Geothermal Systems

Explain (Review of Explore Activities)

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Explore 1

Ground Temperature vs. Air Temperature

1. Average Low and High for July: 60°F and 82°F

Average Low and High for January: 15°F and 30°F

2. As you increase depth in the ground for summer months, the temperature gets cooler (60°F). As you increase depth in the ground for winter months, the temperature gets warmer (60°F).

3. 49°F (Average ground temperature at Blandford is about 53°F according to Progressive AE)

4. The air temperature is hotter than the ground temperature in the summer. The air temperature is colder than the ground temperature in the winter.

Explore 1 Continued

The purpose of this activity is observe the noticeable differences between air temperature and ground temperature throughout the year. As the year goes by, the air temperature changes quite a bit while the ground temperature remains pretty consistent. This is very helpful for geothermal systems because instead of heating/ cooling varied air temperature throughout the year, we use the constant ground temperature to heat/ cool the air for a building. This saves both energy and money!

Explore 2
Temperature Variations at Various Heights

1. Height for Highest Trend of Temperature for Lende, McKay, and Main: 3.3m, 3.3m, and 2.8m

Height for Lowest Trend of Temperature for Lende, McKay, and Main: floor, floor, and floor

2. The outlier is in the main room and is thermochron #3; it was put on a light fixture

3. The overall pattern is that as you increase height, the temperature increases and vice versa.

Explore 2 Continued

The purpose of this activity was to observe the temperature differences at varying heights within Blandford. The building is heated from the floors and after looking at the temperature data, you can see that the air within the rooms is warmest towards the top. This shows that heat rises and, therefore, moves from the floor to the ceiling, giving off heat to the people and objects inside the room as it moves. In addition, the graphs show that the temperature is stable and gradually changes throughout the day.

Explore 3
Model of Geothermal System

1. Temperatures will vary with each trial so write in your answers after completing the experiment.

Temperature of water inside first tube: _____°F

Temperature of the outside of the first tube: _____°F

Temperature of water inside second tube: _____°F

Temperature of the outside of the second tube: _____°F

Explore 3 Continued

2. Heat is lost to the environment in our experiment due to transfer of water from tube to tube.

3. The model used gravity to move the water from tube to tube. This is different because an actual geothermal system uses a motorized pump system to propel the water through the pipes.

4. Have students share answers, opinions will vary.

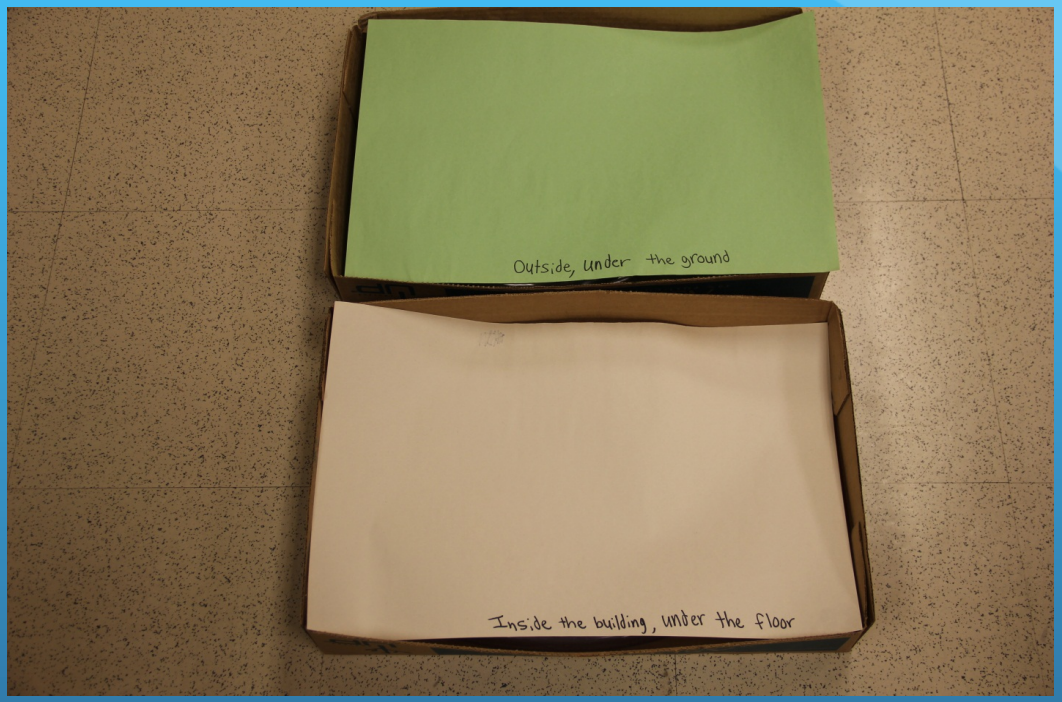
Explore 3 Continued

The purpose of this activity was to show how a geothermal system works. This model is both simple and cost effective in order to show the process of the system. Basically, the water/glycol fluid within the pipes of a geothermal system absorbs the heat from the ground and that heat is moved through the pipes until it reaches the building. From there, other machines use that heat to warm up air within the building and circulates it in order to heat the building. Note that the air still has to be warmed up using electricity, (fossil fuels, natural gas, etc.) but it won't have to warm up the air just by electricity alone. This uses less electricity and saves money!

Explore 3 Continued

This is a picture of the set-up of the coiled tubes, which represents the loop within the geothermal system for the model.

Explore 3 Continued



This is a picture of the model once the colored paper is put over top of the coiled tubes. The green paper represents the grass and ground outside and the tan paper represents the floor in the building. The tubes are hidden in order to show students that the tubes are both underground and under the floor.

Leadership in Energy & Environmental Design (LEED)

- This is a program run by the U.S. Green Building Council which certifies buildings based on their sustainability. The reason for having more sustainable buildings is to conserve our natural resources or in other words, prevent them from becoming depleted.
- Buildings earn points by fulfilling a category. Such categories include: sustainable sites, water efficiency, energy & atmosphere, materials & resources, and indoor environmental quality. These points are added up and determine which level of certification the building is rewarded.

LEED Continued

The certification levels are as follows for buildings (excluding homes):

- **Certified:** 40-49 points earned
- **Silver:** 50-59 points earned
- **Gold:** 60-79 points earned
- **Platinum:** 80+ points earned

Blandford is aiming to earn a silver certification!

The information about LEED came directly from their website, http://www.usgbc.org/leed/why-leed. Feel free to look around and learn more about the details of building certifications.

Here's an interesting fact about geothermal systems for you to think about!