

Physics Olympics Schedule

Saturday, April 18, 2009

Time	Event	Location
9:00AM	Registration & Refreshments	Room 334, Science Building
9:30AM	Welcome/Instructions	Room 334, Science Building
9:45AM	Morning Events	
	<i>Mousetrap Car Race</i>	Shelton Gym
	<i>Egg Drop</i>	Loading Dock, Science Building
	<i>Mentos and Diet Soda Car</i>	Loading Dock, Science Building
12:00 AM	Lunch	Union Station, University Center
1:00PM	Afternoon Events	
	<i>Water Rocket</i>	Intramural Fields
	<i>Trebuchet</i>	Intramural Fields
	<i>Another Brick in the Wall</i>	Room 334, Science Building
3:45PM	Ribbons and Trophies	Room 334, Science Building

MOUSETRAP CAR RACE

- Objective:** Each team is to produce one vehicle powered by a mousetrap. The vehicle should travel a distance of 10 meters in the shortest possible time.
- Apparatus:** Each team is responsible for designing and building one mousetrap-powered vehicle prior to the day of the competition. SFASU will provide the timing system.
- Regulations:** A mousetrap spring is to provide the sole source of power for the vehicle. No other stored energy supplies - including gravitational potential energy - may be released by the spring.

The trap used to power the vehicle must be sold commercially as a mousetrap. As such, the trap spring should consist of a steel wire nominally 1.3 mm in diameter wound into a coil nominally 7 mm in diameter with approximately 20 turns. Rattraps, or any other traps with springs differing significantly from that just described, will be disqualified.

The mousetrap spring and the portion of the trap board to which the spring is attached may not be altered in any way. The trap restraining arm and other portions of the board may be modified. In no case should the spring move through an angle of more than 180 degrees.

The mousetrap must be contained in the vehicle and must propel the vehicle by means of a wheel or wheels in contact with the ground. A launcher or device that pushes the vehicle is prohibited.

One wheel of the vehicle must remain in contact with the ground at all times. The vehicle must remain as a single unit at all times. **The vehicle must have a mass of at least 0.5 kg.** The vehicle must be started from a standstill by releasing the mousetrap spring in a manner that imparts no additional energy to the vehicle, i.e., the vehicle may not be given a push start. There will be a five-minute time limit to prepare and race your vehicle on the day of the Physics Olympics.

The racecourse will consist of a hard, smooth, level surface with lanes for individual vehicles each 10 meters long and 2 meters wide. The time interval required for each vehicle to cover the 10 meters will be measured from the time the leading edge of the vehicle's front wheel breaks the plane of the starting line to the time the leading edge of the same wheel breaks the plane of the finish line. If the vehicle does not travel the entire 10 meters, then the distance traveled from the start will be used to determine the vehicle's score. If the vehicle leaves the lane from either side, it will be considered stopped when it breaks the plane of the lane boundary.

Scoring: 20 points will be awarded to each team that shows up with a viable vehicle.

40 points will be awarded to each vehicle completing the 10-meter distance. If a vehicle completes a fraction of the full distance, the corresponding fraction of 40 points will be awarded.

Vehicles completing the 10-meter distance will be awarded up to 40 additional points based on the time required to complete the distance. The overall fastest time of the day for the entire field of entries will be divided by an individual vehicle's finish time to determine the fraction of 40 points awarded to that vehicle. The standing overall fastest time will be posted for reference while the competition is in progress.

Each vehicle will be allowed to complete two runs. The vehicle's best time/distance will then be used to determine its score.

EGG DROP

- Objective:** To design a container that will protect a Grade A Large egg from a fall of about 13 meters (3 stories) onto a concrete surface of area approximately 3 m x 2.5 m.
- Apparatus:** Each team will construct one container before the day of the competition. Each team will be responsible for the secrecy of their design. We will provide the eggs and they will be raw.
- Regulations:** The container must be able to fit inside a box of dimensions 40 cm x 40 cm x 40 cm. Its mass must be less than 1 kg. The container may be constructed of any kind of material. There will be a five-minute time limit to load the egg into your container on the day of the Physics Olympics.
- Procedure:** The container will be dropped from a hinged board, extending from a balcony over a concrete surface. The container does not have to survive the fall, but the egg must. A cracked or broken egg will disqualify the entry. The judge will inspect the egg within one minute of the drop. Only one drop will be made for each team's device.
- Scoring:** Scoring will be based on the following equation: $\text{Score} = \text{Mass} + (10 * \text{Time})$ where Mass = mass of the egg container in grams (not including the egg) and Time = time in seconds from release of the device till its impact. The device with the lowest score is the winner.

TREBUCHET

A trebuchet is a medieval engine for hurling heavy projectiles.

- Objective:** To vault an object, a softball, as far as possible using only gravity.
- Regulations:**
1. The device must be made of wood, non-elastic fabric, rope, duct tape and wood glue.
 2. No springs or elastic materials may be used.
 3. Lubricants can be used.
 4. There can be no metal parts of any kind including bolts and nails.
 5. Rocks and bricks can be used only for the counterweights.
 6. Only rocks and bricks can be used for the counterweights.
 7. The device can only be powered by a descending counterweight.
 8. Participant cannot touch the trebuchet once the counterweight is released.
 9. The total weight of the device (including the counterweight) cannot exceed 100 pounds.
 10. SFA will provide the softballs to be launched on a grass field.
 11. If a trebuchet poses any threat to safe competition, the judges reserve the right to disqualify it.
 12. No practice launches will be allowed on the day of the Physics Olympics. So be sure to test your trebuchet in advance.
 13. There will be a five-minute time limit to prepare your trebuchet for launch on the day of the Physics Olympics.
- Scoring:** Scoring will be base on the distance from a line in front of the trebuchet to the first impact point of the softball.

WATER ROCKET

Objective: To build a rocket from a 2 liter plastic soft drink bottle.

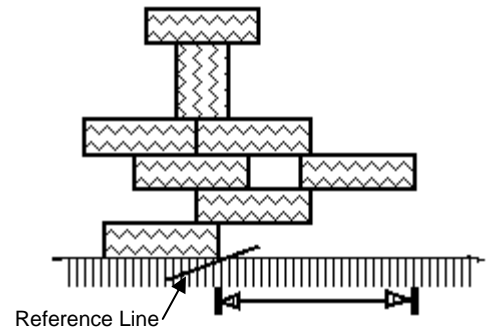
- Regulations:
1. You are to build a rocket from a 2-liter soft drink bottle that uses water and compressed air as a propellant. You are to employ only a bicycle tire pump to pressurize the rocket. As an example, you may fit a rubber stopper with a basketball needle through it into the bottle and attach the tire pump to the needle.
 2. Your launch mechanism must safely hold the pressurizing mechanism and contain any stopper or plug that is ejected by the rocket upon launching.
 3. The rocket must have a parachute. The rocket may have a Styrofoam nose cone and cardboard fins.
 4. All parts of the rocket must remain together during flight (even the nose cone). No metal parts are to be on the part of the rocket that leaves the ground.
 5. Participants are required to wear safety goggles and stay 10 feet away from the rocket during pressurization.
 6. Each team must build their own rocket and launch mechanism prior to the competition and bring these materials (goggles, water, etc.) with them. Teams may not share rocket parts, launch mechanisms, or pumps. SFA will only provide the timing systems.
 7. Water must be in the rocket before the rocket is pressurized with air. Water cannot be added to the rocket after or during the time at which air pressure is added to the rocket. Air must go directly from the pump to the rocket. There can be no air storage tanks.
 8. We suggest that you use extreme care when building and testing your rocket. It is not worth injuring yourself or someone else for this event.
 9. Any mechanism or rocket that is deemed unsafe by the safety committee will be disqualified. **Teams should limit the pressure to 80 psi and limit the pumping times to 2 minutes**
 10. No practice launches will be allowed on the day of the Physics Olympics so be sure to test your rockets and equipment in advance.

Scoring: Scoring will be based upon the time aloft, the time from when the rocket is launched to the time it strikes the ground. You might want to consider a good parachute!

ANOTHER BRICK IN THE WALL

Objective: To construct a brick structure on one side of a reference line with the largest overhang over the line.

Apparatus: SFA will provide 10 bricks or 10 wooden 2-by-4 boards to each team on the day of the competition. SFA will also provide 20 (non-replaceable) elastic **rubber bands** that can be used in the construction.



Regulations: Each team is responsible for its own design. Note: For best results, the center of mass of the structure should be directly over the reference line.

Any team that interferes with the structure or table of another team will be disqualified (accidental or otherwise).

The structure must be constructed using only the materials provided.

No part of the bricks may touch the ground on one side of the **reference** line.

The overhang is defined as the shortest horizontal distance from the most distant part of the structure to the line.

There is a 20 minute time limit. At the end of 20 minutes the structure can no longer be touched.

The structure must remain unsupported until the measurement is made by a judge.

Scoring: The ranking order will be determined by the greatest overhang measured.

MENTOS AND DIET SODA POWERED CAR

Objective: Each team is to produce one vehicle powered by Mentos and Diet Coke. The vehicle should travel a distance of 10 meters in the shortest possible time.

Apparatus: Each team is responsible for designing and building the vehicle prior to the day of the competition. SFASU will provide the timing system.

Each team is responsible for bringing a 2-liter bottle of Diet Soda and Mentos candy. Nozzles, release mechanisms, etc. can be used but each team should bring and use its own apparatus.

The team member that releases the Mentos candy must be wearing eye protection and may want to wear a rain coat or plastic poncho.

Specifications: CO₂, aspartame, potassium benzoate, and caffeine in the Diet Coke, gum Arabic and gelatin in the Mentos, as well as the tiny pits on a Mentos candy (nucleation sites) are responsible for the explosive reaction of Diet Coke and Mentos

Procedure: Each team will begin the reaction with one 2-liter bottle pointed upward on the science building loading dock.

The racecourse will be outside on a concrete surface and will be 10 meters long and 2 meters wide. The time interval required for each vehicle to cover the 10 meters will be measured from the time the leading edge of the vehicle's front wheel breaks the plane of the starting line to the time the leading edge of the same wheel breaks the plane of the finish line. If the vehicle does not travel the entire 10 meters, then the distance traveled from the start will be used to determine the vehicle's score. If the vehicle leaves the lane from either side, it will be considered stopped when it breaks the plane of the lane boundary.

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