

Can water be used to store energy?

Overview: Our sun can be used for all kinds of things. In our world that is suffering from an energy crisis, we need to be more proactive to address these needs. Did you know that large bodies of water are used to store heat? Find out how today!

What to Learn: This lab will allow us to see how water interacts with the heat energy of the sun. Remember the key terms we've learned so far: conduction, convection, etc. What type of heat transfer do we observe here?

Materials

- Paper cups
- Measuring cups
- Hot water
- Watch or clock
- Sink
- Refrigerator (with freezer compartment)
- Thermometer

Lab Time

1. Turn on the hot water faucet and wait until the water is hot. Be careful not to burn yourself!
2. Add $\frac{1}{4}$ cup of hot water to the first paper cup, and 1 cup water to the second paper cup.
3. Place both cups in the freezer compartment of the refrigerator. Be sure to label your cups!
4. Check the water after 30 minutes. Record your data in the worksheet, taking the temperature of each cup and seeing if the water has frozen.
5. Return to the freezer and check the temperature again after 45 minutes. Record your data.
6. Keep checking the cups at fifteen-minute intervals until one has frozen. Record your data in the sheet.

Water Energy Data Table

Time (minutes)	Temperature (Cup 1)	Temperature (Cup 2)	Frozen? (Cup 1)	Frozen? (Cup 2)
0				
30				
45				
60				
75				

1. What conclusions can you draw about the relationship between the water's amount and its ability to store energy? How do you know?

Reading

The sun's rays interact with the earth in a number of different ways, and scientists are getting more creative in their attempts to harness the abundant energy that comes down to influence the surface. Solar ponds are large bodies of water that can store heat during the daytime and release it during the evening to be used by some nearby area. They involve placing a layer of fresh water atop salt water, which remains heavier and sinks to the bottom. The fresh water insulates the bottom layer of water and can retain quite a bit of heat.

In a freshwater pond, as the water on the bottom is heated by sunlight, the hot water becomes lighter and rises to the top of the pond. This convection or movement of hot water to the top tends to carry away excess heat. However, in a saltwater pond, there is no convection so heat is trapped. In Israel a series of saltwater, solar ponds were developed around the Dead Sea. The heat stored in these solar ponds has been used to run turbines and generate electricity.

For another example of water storing large amounts of heat energy, consider the city of San Francisco. It lies at the end of a peninsula, surrounded on three sides by water. If you've ever visited the city during the summer, you'll be surprised by how cold it can get! This is because the water absorbs a large amount of the energy from the sun, leaving the landmass colder than the continental inland. This is why the city of Oakland across the bay can be experiencing completely different weather just a few miles away.

Temperature is a measure of the average hotness of an object. The hotter an object, the higher its temperature. As the temperature is raised, the atoms and molecules in an object move faster. The molecules in hot water move faster than the molecules in cold water. Remember that the heat energy stored in an object depends on both the temperature and the amount of the substance. A smaller amount of water will have less heat energy than a larger amount of water at the same temperature.

Increasing the temperature of a large body of water is one way to store heat energy for later use. A large container filled with salt water, called brine, may be used to absorb heat energy during the day when it is warm. This energy will be held in the saltwater until the night when it is cooler. This stored heat energy can be released at night to warm a house or building. This is one way to store the sun's heat energy until it is needed.

Exercises Answer the questions below:

1. What type of heat transfer is at work in a solar pond?
 - a. Kinetic
 - b. Conduction
 - c. Potential
 - d. Convection
 - e. Radiation
2. What units do we use to measure energy?
 - a. Kilowatts
 - b. Joules
 - c. Newtons
 - d. Kilowatt-hours
3. Draw a diagram of a solar pond in the space below:

Answers to Exercises: Can water be used to store energy?

1. What type of heat transfer is at work in a solar pond? (convection)
2. What units do we use to measure energy? (Joules)
3. Draw a diagram of a solar pond in the space below: (should show salt water on bottom, layer of fresh water, and heat stored in the upper layer by the sun's rays from above)