



Absorbing the Heat

Scientific Investigation

Earth's surface is about 70% water and only 30% land. By understanding how these two surfaces absorb and release heat from the radiant energy of the Sun, we can better understand how our planet uses this energy.

Use this investigation to observe a property of water: to store and slowly release thermal energy.



Step 1: Question

Step 2: Relevance

Step 3: Variables

Independent variable (also known as the manipulated variable):

Dependent variable (also known as the responding variable):

Control variable(s) or group, also known as constants:

Step 4: Hypothesis

Is a hypothesis needed? If so, what is it?

How will the responding variable change when the manipulated variable changes?

Step 5: Materials

Step 6: Safety considerations

Step 7: Procedure

Air

1. Hold the resealable bag open and move the bag quickly to “scoop” up air.
2. Place a thermometer inside the resealable bag.
3. Close the bag around the thermometer, trapping as much air as possible.
4. Read and record the temperature of the air in the bag, making sure the thermometer bulb is suspended in air, not pushed against the bag.
5. Place the bag under a lamp. Adjust the lamp so that the bulb shines directly on the bag and the head of the lamp is 20 cm from the bag.
6. Turn on the lamp and begin the timer.
7. Record the temperature each minute for 5 minutes.
8. At the end of 5 minutes, record the temperature and turn off the lamp.
9. Continue to record the temperature of the bag full of air each minute for 5 more minutes.



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Scientific Investigation, continued

Sand

1. Pour 250 mL of sand into a resealable bag.
2. Place a thermometer inside a plastic resealable bag so that the bulb of the thermometer sticks into the sand.
3. Close the bag around the thermometer, squeezing out as much air as possible.
4. Read and record the temperature of the sand in the bag.
5. Place the bag under a lamp. Adjust the lamp so that the bulb shines directly on the bag and the head of the lamp is 20 cm from the bag.
6. Turn on the lamp and begin the timer.
7. Record the temperature each minute for 5 minutes, being careful to not move the thermometer around in the sand.
8. At the end of 5 minutes, record the temperature and turn off the lamp.
9. Continue to record the temperature of the bag of sand each minute for 5 more minutes.

Water

1. Pour 250 mL of room temperature water into a resealable bag.
2. Place a thermometer inside a resealable bag so that the bulb of the thermometer is under water.
3. Close the bag around the thermometer, squeezing out as much air as possible.
4. Read and record the temperature of the water in the bag.
5. Place the bag under a lamp. Adjust the lamp so that the bulb shines directly on the bag and the head of the lamp is 20 cm from the bag.
6. Turn on the lamp and begin the timer.
7. Record the temperature each minute for 5 minutes.
8. At the end of 5 minutes, record the temperature and turn off the lamp.
9. Continue to record the temperature of the bag of water each minute for 5 more minutes.



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Scientific Investigation, continued

Step 8: Data collection

Create data tables similar to the example table below in your lab journal and fill in during your investigation.

| Temperature of Air, Sand, and Water from Light | | | |
|--|-----|------|-------|
| Heating Time (min) | Air | Sand | Water |
| 0 | | | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| Cooling Time (min) | Air | Sand | Water |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

Step 9: Data analysis

Create a graph based upon the data. Make a general statement about the results shown in graph.

Step 10: Conclusion and scientific explanation

How does water's ability to store and slowly release thermal energy affect the heating of Earth?



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Rubric for writing a scientific explanation

| Points Awarded | 2 | 1 | 0 |
|----------------|--|--|--|
| Claim | Not applicable. | Answers the question and is accurate based on data. | No claim or does not answer the question. |
| Evidence | Cites data and patterns within the data. Uses labels accurately. | Cites data from the data source, but not within the context of the prompt. | No evidence, or cites changes, but does not use data from data source. |
| Reasoning | Cites the scientifically accurate reason using correct vocabulary and connects this to the claim. Shows accurate understanding of the concept. | Cites a reason, but it is inaccurate or does not support the claim. Reasoning does not use scientific terminology or uses it inaccurately. | No reasoning or restates the claim, but offers no reasoning. |
| Rebuttal | Rebuttal provides reasons for different data or outliers in the data. Can also provide relevance to the real world or other uses for the findings. | Rebuttal is not connected to the data or is not accurate. | Does not offer a rebuttal. |