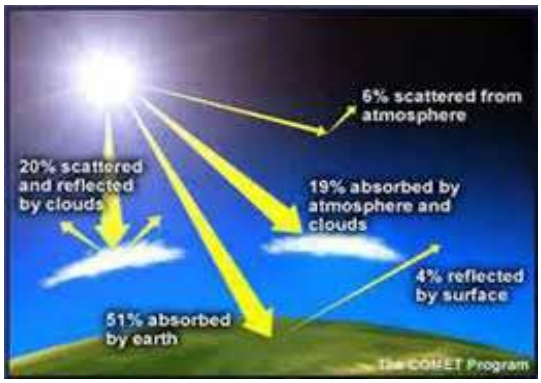
Student Sheet 1

LAB ACTIVITY:
EXPLORING CONVECTION CURRENTS

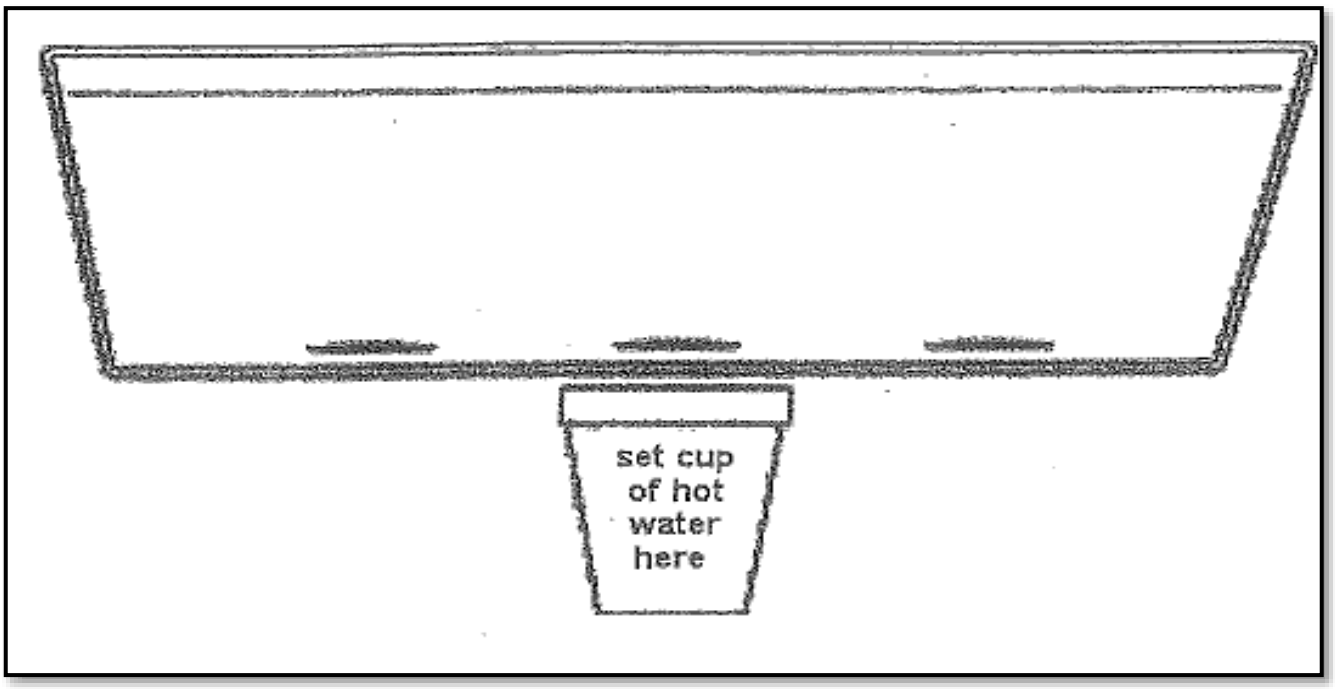


Nearly all of the earth's energy comes from the sun. Some of this radiant energy is reflected by water droplets and dust particles in the atmosphere and bounced back into space or scattered throughout the atmosphere; some is absorbed by clouds or ozone. The remaining energy that is not absorbed or scattered by the atmosphere reaches the Earth's surface. This energy is absorbed by the earth and radiated as heat. The heating of the earth's surface by the sun's radiant energy directly influences the heating of the air above it. Different surfaces absorb varying amounts of incoming solar energy. We can observe the land surface warm up and cool off faster than bodies of water. This unequal heating and cooling is a cause of wind currents, cloud formation, and even severe storms in some locations. While the process of differential heating plays a key role in atmospheric heating, its origins are not always readily apparent.

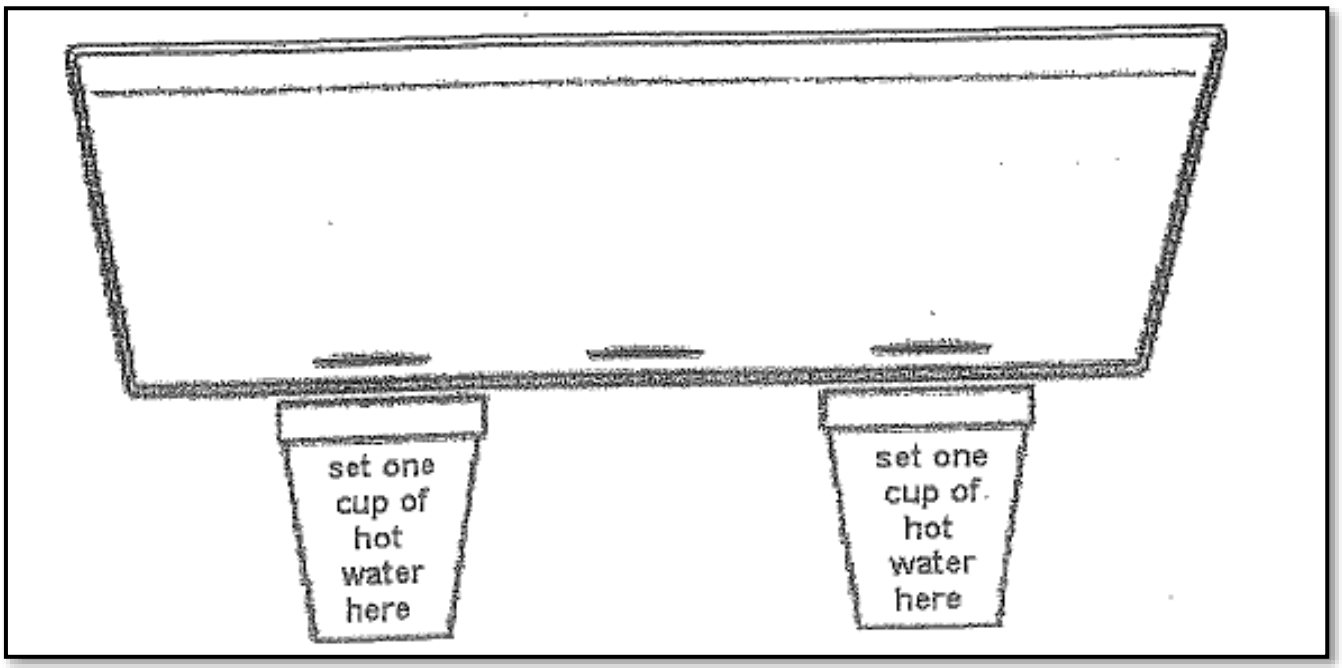
The transfer of heat through the movement of a heated fluid is called ***convection.*** When fluids, like air or water, are heated unequally, ***convection currents*** form. The difference in heat amount is what causes the unequal heating of the nearby air and the formation of convection currents along coastlines. You can see convection when heating a pot of water on a stove. As the water at the bottom, nearest the heat source, begins to heat up, it expands and becomes less dense than the cooler water above it. The cooler, denser water now sinks and forces the warm water to the surface. A convection current forms as the cycle of rising warm water and sinking cold water takes place. Convection currents are an important part of many earth processes, effecting atmospheric circulation, currents in lakes and oceans, and even the movement of plates in the Earth's crust.

Student Sheet 2

Part A: Diagram 1

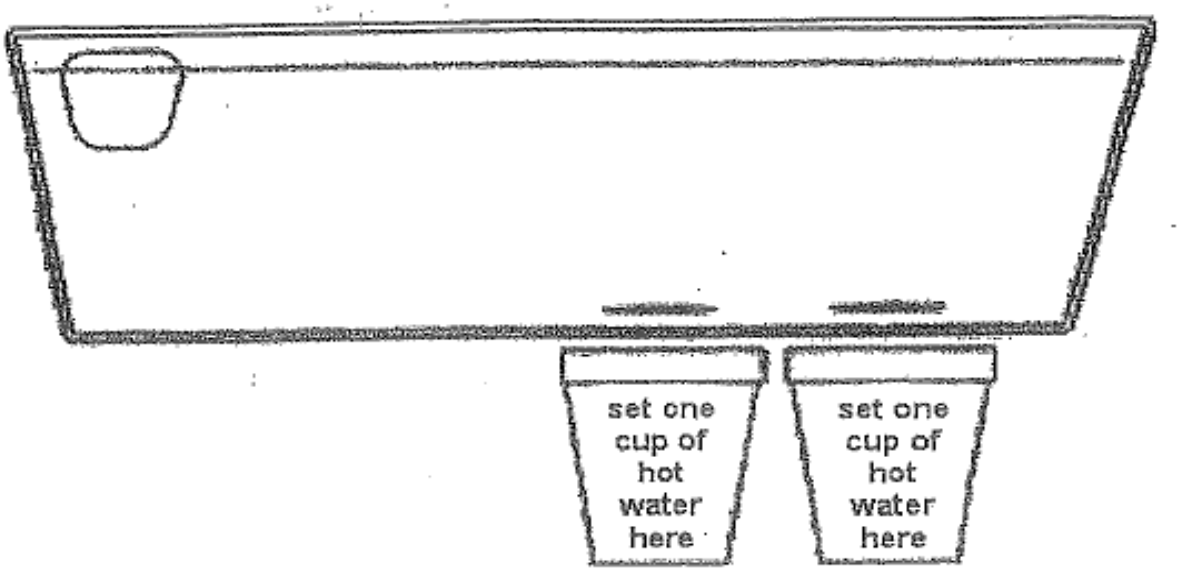


Part B: Diagram 2



Student Sheet 3

Part C: Diagram 3



ANALYSIS: As you answer these questions, keep in mind that convection in our atmosphere and our oceans works in much the same way as what you observed in the clear box of water.

1. During the lab, what effect did the cups of hot water have on the density of the water directly above them? (hint: think about particles moving)

2. What happened as a result of this change?

3. You may have noticed convection cells in a pot of boiling macaroni. Put arrows on the dashed lines in Figure 4 to show the direction of the flow in the pot. The hottest part of the burner is beneath the center of the pot.

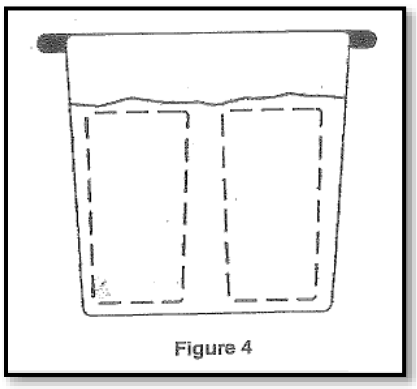


Figure 4

Student Sheet 4

4. Which situation would result in a decrease in pressure at the ocean's surface? Circle the correct answer.
   a. Water gets hot and begins to evaporate
   b. Cold water is sinking below the surface

5. Go back to the three diagrams you constructed in your lab. Label the spots in each diagram that became areas of lower

6. Think globally now. Which region in our ocean is heated most intensely by the sun? Circle the correct answer.
   a. The polar region
   b. The mid-latitudes
   c. The equatorial region

7. As water near the equator is heated, does this become an area of higher or lower pressure? Explain pressure.

8. What moves in to replace the evaporating water?

9. Number the following stages of oceanic circulation (1-4) in the order in which they are most likely to occur.
   _____ wind (movement of air/surface water)
   _____ convection (air rises/surface water evaporates)
   _____ uneven heating
   _____ area of low pressure develops