

## Physics 11 Thermos Challenge

**Purpose:** To make a thermos that losses the least amount of heat as possible. The first part to design three different prototypes using materials that keep under the budget of \$3.00. Then create a procedure to test each prototype and see which thermos losses less heat as possible.

### Materials/Equipment

- The 3 prototype thermoses
- Heat Plate
- 200ml beaker
- Thermarator
- Timer

### **Procedure**

1. Use a breaker that is able hold at least 150 ml of water and fill it up to 150ml, place it on heat plate and wait until the water boils.
2. Pour 150ml of hot water into the first prototype thermos, then measure the temperature with a Thermarator and record it.
3. Leave the thermos with the hot water and check it temperature again in 30 mins, then check again in the next 30mins, record temperature for each check.
4. After the first 60 mins with the first prototype, repeat steps 1-3 for second and third prototype.
5. Compare data from each prototype and choose which thermos had the highest temperature for the long time in the total of 60 mins.



### **Thermos A**

#### Materials

- 2 styrofoam cups
- Ducktape/decorative tape
- Aluminum foil

The 2 cups were stacked on top another, however the top cup wasn't touching the bottom of the lower not completely, leaving space inside. The top was wrapped with aluminum foil, while the bottom was wrapped in duct tape. And a piece of aluminum foil was used as a lid.



## Thermos B

### Materials

- Glass cola bottle
- Aluminum foil
- Yarn
- Aluminized polyester

For this, the container was a glass cola bottle wrapped in layers. The first layer was aluminum, the bottle was then wrapped in yarn as the second, then the top layer is aluminized polyester (which was designed to reflect heat).



## Thermos C

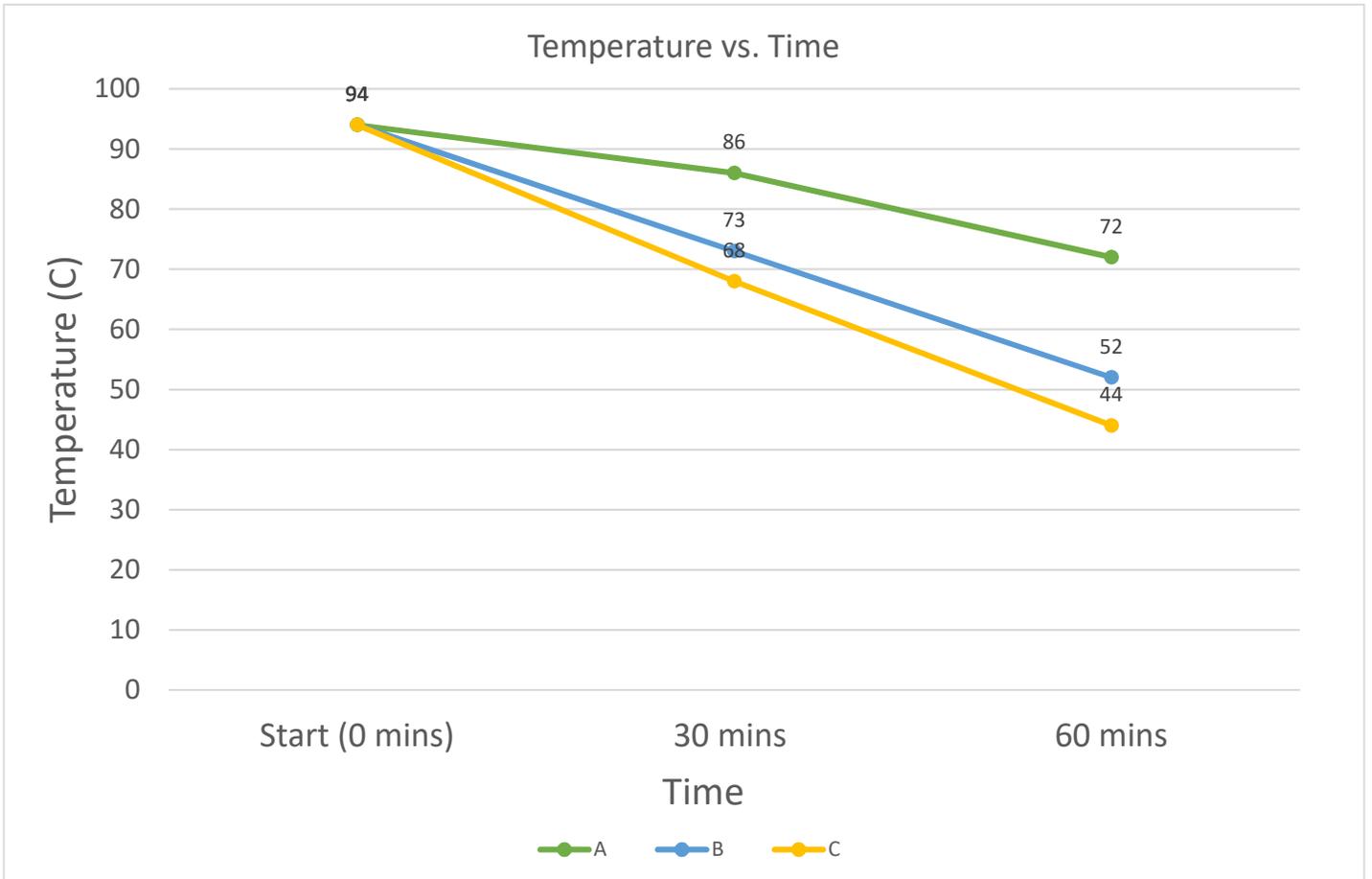
### Materials

- Styrofoam cup
- Aluminized polyester

Similar to thermos A and B. Based on previous results, we tried to combine the same materials from other thermoses. It's a styrofoam cup wrapped with aluminum polyester and foil.

## Final Result

For this project, we mainly took the approach where we would first come up with 3 designs, then decide which was the best. At the start of each test, the water used was at 94 °C. For thermos A after 60 minutes, the water had the temperature of 72 °C, losing 22 °C. Thermos B's water had a temperature of 52°C, losing 42 °C and C had lost 55 °C , lowering to the temperature of 44 °C. The reasons for losing heat or 'thermal energy' was because for thermoses B and C, the outside layer was aluminized polyester. The polyester was mainly used to reflect heat, meaning that since it was the outer layer, the polyester happened to conduct cold from the room into the thermoses, losing thermal energy and making the water cooler, therefore the polyester should have been the first or second layer. Overall, the testing of Thermos A proved that layering styrofoam offers better insulation with regular aluminum foil as the outside layer instead of yarn and duct tape.



Prototype	Temp at 30 mins (C)	Temp at 60 mins (C)
A	86	72
B	73	52
C	68	44