 105°F temperature faster?
- If we painted the entire roof black and had a layer of water only two to three inches deep all the way across it, could we get a greater amount of 105-degree water faster?
- Could we enhance the capture of solar energy through other means?
- Would somehow insulating the tanks make it easier to quickly reach the desired temperature?
- Will these techniques work the same regardless of where the tank is located in the U.S.?



Tank-type simple solar water heater

Figure 7

If you wanted to make this type of solar technology possible for prolonged use of the heated water and not be limited by the existing amount of water in the tank, how would you accomplish this? Is it a matter of simply having a larger tank and waiting longer for the tank to heat up; or could you adjust the flow rate through the tank so as the Sun shines on it and people are drawing water off of it, it is also recharging itself from the available sunlight.



Tank-type simple solar water heater

Figure 8

Repeat the experiments of Figures 7 and 8 and see how various flow rates through the tank affect available temperature at the tank output.

- Would you need a greater bottom temperature to enable this to work, or would the top tank temperature need to be higher?
- Can you design a better way to use the water temperatures in the tank to provide for more hot water usage?
- How is this similar or different from the previous discussion in this book about solar water-heating panels and how they work?