

# Trial/Pilot Event

Contact the organizers of your tournament to find out what trial/pilot events will be held.

## KEEP THE HEAT

DESCRIPTION: Teams will construct an insulated structure prior to the tournament, hereafter called the device, which will fit into a 30 cm cube. The device will be designed to retain the heat of approximately 100 ml of water in a standard, unaltered, empty, Pyrex 250 ml beaker (supplied by students).

A TEAM OF UP TO: 2

APPROXIMATE TIME: 45 minutes

THE COMPETITION:

1. The device will be impounded a minimum of one hour before the event. The water will be added to devices by the judges at **approximately** thirty-second intervals until all of the competing devices have their hot water samples. Judges could use water taken from a constant temperature bath such as a large electric coffee pot. **Temperatures will be measured in degree Celsius (°C).**

2. The beaker must be removable from the device and there must be easy access to the interior of the device for easy loading or pouring and rapid temperature measurement of the water sample at the end of the competition period. Loose fiberglass must be covered, plugs are allowed. No free fiberglass will be allowed.

3. At the end of a 20 - 30 minute time period (determined by the judges), **the temperature of the water in the devices will be measured** in the same order in which they were loaded by the judges, at **approximately** thirty-second intervals. **The devices may be opened or not depending upon the temperature measurement method chosen by the judge(s). All devices will be measured using the same method.** Temperature measurements will be taken and recorded immediately by the judges. Judges will supply the thermometer(s) (digital **or thermocouple** would be best). At least one student from the competing team must be present during the entire test (loading, cooling, and temperature measurement) of the device.

4. **Prior to the tournament, participants will develop a set of temperature vs. cooling time (30 minutes) curves for various initial starting temperatures in the range of 50°C-90°C. These curves will be used by the students to predict the final temperature of the device when used in the competition.**

5. **(Optional)** The event director may choose to give a short quiz on heat and temperature during the time the devices are under test. The quiz scores may be used to reduce the score by up to 10%. Questions could include temperature conversions; definitions of heat units, thermal conductivity, heat capacity and/or specific heat; or simple calculations of heat capacity and/or specific heat. Teams should be notified in advanced of the range of questions if different than the above.

SCORING: 1. The team with the lowest score will be the winner. The score will be based on the formula:  $SCORE = [(100 \times \_T) + \text{mass of device (in grams)} + 5 \times \_t_{\text{prediction}}][1 - 0.1(\text{quiz score \% if used})]$

where:  $\_T = |\text{the final water temperature} - \text{the initial water temperature}|$

$\_t_{\text{prediction}} = |\text{the difference between actual and predicted final temperatures}|$

(e.g., if quiz score = 80%, the mass of device = 300 grams, the water temperature change ( $\_T$ ) = 10°C and  $\_t_{\text{prediction}} = 1.5^\circ\text{C}$ )

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**then the score is**  $[(100 \times 10^{\circ}\text{C}) + 300 \text{ grams} + 5 \times 1.5^{\circ}\text{C}][1 - 0.1(0.8)]$

**$[1000 + 300 + 7.5][0.92] = [1307.5][0.92] = 1202.9$**

2. In case of a tie, the team with the smallest  $t_{\text{prediction}}$  will be declared the winner. **The second tie breaker will be the smallest  $t_{\text{prediction}}$ .**

3. Winning structures will be inspected to insure that no other source of energy was used other than the hot water supplied by the judge.

4. **If accurate instrumentation and data collection is available, heat loss values may be corrected for variations, if any, in cooling time, water start temperature, and/or room ambient temperature over the course of the competition.**

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