



- LEVEL:** Middle School/High School
- NUMBER OF TEAMS:** One (1) per school
- TEAM MEMBERS:** Two (2) to six (6) members per team
- OBJECTIVE:** Design, test and build an efficient, passive solar still capable of purifying water through the natural process of evaporation and condensation. Distillate will be captured in a detachable container and measured for presence of dissolved solids. Based on original design, teams will create a second design to increase efficiency by changing at least one (1) parameter. Students will enter the most efficient design and formally present their results. **Design efficiency** will be derived from the **still quality factor**: ($Q[\text{mL}/\text{cm}^2/\text{hr}]$), which considers:
a) volume of distillate; b) area of the still;
c) the total dissolved solids; and d) elapsed time measured in fractional hours.
- MATERIALS:** Supplies & equipment required for this event include beveled glass, foam insulation, a saw blade, tape measure, roll of HVAC tape, silicon, tubing, and pvc strips. Please review this website for more information and inspiration. (<http://www.sahra.arizona.edu/education2/solarstill/mesasolar.htm>)

Other suggested materials:

Wood	plastic	styrofoam	cardboard
metal	aluminum foil	duct tape	silicon
paint	plastic tubing	squeeze bottle	collection jar

DESIGN PARAMETERS:

1. Stills can be no larger than 50 cm x 50 cm x 50 cm, *not including the collection jar*. The collection container must be easily disconnected from the still for judging.
2. Electric power cannot be used (even from solar panels).
3. All **glass edges must be sanded/beveled** and no edge of the glass can be exposed or otherwise considered a danger.
4. The still must be refillable so that it can be filled immediately before the event in less than ten minutes.
5. A simple diagram showing how the total surface area can be calculated must accompany any glass cover that is not rectangular.
6. Stills that leak outside of their 50 cm x 50 cm allotted space will be disqualified.
7. Design should be constructed sturdy and durable enough to withstand a minimal amount of movement (wind, judges handling, etc.).

ORAL PRESENTATION:

1. A minimum of two (2) team members are required to present a 4-6 minute technical brief to include a short introduction of team members, summary of project design, expectations, results, and discussion of how changing one (1) parameter varies the efficiency of the design.
2. Presentations will be given before a panel of judges. A maximum of five (5) power point slides and/or overheads are permitted for use during the presentation.
3. Following the presentation, judges will be allotted two (2) minutes to ask clarifying questions.
4. Three (3) clean paper copies of the presentation must be submitted prior to giving the

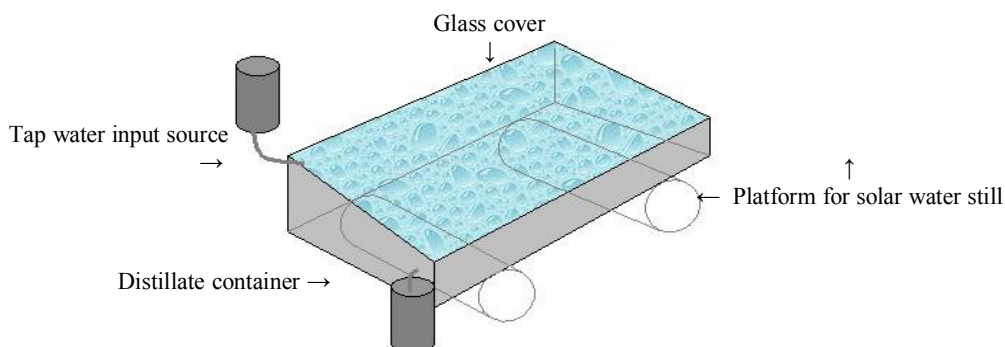
technical brief. TESTING CONDITIONS:

1. Entries will undergo specification checks to ensure that design meets parameters described above.
2. Still reservoir and distillate container must be empty of water (minimal dampness allowed) to begin.
3. Up to two (2) team member(s) can place still in testing area as directed by event judge. Students will place designs on two (2) cement blocks (4"x 8"x 16") in their designated space.
4. Students will have up to ten minutes to fill their still with tap water (provided on site).
5. Students may make final adjustments to the placement of their still just prior to the start of the competition. Once the competition begins, no one will be allowed to touch or adjust the stills till the competition concludes over a period of three (3) hours.
6. Judges will detach the distillate collection containers within two (2) minutes of end time and then measure volume and conductivity of distillate.

SCORING:

1. Judges will collect and measure the distillate volume and conductivity after three (3) hours, calculate the still quality factor and rank the stills from most efficient to least efficient.
2. The panel of judges will average their presentation scores and then rank them from highest to lowest. Maximum points will be given for comparisons of multiple solar still designs.
3. The ranks from the two parts (performance and presentation) will be weighted equally to determine the final score.

I. Sample Drawing of Passive Solar Water Still



Middle School: _____

Student Names: _____

**For Official Use
Only**

	Technical Content	Overall Presentation	Oral & Visual Performance
5	<ul style="list-style-type: none"> - Analysis and testing of at least 3 cases - Process and procedures clearly explained and appropriate - Observations clearly explained - Conclusions logical and follow from data 	<ul style="list-style-type: none"> - Brief introduction of team members - Flow moved smoothly; well rehearsed - Simple explanation of what factor was studied and why - Presentation holds interest of judges and audience - 5 min +/- 30 sec. 	<ul style="list-style-type: none"> - All voices heard and understood throughout room - Student demeanor and appearance are suitable for event - All students share equally in presentation - All visual aids contribute to understanding; - Neat, well labeled slides
4	<ul style="list-style-type: none"> - Analysis & testing of only 2 cases - Some process and procedures clearly explained and appropriate - Some observations clearly explained - Some conclusions logical and follow from data 	<ul style="list-style-type: none"> - Inconsistent or excessive introduction of team members - 1-2 minor problems with flow; rehearsed but not enough - Complicated explanation of what factor was studied and why - 1-2 items in presentation are confusing - 5 min +/- 60 sec 	<ul style="list-style-type: none"> - Most voices heard and understood throughout room - 1-2 lapses in student demeanor or appearance - Students share equally in presentation most of the time - Most visual aids contribute to understanding; - Mostly neat, well labeled slides
3	<ul style="list-style-type: none"> - Analysis & testing of only 2 cases - Few process and procedures clearly explained and appropriate - Few observations clearly explained - Few conclusions logical and follow from data 	<ul style="list-style-type: none"> - Poor introduction of team members - Several problems with flow; seemingly unrehearsed - No introduction of factors studied - Several parts of presentation are confusing - 5 min +/- 90 sec 	<ul style="list-style-type: none"> - Several lapses in voice projection - Student demeanor or appearance questionable - One student dominates or is excluded from presentation - Visual aids are unclear, hard to read or confusing
2	<ul style="list-style-type: none"> - Analysis & testing of only 1 case - Process and procedures are not explained and/or appropriate - No observations made related to variable - No conclusions logical and/or follow from data 	<ul style="list-style-type: none"> - No introduction of team members - Flow erratic; no clear transitions - Content inappropriate to topic - Presentation fails to hold interest - 5 min +/- 2 min 	<ul style="list-style-type: none"> - Voices difficult to hear or understand - Appearance not appropriate for presentation - Presentation dominated by one student - Visual aids are unreadable or very confusing

Middle School: _____

Student Names: _____

**For Official Use
Only**

Specification Check

____ Size Check ____ Fill-up < 10 min ____ Safety Check

Still Quality Factor Scores:

Glass cover size [cm]	Cover area A [cm ²]	Produced distillate	Vol/A	Distillate Tds [ppm] (Tap 400)	Tap-Tds Tap	Time [hr]	Q [mL/cm ² /hr]
36 x 28 example	1008.0	100	.099	20	.950	3	.033

Presentation Scores:

Judge 1	Judge 2	Judge 3	Total	Rank

Combined Total Score:

High School: _____

Student Names: _____

**For Official Use
Only**

	Technical Content	Overall Presentation	Oral & Visual Performance
5	<ul style="list-style-type: none"> - Analysis and testing of at least 3 cases - Process and procedures clearly explained and appropriate - Observations clearly explained - Conclusions logical and follow from data 	<ul style="list-style-type: none"> - Brief introduction of team members - Flow moved smoothly; well rehearsed - Simple explanation of what factor was studied and why - Presentation holds interest of judges and audience - 5 min +/- 30 sec. 	<ul style="list-style-type: none"> - All voices heard and understood throughout room - Student demeanor and appearance are suitable for event - All students share equally in presentation - All visual aids contribute to understanding; - Neat, well labeled slides
4	<ul style="list-style-type: none"> - Analysis & testing of only 2 cases - Some process and procedures clearly explained and appropriate - Some observations clearly explained - Some conclusions logical and follow from data 	<ul style="list-style-type: none"> - Inconsistent or excessive introduction of team members - 1-2 minor problems with flow; rehearsed but not enough - Complicated explanation of what factor was studied and why - 1-2 items in presentation are confusing - 5 min +/- 60 sec 	<ul style="list-style-type: none"> - Most voices heard and understood throughout room - 1-2 lapses in student demeanor or appearance - Students share equally in presentation most of the time - Most visual aids contribute to understanding; - Mostly neat, well labeled slides
3	<ul style="list-style-type: none"> - Analysis & testing of only 2 cases - Few process and procedures clearly explained and appropriate - Few observations clearly explained - Few conclusions logical and follow from data 	<ul style="list-style-type: none"> - Poor introduction of team members - Several problems with flow; seemingly unrehearsed - No introduction of factors studied - Several parts of presentation are confusing - 5 min +/- 90 sec 	<ul style="list-style-type: none"> - Several lapses in voice projection - Student demeanor or appearance questionable - One student dominates or is excluded from presentation - Visual aids are unclear, hard to read or confusing
2	<ul style="list-style-type: none"> - Analysis & testing of only 1 case - Process and procedures are not explained and/or appropriate - No observations made related to variable - No conclusions logical and/or follow from data 	<ul style="list-style-type: none"> - No introduction of team members - Flow erratic; no clear transitions - Content inappropriate to topic - Presentation fails to hold interest - 5 min +/- 2 min 	<ul style="list-style-type: none"> - Voices difficult to hear or understand - Appearance not appropriate for presentation - Presentation dominated by one student - Visual aids are unreadable or very confusing

High School: _____

Student Names: _____

**For Official Use
Only**

Specification Check

____ Size Check

____ Fill-up < 10 min

____ Safety Check

Still Quality Factor Scores:

Glass cover size [cm]	Cover area A [cm ²]	Produced distillate	Vol/A	Distillate Tds [ppm] (Tap 400)	$\frac{\text{Tap-Tds}}{\text{Tap}}$	Time [hr]	Q [mL/cm ² /hr]
36 x 28 example	1008.0	100	.099	20	.950	3	.033

Presentation Scores:

Judge 1	Judge 2	Judge 3	Total	Rank

Combine Score: Total Score: _____