Event Specifications
Tape & Paper Boat Challenge
MESA Day 2020

LEVEL: Middle School/High School

NUMBER OF TEAMS: One (1) team per school can participate at the MESA Day state competition. Three (3) teams can participate at MESA regional events.

TEAM MEMBERS: Two (2) to Four (4) Students per Team

OBJECTIVE: Using only tape and paper, design and construct a boat that can hold the most water bottles while having the smallest weight and staying afloat.

Students will also be required to submit their Engineering Design Notebooks during specification check for review and scoring.

MATERIALS: The only materials allowed are paper and tape. Paper or Tape designed to be waterproof are not allowed. Including but not limited to Flex Tape, Foil Tape, Vellum, Wax Coated paper.

DESIGN PARAMETERS:

1. Boats must be:
   a. Entirely constructed from tape and paper.
   b. Have a keel (i.e. no flat bottom)
   c. Maximum dimensions of the boat are 25 cm (length) x 20 cm (width) x 20 cm (height)
   d. Must have space to place weights on interior of boat.
      i. Golf balls weighing a max of 46 g will be used as weights. Standard weight of a golf ball is 45.93 g.

TESTING PARAMETERS:

1. Two (2) team members are required to be present during testing.
2. Team will place their boat in the water to ensure that it floats for at least 5 seconds before weight is added.
3. At a constant rate (every 2 seconds), weight will be added to the boat.
4. When the boat sinks, the last weight added before sinking will be counted as the final weight.
   a. Sinking is defined as the point when the water level is equal to the top of the boat
5. If the boat disintegrates, the last weight added before disintegration will be counted as the final weight.
   a. Disintegration is defined as the loss of unity or integrity by breaking into pieces or complete structural collapse.
6. If the boat capsizes, the last weight added before capsizing will be counted as the final weight.
   a. Capsizing is defined the overturning of the boat

SPECIFICATION CHECK:

1. During specification check, teams will check in to the competition area and submit their boat and Engineering Design Notebook for impounding.
2. Teams that use materials other than tape and paper will be disqualified.
3. Teams that do not have an engineering design notebook will be given a notebook multiplier of .10.
4. Boats that do not meet the size requirements will be disqualified.
5. Essential components or scored components of the Engineering Design Notebook will be listed and included in a rubric on the reverse side of the score sheet.

JUDGING:

1. The students will place their boat in the container.
2. The judge will wait for 5 seconds to ensure the boat does not sink or capsize.
3. The judge will place a weight in the boat and wait 2 seconds. The cycle will repeat until the boat either sinks, capsizes, or disintegrates.
4. The last weight placed before the boat sank or disintegrated will be the final weight
5. The judge will record the weight held on the score sheet.

SCORING CRITERIA:

1. Boats will be weighed, in grams, before being placed in the water.
2. Boat will be placed in water to ensure boat does not sink or capsize. If it does sink or capsize, the Performance Score will be 0.
3. Weights will be added every 2 seconds until the boat sinks or disintegrates.
4. The last weight placed in the boat before sinking or disintegrating will be the final weight.
5. The Final Score will be determined by multiplying the Performance Score by the Notebook Multiplier (N).
6. The Performance Score will be determined by dividing the weight added by the weight of the boat. The Performance Score will be rounded to the nearest tenth.

   For example, if the boat weighed 25 grams and held 4 bottles of water that weighed 240 grams each, the performance score would be (4 x 240) ÷ 25 = 38.4 (rounded to the nearest tenth)
7. The Notebook Multiplier will be determined by dividing the notebook score by the maximum points. (25 point maximum) If team does not submit a notebook their notebook multiplier will be .10. For example, if a notebook receives 20 points. The notebook multiplier will be .80 (20/25).

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School:_____

Student Names:_____

_____

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Specification Check (circle one):

Team has submitted an Engineering Design Notebook*	Yes	No
The boat is no bigger than 25 cm (l) x 20 cm (w) x 20 cm (h)	Yes	No
Boat is made of only non-waterproof paper and tape	Yes	No
Boat has a keel	Yes	No

Record the boat weight (nearest gram):_____g

If team fails specification check, they are disqualified (except during regional events)	**Pass**	**Fail**

Design Testing:

Does the boat capsize or disintegrate immediately?	Yes	No

If "Yes" is circled for the question above performance score is zero.

Weight of Boat (grams)	
Weight Held (grams)	
Performance Score (Weight Held/Weight of Boat)	
Engineering Design Notebook Multiplier* *If no notebook, multiplier is .1	

Lead Judge Signature:_____

Student Signature:_____

Comments/Suggestions:

Rubric for Engineering Design Notebooks (EDN).

EDN Goals	3	2	1	0
1. Explore				
□ Described Design Objective □ Described Success Criteria □ Described Constraints □Described Variables and Constants	All	Most	Some	None
□ Described Prior Knowledge □ Described Brainstorming □ Described Exploration (testing materials, modelling, etc.)	All	Most	Some	None
□Has Research documented with at least 5 sources (website, book, video, article, interviews, etc.) □Research is reliable (i.e. experts, researched websites, etc.)	All	Most	Some	None
2. Design				
□Describes materials used □Documents data from previous trials □Documents modifications	All	Most	Some	None
□Includes sketch/photo of initial prototype □Includes sketch/photo of final prototype	All	Most	Some	None
3. Test				
□Has data in graphical form □Has written description of data □Multiple iterations	All	Most	Some	None
□Describes pros and cons of data results □Discusses next steps □Tests are well designed	All	Most	Some	None
4. EDN Organization				
□Has Table of Contents or clearly labelled sections □Notebook is organized	All	Most	Some	None
4.2 Labeled. Clearly labeled with School and Team Members names.			Yes	No
Column Totals (for selected categories)				
			Total (out of 25)	

Comments/Suggestions: