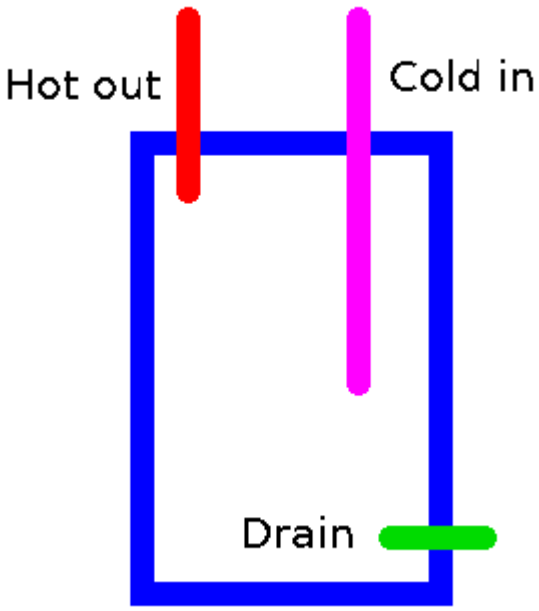
Lab 08
measurement and observation of thermocline persistence

As we found in lab 07, hot water floats on cold water. A question is this: how long can we expect the water to be separated with hot on the top and cold on the bottom? A partial answer to this involves still water which is heated by the sun. You probably have experienced thermoclines when you have been swimming. Diving into a lake on a warm summer day will allow you to experience the variations in temperatures as you pass through the layers of water. It is necessary to have the energy from the sun (or some other source) to establish the thermocline initially. This property of water is important for the storage of water heated by the thermal solar panels: in particular it is very closely related to how your water heater works. The hot water is at the top of the water heater while the colder water is introduced into the water heater well below the surface (this is normally done with a plastic tube which if damaged, will render the water heater essentially ineffective). So indeed thermoclines are essential to water heaters and thus the storage of the energy. One item of significance is how this is implemented for thermal solar panels? The answer is that hot water from the thermal solar panes is introduced via the hot outlet (a T junction is used for this) and cold water from the drain will be introduced into the thermal solar panels. The idea is that the sun will heat the water, pushing the hot water into the top of the water heater and the cold water will be pushed out of the water heater into the solar panel. Throughout the day, the hot level in the water heater will drop lower and lower as more and more energy is collected.



Our lab for today is somewhat qualitative: we are going to pour hot water into a container of cold water with a plastic membrane on top of the cold water. The hot water will have food coloring in it to serve as an (imperfect) indicator and we will monitor temperature on the top and the bottom for about 15 minutes. Although we do not have sufficient time today to monitor the persistence more than for about 15 minutes, we will never-the-less make a table of temperature on top, temperature on bottom and time, which we will plot into a graph on the spreadsheet.

Your assignment today is to write a paragraph of about 5 sentences describing your understanding of thermoclines, their persistence and how this applies to the storage of thermal energy. You will also include a screen capture of the spreadsheet that show the temperature variation with time. Each student will write individual paragraphs.