| "" | HANDS-ON LAB Design and Test an Insulated Container |
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You will design a device to insulate a paper cup containing ice-cold water. After you design the device, you will build a model and test it by measuring the change in water temperature over a period of 30 minutes.

The engineering problem is to design a system that minimizes the transfer of thermal energy to the water from its surroundings. In this case, the criteria and constraints include the use of available materials and completion of the design and construction of the model in the time designated by your teacher.

## Materials

* aluminum foil
* bubble packing
* cardboard
* cotton balls
* cotton fabric
* drinking straws
* graduated cylinder, 100 mL or larger
* ice
* paper cup
* plastic film
* rubber bands
* sheets of paper
* stopwatch or timer
* string
* thermometer
* water
* wire
* other materials provided by your teacher

  

## Procedure and Analysis

Set Up your lab journal:

1. Title at top center
2. Partners at top left
3. Create a new heading each time you work on a new step- heading is the step name and add the date
4. Record ideas, drawings, summaries, etc. for each step.
5. Record the final data in your lab journal.

STEP 1 With your group, brainstorm ideas for building an insulation system to minimize change in temperature of the water in the cup. Record ideas in your lab journal. Label each idea.

STEP 2 Evaluate the solutions that were suggested during the brainstorming session. During evaluation, you may want to eliminate some ideas. You may also want to combine parts of two or more ideas. Then build a model of the selected solution for testing. Record ideas and models in your lab journal

STEP 3 Test your model by measuring 100 mL of ice-cold water into the cup and placing the cup in the model. Be careful not to include any ice in the water. Measure the temperature of the water, and record it as time zero on the data table below.

STEP 4 After 5 minutes, measure and record the temperature of the water. Repeat every 5 minutes for 30 minutes.

STEP 5 Create a graph with Time on the X axis and Temperature on the Y axis. Label each axis with a title and unit. Make the graph in your lab journal. It should take up at least half a page.

STEP 6 What did you observe during your investigation? How does your data show that a transfer of thermal energy did or did not occur? Answer in your lab journal

| Thermal Energy Transfer Data | |
| --- | --- |
| Time (min) | Temperature (°C) |
| 0 |  |
| 5 |  |
| 10 |  |
| 15 |  |
| 20 |  |
| 25 |  |
| 30 |  |

STEP 7 Based on your results, suggest some modifications to improve your container. Support your argument using evidence from your experiment and your notes. Add an answer to your lab journal.

Grading

| Item | Requirements | Point Value |
| --- | --- | --- |
| Formatting | Title at top center  Partners at top left  Headings for each step that requires content  Date for each step | 2  2  6  7 |
| Step One | Brainstorm  List and describe ideas from each team member  Include drawings or diagrams | 5 |
| Step Two | Evaluate Solutions  Describe how/why you chose the design  Describe your choice and explain why this was the best choice- include tradeoffs and any decision making tools used  Drawing of Model  include parts and materials used | 10  10 |
| Step Three & Four | **Data Table with data** | 10 |
| Step Five | **Graph**  Title of graph relates to the lab experiment  X axis labeled and includes the unit  Y axis labeled and includes the unit  Graph represents a line-graph of data | 10 |
| Step Six | **Question**  Answer addresses both parts of the question and it is supported with evidence from the lab and explanation from your notes  See rubric on next page | 15 |
| Step Seven | **Question**  Answer addresses both parts of the question and it is supported with evidence from the lab and explanation from your notes  See rubric on next page | 15 |
|  | **total** | 100 |

| **Part of Answer**  **Each question has 2 parts that can be summarized with one claim.** | **Criteria** | **Point Value** |
| --- | --- | --- |
| **Claim**  *This is your topic statement such as a statement, whether a hypothesis was supported or not,*  *a conclusion that answers a question or a problem.The topic statement must meet the 3 criteria* | Makes a claim that is Relevant | 1 |
| Makes a claim that is Accurate | 1 |
| Makes a claim that is a Complete sentence that stands alone | 1 |
| **Evidence**  *Scientific evidence that supports the claim. Specific structures and functions are described and discussed. The evidence chosen supports the topic statement.* | Provides evidence to support the claim that is Appropriate (Scientific information from notes, textbook, and class discussions only) | 1 |
| Provides evidence to support the claim that is Sufficient (Enough features to support the claim- 3 to 4 specific structures and functions) | 1 |
| **Reasoning**  *A justification that connects the evidence to the claim. It shows how and why the features listed help with homeostasis as stated in the claim.* | Explanation provides reasoning that is Clear (it is clear that you know how the parts help with homeostasis) | 1 |
| Explanation provides reasoning that is Connected (Explains why the evidence is important or why it is relevant to homeostasis) | 1 |
| Explanation provides reasoning that is Integrated (Links the evidence to the claim) | 1 |