

# Specific Heat

# Teacher's Guide

**Subject (Body of Knowledge):** Science (Physical Science)

**Big Idea (topics):** Heat, Temperature, Thermal Energy, Specific Heat

**Summary:** Students will measure and observe the change in temperature for four different materials of the same volume.

**Objective(s):** After completing the field lab, students will be able to:

1. Define temperature, heat, thermal energy and specific heat
2. Describe heat transfer
3. Measure and compare the specific heat of three substances

**Ecosystem(s):** Springs, other

## Equipment:

- 4 x 300 ml Glass Beakers
- 4 x thermometer probes
- 1 x LabQuest
- Container for shade or cold water bath.
- Stopwatch
- Light meter (optional)

## Background (Pre-field Classroom Activity):

- **Equipment Training:** LabQuests
- **Vocabulary:** temperature, heat, thermal energy, specific heat
- **Reference material:** <http://www.glencoe.com/sec/science/Science600/co/663.php?iRef=663&iChapter=10>
- **Advanced Preparation:** Set up LabQuests with temperature probes and set to record every 30 seconds. Place substances in shaded area to establish an equal baseline temperature.

## Procedures (Engage; Explore; Explain; Elaborate; Evaluate):

1. **Engage.** Ask students to touch four different items that have been left in the sun (wood, stone, metal, water). Ask them why some felt warm and others cool? Introduce temperature as the average kinetic energy of an object. Ask them why spring water is constant all year round. Ask them if it remains constant once it reaches the surface.
2. **Explore.**
  - a. Fill three or four beakers with equal amounts of sand, clear water, dark water.
  - b. Place a thermometer probe in each
  - c. Place these in a shaded area for about 1 hr
  - d. Move the items into direct sunlight. Monitor and record the temperature change every 30 seconds for each substance.
3. **Explain.** Complete the assessment questions. Be sure to touch on the key concepts included in pre/posttest.

## Sunshine State Standards:

**Science:** SC.6.E.7.5; **Mathematics:** MA.8.G.5.1; **Language Arts:** LA.6.4.2.2; **Social Studies:** SS.7.G.5.1

# Specific Heat

# Student Data Sheet

## General Information

Full Name:		Date:	
School (teacher):		Time:	

## Student Hypothesis and Rationale

If the same amount of heat is added to the following substances, then the one that will warm most quickly will be (choose one: clear water; dark water; or sand), because . . . \_\_\_\_\_

## Field Observations/Measurements

Time	Temperature (degrees celsius)			
	Clear water	Dark Water	Sand	Air Temp
0 Seconds				
.5 minutes				
1.0 minute				
1.5 minutes				
2.0 minutes				
2.5 minutes				
3.0 minutes				
3.5 minutes				
4.0 Minutes				
4.5 minutes				
5.0 minute				
5.5 minutes				
6.0 minutes				
6.5 minutes				
7.0 minutes				

## Specific Heat

## Assessment

1. Which of the substances warmed up the slowest? Which warmed up the fastest?

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2. What was the difference between the final temperature of the sand and the water?

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3. Was your hypothesis supported by your data? Explain your results and what you can infer from your observations, measurements, and results.

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4. How would the temperature change be different if the sand was black? What if it was wet?

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5. If lighter colors on substances reflect more light energy, how could people use this to cool their homes?

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6. Think about the observations you have just made. Did the activity raise new questions? Write a short question (start with “What, Why, Where, When, or How”) about something you want to learn more about.

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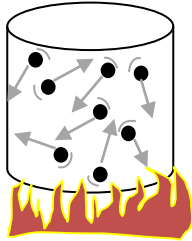


## Specific Heat

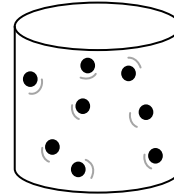
## Reference

**Temperature = Average Kinetic Energy of Particles in Matter**

More kinetic energy = higher temperature



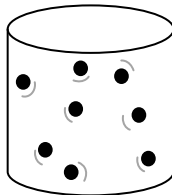
Less kinetic energy = lower temperature



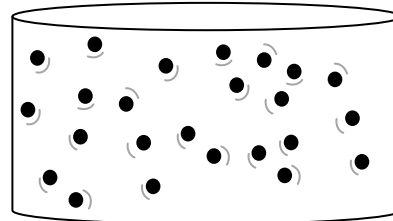
**Thermal Energy = Total Energy of All Particles in an Object**

At the same temperature . . .

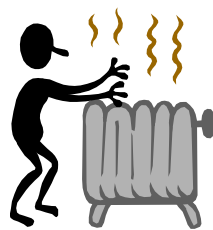
Less volume = less thermal energy



More volume = higher thermal energy



**Heat = Thermal Energy Transferred from a Warmer Object to a Cooler Object**

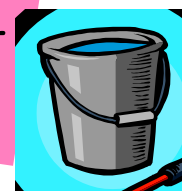


Cold air

Warm radiator

**Specific Heat = Energy Required to Raise the Temperature of 1 gram of Material by 1 Degree Celsius**

It takes less energy to warm sand



It takes a lot of energy to warm water

