

Names:

I. Challenge problem: Design an insulating device that will keep 250 ml of water warm or cold for the longest time (compared to your peers' devices).

→ **Question: Which material(s) would make the best thermos?**

Design constraints:

- 1) Fit in your teacher's hand
- 2) Must hold 250 mL of hot water
- 3) Be structurally sound (doesn't easily fall apart)
- 4) No part of your container may be permanently altered as a result of the final test (your results must be repeatable without changing your container.)
- 5) The container that shows the lowest change wins!

- 1) Use a plastic/glass/ceramic cup as the core
- 2) Use any raw materials at home or from the store as long as they obey the "May NOT" section.

You May NOT:

- 1) Use a thermos/travel mug as the core
- 2) Use materials only accessible to research laboratory personnel
- 3) Use a top/cap/lid that completely seals the thermos.

You May:

II. Research the problem: In the space below, summarize what you learned from your research.

III. **Brainstorm Solutions:** In the space below describe (draw/write/label) your initial design ideas. Include annotations, questions, measurements, sources (where you found the information) **NOTE:** *There are just your ideas. You will describe your prototype in the next section.*

IV. Build a Prototype: Now that you have selected an idea to begin with, use the space below to draw your initial design before you begin building. Take your time and put effort into this drawing. It should include clean lines, measurements, labels, at least two perspective (cut away and top down), materials, and notes.

V. Test the prototype: Congratulations. You have built your first prototype and are ready to begin testing. Your initial tests should include the following:

- Size: Will it fit in your teacher's hand?
- Water holding ability: Will your prototype hold 250 ml of water?
- Structure: Is your prototype build to last? Is it structurally sound?
- Insulation: Will it keep 250 ml of water warm for 30 min or longer?

Use the space below to display your testing data. Please include a brief description of each test and column/row headings for tables and units for all data. *Attach additional pages if needed.*

VI: Communicate Results: Now that you have tested your device, what have you learned? Is there more research you need to conduct? Are there changes you wish to make to your design? In the space below, summarize your test results and the next steps you plan to take. If you are considering a new design, please attach the new blue print to this packet.

VII. CER: Question:

C Claim: Write a <u>clear</u> statement that responds to the <u>question</u>. 2	
E Evidence: Provide <u>scientific data</u> to <u>support</u> your claim. Your evidence should be appropriate (relevant) and sufficient. You can use bullet points, graphs, or data. Sometimes this data will refute, or go against, your original claim. 1	

R

Reasoning: Use scientific principles and knowledge that you have gained about why your evidence supports your claim. In other words, summarize how your data proves your point (or refutes

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