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Lesson 3: Investigating Rates of Heating and Cooling

Purpose: Design an experiment to test how soil and water heat and cool.

Guiding Questions: How are heating and cooling rates affected by the material that is being heated?

1. In this investigating we will examine the effect a material has on its heating and cooling rates.
2. Do all substances heat and cool at the same rates? Answer this question and support your answer with specific examples you are aware of.

3. In this investigation, we will heat two substances: soil and water. We will conduct a fair trial by keeping everything as equal as possible. Both substances will be exposed to the same amount of heat and we will record the temperature of these substances over time.

Do you think these substances will reach the same temperature in the same amount of time? Why or why not?

Do you think these substances will cool at the same rate in the same amount of time? Why or why not?

4. With this information in mind, we need to design the experiment. Gather your materials kit from the back of the room. Look at page 42 in your book for a picture of how the experiment will be setup. Use this information to help you complete the table on the back of this sheet.

Investigation Planning

Question(s) we will try to answer: ***Do different substances have the same heating and cooling rates?***

What we think will happen (prediction):

What we will keep the same when testing each substance:

Things we will measure and how we will measure each one:

- Amount of each substance:
- Temperature:
- Time:
- Results (graphing):

Note: The procedure for this lab has already been written. Look at pages 42-45. Answer the following questions:

- a. In what unit will you record the temperature? What is the nearest place value you will record the temperature?
- b. How often will you record the temperature? How long will each substance be heated? How long will each substance be cooled?
- c. How much of each substance will you test?
- d. How far will the thermometer be placed into each substance?

Data Collection.

You will record your data in a self-created Google Spreadsheet. Below is a sample data table to help you create your spreadsheet.

After collecting your data, you will create a graph of this data. You must decide which type of graph to create. Here are your choices:

- **Bar Graph:** A bar graph is used to compare only two points in time or to compare a single type of data. For example, our school may look at the total number of hot lunches sold each day to determine which lunches are most popular. The single data point is the hot lunch. It might also be used by teachers to compare pre-test and post-test scores.
- **Scatter Plot:** A scatter plot is used to look for relationship between two variables. For example, the school nurse might make a scatter plot of the 7th grade students' weight vs. their height. She can then look for trends within this data.
- **Line Graph:** A line graph is used to show changes in data over time. This graph is best when a single type of data (e.g. money, height, volume, etc.) is tracked over a period of time at regular intervals (e.g. every minute, day, week, year, etc.)

Which type of graph is best for the data you are collecting? Why?

Create this graph within your spreadsheet (we will discuss how to do this). Take screenshots of your data table and your graph and insert them into the extra pages on this handout.

Name Period Date

Space for your Google Data Table and Graph

Analysis. Answer the following questions.

1. How would you describe the heating and cooling rates of soil and water in this investigation? Use specific data to support your answer.
2. Which material held its heat the longest? Use specific data to support your answer.
3. Read the introduction to lesson 3 (p. 38). Provide an explanation why concrete feels hot under your feet in early summer, while water in a pool feels cold.
4. Based on your investigation, how do you think oceans absorb and hold heat? How do you think the temperature of the ocean compares with the temperature of the land nearby?
5. In this investigation you graphed your collected data as a line graph. Why was a line graph the best choice for graphing your data?

Answer the following questions after you read pages 46-49.

6. Based on what you read and what we learned in this investigation, write an explanation for why wind occurs.

7. Are greenhouse gasses beneficial or harmful to life on our planet?

8. Why is it hotter in the summer than it is in the winter?