

Geothermal Energy

Purpose

To show how heated gravel will heat the water flowing through it and to show how quickly the gravel loses heat. To show how the rate of flow of water determines how hot the water gets and how long the gravel takes to cool.

Instructions

Prior to experiment

- 1. Place the copper tube in the container and then fill the container with well sorted gravel 4mm to 8mm.***
- 2. Attach a piece of tube to a water tap and put the adjustable clip on the tube. Attach the other end of the tube to the copper pipe. Use a piece of tube to connect the outflow of the displacement can or the tank connector to the T junction and then a second piece from the T junction to the measuring cylinder.***
- 3. Place the thermometer in the T junction and use the retort stand to support it.***
- 4. Turn the tap on and adjust the water flow using the clip. Open the clip until there is a relatively slow flow of water through the gravel without it overflowing.***
- 5. Turn off the tap but do not alter the clip.***
- 6. Disconnect the container and heat the container and gravel to just below 100° in an oven.***

During the experiment

- 1. Measure the temperature of the tap water.***
- 2. Remove from the oven and quickly reconnect the container and turn on the tap. do not adjust the clip. Start the timer.***
- 3. Measure the temperature every minute and record the rate of flow several times.***
- 4. Stop when the temperature is back to the temperature of the tap water***

Repeat all these instructions but using a slower flow rate.

Teacher's Section

Requirements

Gravel 4mm to 8mm, enough to fill the container

Large displacement can or old saucepan. If the latter you will need insert a small tank connector near the top to fix the polythene tube to. A large saucepan with a capacity of about 5 litres is best because the gravel loses its heat too quickly with a displacement can.

Copper pipe that the polythene tube will fit over tightly. It should be 3cm longer than the container is deep and the bottom end should be cut at 45°.

Polythene tube

Adjustable tubing clip (for adjusting the flow through the tube)

T junction for polythene tube

Thermometer

Wooden block to support tube

Retort stand to hold thermometer vertical

Measuring cylinder

Timer

Notes

Getting the correct flow of water is important and this must be done before the container and gravel is heated. Start with the largest flow possible without the container overflowing. Then for subsequent experiments reduce the flow of water. If only doing the experiment once have the water flowing below the maximum rate. The water temperature drops surprisingly quickly which is why a large container is best.

Results

The temperature drops quickly to start with. The faster the flow the lower the temperature of the water but the quicker the gravel cools.

