

# 4

## Energy

### Objectives

You will be able to

- Explain the relationship between mass and thermal energy.
- Design and conduct an experiment.
- Give reasons for lab decisions.
- Summarize information and use evidence to write an argument.



*How do we use and control thermal energy in a system?*

### Evaluation and Feedback

To evaluate your work, you will

- Use the “Planning and Carrying Out an Investigation” row of the Science and Engineering Practices Rubric.
- Use the “Engaging in Arguments from Evidence” row of the Science and Engineering Practices Rubric.

## Task 4: Mass and Thermal Energy

As a group:

- Listen to *Goldilocks and the Three Bears*.
- Brainstorm (share ideas for) reasons why Papa Bear’s, Mama Bear’s, and Baby Bear’s porridges are three different temperatures.
- Decide on an experimental question about the porridge.
- Design and conduct an experiment to test your question.
- Collect and graph the data from your experiment.
- Construct an argument using evidence from the experiment.

### Vocabulary

- mass
- variable

### Connect to the Culminating Project

Update your client in your Individual Project Organizer:

- Decide on the size (mass) of the device you will be making for your client.
- Explain why your choice is effective in terms of thermal energy.
- Sketch a model of your device.

**Part I • Design and Conduct an Experiment: This Porridge Is Too Hot!**

LAB

This Porridge Is Too Hot!

What variables might account for temperature differences among Papa Bear's, Mama Bear's, and Baby Bear's porridges?

Experimental Question • Write a question you will answer in your experiment.

Materials • Make a list of your materials.

Procedures • Draw and label your experimental procedures.

Experiment should include at least three setups. Everything should be the same between the three setups except for one variable.

**SAFETY NOTE**

Do not eat the oatmeal.

Teacher's Initials \_\_\_\_\_

## LAB

## This Porridge Is Too Hot!

**Prediction**

Predict what will happen in your experiment. Give a reason for your prediction.

Prediction

Reason

**Data**

Decide what measurements you will make and how often you will collect your data

**Data Table**

Organize your data in a table, showing the difference in temperature for each amount of oatmeal.

**Graph**

Graph your data on graph paper or on a large piece of poster paper.

## Part II • Debrief the Experiment

### Group Discussion

- Describe your results. How do your results compare to your prediction?
- In Task 1, you learned that the amount of thermal energy depends on the number of particles and the amount of kinetic energy. Use this information to answer these questions.
  - Which bowl had more particles?
  - Which bowl had more thermal energy?
- In *Goldilocks and the Three Bears*, which bear do you think had the most porridge, the least porridge, and the middle amount of porridge? Explain your reasoning.

### Conclusion

Answer this question in the boxes below:

- How does having a greater mass (larger number of particles) affect the change in thermal energy?

	Possible Sentence Starters	Your Response
Claim	The bigger the _____, the less the _____. As the size (mass) of _____ increases/decreases, _____.	
Evidence	My group saw that _____. Our data is _____. The temperature for the _____ went down by _____, and the temperature for _____ went down by _____.	
Reasoning	The data makes sense because _____. The data shows that temperature change is dependent on _____. The reason the evidence makes sense is because _____.	

## Part III • Connect to the Culminating Project and Assessment

### Application

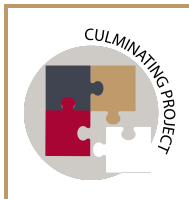
Apply what you have learned about how mass affects thermal energy transfer to your device. Think about the needs of your client.

1. Decide which size (mass) option would be best for your client. Choose one of the given options.
2. Give evidence to support your choice. Explain your choice using terms such as mass, thermal energy, transfer, insulator, conductor.

### Client List

Apply what you have learned about how mass affects thermal energy transfer to your device. Think about the needs of your client.

- A. **Cocina del Sol: A Latin American, eco-friendly food truck company**  
Choice: cookie size (mass)
  - 2 in. diameter (10 g) or
  - 4 in. diameter (20 g)
- B. **Salmon Conservation Foundation: A company that researches Alaskan salmon**  
Choice: hand size
  - 10 cm hand length or
  - 20 cm hand length
- C. **Only Have Ice for You: An ice delivery company, specializing in ice for ice-carving competitions**  
Choice: ice block size
  - 200 cm tall x 130 cm wide x 65 cm thick or
  - 100 cm tall x 60 cm wide x 30 cm thick
- D. **Homemade Hot Tubs, Inc.: A company that provides the materials and instructions for people to make their own hot tubs**  
Choice: Volume of water for the engineering model
  - 250 mL or
  - 500 mL



Complete the individual  
Project Organizer for this task.