

1999 rulebook

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The Great Paper Tower Event

Objective: To build a paper tower on site in a period of 10 minutes that can hold as much weight as possible for a time of one minute. Teams will supply the platform, weights and any additional guide structure used in testing the tower.

Materials: The teams will be required to bring the following supplies:

- 1) Standard paper staplers with standard staples.
(Staples with 1/2" crown, 1/4" leg, chisel point.)
- 2) Scissors.
- 3) A platform and test weights.
- 4) A guide structure (optional).

At the beginning of the event, each team will be provided with 10 sheets of 20 lb photocopier paper. Towers are to be built with this paper only.

Construction:

- 1) The tower must be constructed during a 10 minute period at the beginning of the event. It must be constructed from no more than 10 standard 8¹/₂" x 11" pieces of 20 lb photocopier paper and standard staples. No other materials may be used in its construction. Any number of staples may be used, but staples must serve a fastening function only; specifically, every staple used must pierce some piece of paper provided by event organisers.
- 2) Teams may bring a "blueprint" of their tower design to aid in the construction, but no piece of the blueprint may be incorporated into the tower itself.
- 3) The tower must be between 39.5 cm and 40.5 cm in height. The finished tower must fit inside a rectangular box with a 30 cm x 30 cm square base and 40.5 cm in height.
- 4) The tower must be strong enough to support the chosen weight for 1 minute.

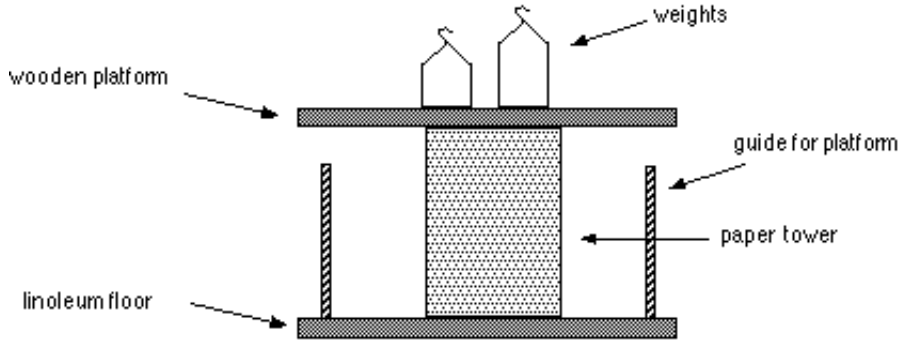
Rules for Event:

- 5) The platform, test weights and optional guide structure must be checked-in as a prebuilt. The total weight of platform and weights at check-in time must be specified by the contestants.
- 6) Teams are required to bring a platform and weights for use in testing their tower. A platform is a flat board or any other flat rigid material. It must fit flat into a 50cm by 50cm square. It must be designed so that when sitting on top of the tower, its flat bottom surface is parallel to the floor. The platform and weights may be one object. The weights can be of any number, size or composition.

7) The tower will be tested by positioning it on a flat linoleum floor, placing the platform on its top, then placing weights on top of the platform. Teams will be responsible for placing all weights. All weights must remain entirely on top of the platform with no part hanging below it at all times.

8) Teams may bring a guide structure to assist in maintaining the levelness of the platform while placing weights. The device may have any configuration and may touch the platform during the loading phase. **However it must not touch the platform, tower or weights at any time during the one minute testing period.** If any contact is made, the trial will receive a score of zero.

Such a device is illustrated below.



The wooden platform is above guides that serve to keep it from tilting or sliding off too much to the side during weight placement.

9) Teams will have 8 minutes to set up their tower and demonstrate that it will hold the selected weights for one minute. Contestants are allowed a maximum of two trials in the 8 minute period.

10) Teams must notify the judge when they are ready to begin each trial. The judge will indicate to the team when to begin. When a team has completed the addition of weights, they must indicate this to the judge who will then begin timing one minute.

11) The tower must support the weights for one minute. At the end of the one minute period, the lowest point of the platform must be at least 35 cm above the floor. Towers that collapse below this height during the addition of weights or before one minute is up receive a score of zero for that trial. Towers that do not collapse but whose platform's lowest point is less than 35 cm high during or at the end of the timed minute also receive a score of zero.

12) Teams may not modify their tower between trials. Teams may change the amount of weight supported by their tower for the second trial.

Scoring:

The team's score will be the maximum of the score for each of their two trials. It is computed by

$$\text{Score} = \frac{\text{total weight supported}}{(11 - \text{number of unused sheets of paper returned})^2}$$

where the total weight supported is the sum of the weight of the platform and all weights placed on it. The maximum score wins. Ties if any will be broken by considering the score for the other trial.

Mystery Event

This event will involve solving a simple experimentally oriented problem or problems using logic and knowledge of basic principles of physics, especially those involving magnetic fields, coils and induction.

Intuitive Physics

Each team will be presented with several simple computer simulations or experiments based on basic principles of mechanics, electricity and magnetism. Teams will be required to provide answers to questions based on these simulations or experiments. Answers to questions may involve simple calculations. The team with the most correct answers will win. Quality of answers involving explanations will be used to resolve ties.

Musical Mayhem

This event requires you to use your knowledge of waves to construct a simple stringed musical instrument.

Rules:

- 1) You should bring a non-programmable calculator and pencil.
- 2) Assorted material such as thin wire, weights and all other materials needed for this event will be provided by the invigilators. No other materials may be used.
- 3) You will be required to construct an musical instrument that has a specified property or properties. You will also be required to carry out calculations to aid in the design of this instrument.
- 4) The score for this event will be based both on the correctness of the calculations and the success of the construction and design of the musical instrument. Answers to a set of questions regarding the physics of music may be used to resolve ties.
- 5) This is not an impossible exercise. So don't despair if you do not know how to solve it before you get to the event. Also, the invigilators are a really fun bunch of people, so don't be afraid to ask questions.

The Carnival Thrill Ride

This is a prebuilt event which requires the design of a race track for a car such that it completes the course in minimum time.

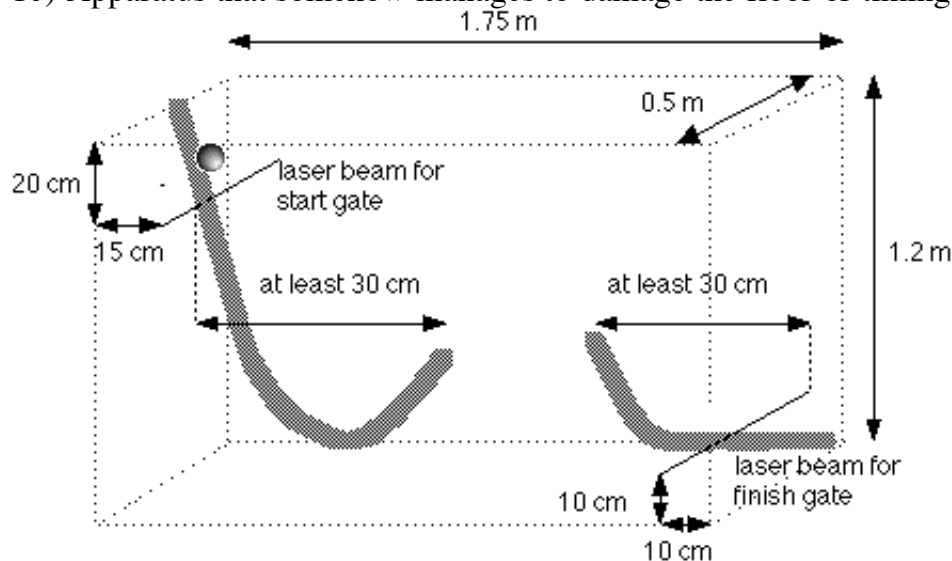
Apparatus:

- 1) The part of the apparatus that will cross the timing gates is called the car. The part of the apparatus that guides the car from the start line to the finish line is called the track. The car and the track must be designated by the contestants before the beginning of the event.
- 2) The total energy for powering the car can **only** come from the gravitational potential energy of the car itself.
- 3) The apparatus must be constructed by contestants themselves and should not consist mainly or exclusively of any sort of pre-purchased model kit or device. For example, it cannot consist of Hot Wheels™ track or any other commercially made track.
- 4) The apparatus (that is the track and the car) must fit in a bounding box that is 1.2m in height, 1.75m in length and 0.5m in width at all times. The car itself must fit into a 10cm by 10cm by 10cm box at all times. Contestants must be able to slide/place their apparatus into the bounding box from either (or both) the front and back plane so as not to disturb the timing gates.
- 5) The track must be designed to not block the laser beams used in the timing gates at any time during the race. However, it must carry the car past both timing gates at a height guaranteed to trigger them. The start gate laser beam will be positioned at a height of 1m a distance 15cm in from the back plane of the bounding box as shown in Figure 2. The finish gate laser beam will be positioned at a height of 10 cm a distance of 10 cm from the front plane of the bounding box.
- 6) There must be one gap on the track. This gap must be 30cm wide horizontally. The height of the track the car lands on must be 5cm higher than that of the track the car takes off from as shown in Figure 3. This means that the car must jump, not drop, over the gap. The gap must be positioned at least 30 cm horizontally away from the finish timing gate laser beam and 30cm horizontally away from the start timing gate laser beam.

Rules:

- 7) Teams will have a maximum of 8 minutes to set up their apparatus and complete three trial runs. Adjustments can be made on the apparatus between each trial run.
- 8) A designated team member will release the car from rest to begin each trial run. The height that the car is released from must be such that the entire apparatus obeys rule 4) at time of release. The car must be released from a position behind the starting timing gate laser beam.
- 9) No external human intervention is allowed to stop, align or redirect the car during a run. The car must begin and finish the race in one piece. That is, all parts of the car must finish the race together. The car must remain on the track except when jumping over the gap. It must remain in the bounding box at all times during the race until it crosses the finish timing gate laser beam.

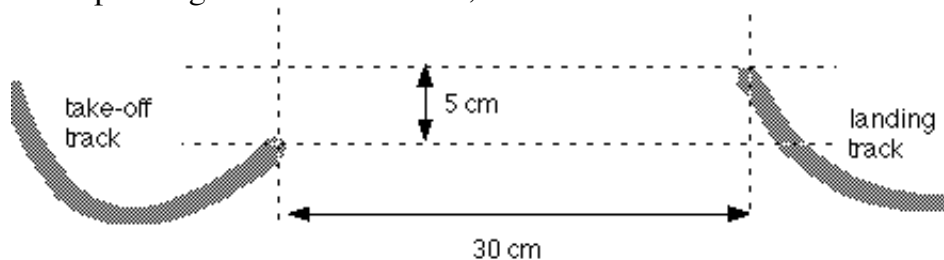
10) Apparatus that somehow manages to damage the floor or timing gates will be disqualified.



Scoring:

The score for a successful trial run will be determined by the time the car takes to get from the start gate to the finish gate. Cars that do not finish the race (e.g. fly off the track) will be given a penalty time of 30 seconds.

The best two out of the three trial runs will be summed to find the score for this event. The lowest score, corresponding to the fastest track, will win.



Balancing Act

The event consists of estimating the center of gravity of objects and placing them on a balance so as to level it.

Rules:

- 1) Teams should bring a non-programmable calculator, pencil or pen, and a ruler. Teams are not allowed to bring or use any materials or equipment other than the above with the exception of the apparatus for the event.
- 2) At the beginning of the event, each team will receive a box containing several objects of different shapes and sizes. Teams will also receive equipment that can be used to measure the weight of the objects.
- 3) A balance will be provided to each team for use in this event. This balance has the form of a bar that moves

freely on a pivot. The exact configuration of the balance will be described to each team at the beginning of the event. The objects of different shapes and sizes are to ultimately be placed on this balance so as to level it.

4) Teams will have 15 minutes to determine each object's weight and center of mass. Using this information, teams will have to decide where to place each object on the balance so it will be level after all objects are placed. Teams will be required to record these measurements and calculations.

5) After the 15 minute period, each team will have two minutes to implement their solution using the actual balance. After the two minute period their solution will be tested by the judges and assessed for correctness.

6) The team that comes closest to leveling the balance with their solution and presents the most accurate measurements and calculations will win.

All official updates to the 1999 rulebook will be posted here.

No Changes or Updates in the rules but 2 comments

Comments on The Carnival Thrill Ride

1) A ball does qualify as a car.

2) Part of Rule 9 states:

"...The car must remain on the track except when jumping over the gap. It must remain in the bounding box at all times during the race until it crosses the finish timing gate laser beam."

This means that the car cannot be airborne as it crosses the finish line; in particular it must be in contact with the landing track except while in the 30 cm gap. To be precise, the car must land no more than 10 cm from the starting point of the landing track..

Also, air does not qualify as track.

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