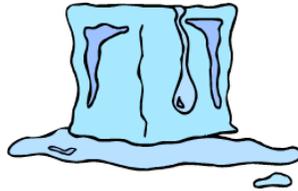


Name: _____

Section: _____

Engineering Design Process - Ice Cube Challenge



Problem:

A new company has started providing individuals with guided tours of Death Valley, California, one of the hottest places on Earth. The company, HPT (Heat Prevention Tours), is currently in search of a new product that can help make the tours more enjoyable - an insulated container. Due to glaring sun and extremely high temperatures, maintaining a cold and refreshing drink has become a challenge.

Goal:

Work as a team to construct a container that will help prevent the ice-cubes from melting and subsequently warming your drink while traveling from the different cooling stations in Death Valley - **fifteen minutes.**

Good Luck!

Guidelines:

1. The container must be able to fit a small plastic bag with an ice-cube, and will be placed into a "thermal zone."
2. Each group will calculate the percent change of the ice cube's mass by dividing the change in mass by the initial mass and then multiplying by one hundred.

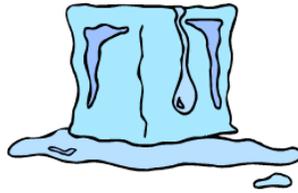
3. Each group is allotted **\$25.00** and it will be necessary to purchase the listed materials prior to building the prototype. The cost of each item is below.

\$5.00 each	\$3.00 each	\$1.00 each
Glass Cup/Bottle	Lid/Cap	Rubber bands
Metal Cup/Bottle	Aluminum Foil	Masking Tape
Plastic Cup/Bottle	Foam	Cardboard
Paper Cup/Bottle	Cotton Balls (4)	Paper
	Plastic Wrap	Plastic Bag
	Felt	Glue sticks

Scissors can be rented for \$1.00 per day

4. Each member of the group must complete the Ice Cube Challenge **Student Worksheet**.

Assessment: The total score earned for this activity will be based on the grading rubric below.



Grading Rubric				
Criteria	Exceptional (5 - 4 Points)	Acceptable (3 - 2 Points)	Marginal (1 - 0 Points)	Points
Define Problem	Clearly and precisely defines the problem.	Defines the problem.	Defines a problem that cannot be tested or does not define the problem at all.	
Research	Accurate information taken from a minimum of three sources in a systematic manner; sources appropriately cited.	Accurate information taken from a few sources; sources cited.	Incorrect or no information; no sources cited.	
Brainstorm	Extensive list of possible solutions to the problem accompanied by labeled diagrams.	List of possible solutions to the problem with sketches.	Limited list of possible solutions to the problem or no possible solutions listed.	
Design Proposal	Plan/blueprint has neat diagrams with clearly labeled measurements and components/materials.	Plan/blueprint has diagrams with most of the necessary measurements and components/materials.	Plan/blueprint has rough diagrams that do not adequately provide the necessary measurements and components/materials.	
Prototype/Model	Meticulously constructed according to the blueprints and functional.	Constructed according to the blueprints and functional.	Carelessly constructed; does not function properly.	
Test, Evaluate, & Redesign.	Clear evidence of troubleshooting, testing, and refinements based on data.	Some evidence of troubleshooting, testing and refinements.	Little evidence of troubleshooting, testing or refinement.	
Total Group Effort	All students worked as a cohesive unit and equally participated.	Most students participated, but some members appeared to be non-existent.	Few students effectively participated.	

Criteria	Exceptional (5 - 4 Points)	Acceptable (3 - 2 Points)	Marginal (1 - 0 Points)	Points
Question #1	Answer is thoughtful, detailed, and reflects a clear understanding of all aspects associated with the engineering design process.	Answer reflects a general understanding of the aspects associated with the engineering design process.	Answer does not reflect an understanding of the engineering design process.	
Question #2	Answer is thoughtful, detailed, and reflects a clear understanding of all aspects associated with the engineering design process.	Answer reflects a general understanding of the aspects associated with the engineering design process.	Answer does not reflect an understanding of the engineering design process.	
Question #3	Answer is thoughtful, detailed, and reflects a clear understanding of all aspects associated with the engineering design process.	Answer reflects a general understanding of the aspects associated with the engineering design process.	Answer does not reflect an understanding of the engineering design process.	
Question #4	Answer is thoughtful, detailed, and reflects a clear understanding of all aspects associated with the engineering design process.	Answer reflects a general understanding of the aspects associated with the engineering design process.	Answer does not reflect an understanding of the engineering design process.	
Criteria	40 Points			Points
Execution	<p style="text-align: center;"> $\% \text{ Change} = \frac{\text{Change in Mass}}{\text{Initial Mass}} \times 100$ </p> <p style="text-align: center;"> Initial Mass - _____ Final Mass - _____ </p> <p>Calculations:</p> <p style="text-align: center;">➤ For each percent the mass lowers, there will be a penalty of 0.5 point.</p>			

Total = ____ /95

Additional Comments:

Name: _____ Section: _____
Engineering Design Process - Ice Cube Challenge - **Student Worksheet**

Problem

Define/describe the problem to be solved

--

Research

Cite sources your group used to gather information

--

Imagine Possible Solutions

Brainstorm for various solutions to help solve the problem

Choose a Solution (Preliminary)

- Complete the materials chart.
- Draw a detailed sketch of the prototype to be used.

Materials	Quantity	Cost
Total Cost =		

Refer to the materials list for pricing information

Create and Test Prototype

Record observations related to the testing, evaluation, and redesign of the prototype

Choose a Solution (Final)

- Complete the materials chart.
- Draw a detailed sketch of the final prototype to be used.
- Be sure to include **metric** measurements and label all materials used.

Materials	Quantity	Cost
Total Cost =		

Refer to the materials list for pricing information

Improve

Reflect on your design solutions

- 1) As you were building and testing, what were 3 specific changes your group made in efforts to improve the design? Explain the reasoning behind each of the changes.

- 2) If you could do this challenge again, by yourself, how would your purchasing and construction strategies be different? Why?

3) The purpose of your container was to prevent heat transfer from taking place. Explain how your container was able to limit the rate at which heat transfer occurred.

4) For this challenge, there were limited materials that could be used to construct your container. If you could have used one other material of your choice (not on the required materials list), what would it be and why would you use it?
