

# HYDROGEN FUEL CELL CAR COMPETITION RULES NATIONAL SCIENCE BOWL<sup>®</sup> FOR MIDDLE SCHOOL STUDENTS

## Eligibility Requirements

1. Each competing team consists of four student members and may also include one student alternate. To be eligible to compete, a student must be enrolled for the current school year in grades six, seven, or eight at the team's school, and be older than 10 years of age and less than 16 years of age or receive a special waiver from the Department of Energy. Teams may be from an accredited public, private, or home-school and all students on the team must attend the same school in the most recent school year. Teams of home school students, girl scouts, boy scouts and science clubs are welcome to participate; **however, if the school a student attends is competing in a Regional Science Bowl, then that student may compete only on a team from that school.**
2. No school or student group may compete in more than one regional competition. **No student may compete on more than one team.** No more than 3 teams from one middle school or student group may compete in a regional event. Each regional coordinator will determine if more than one team from a school will be allowed to participate in that regional as well as the geographic area their regional will encompass.
3. The team coach is required to report the team's availability to participate in the national event to their regional coordinator within two weeks of the regional event completion or prior to the NSB deadline for entry notification. All teams must arrive and depart on the event's designated dates and be in attendance throughout the duration of and participate in all aspects of the national event. In the interest of safety, continuity, and educational value, the National Science Bowl<sup>®</sup> requires students to take part in ALL of its events and activities. Therefore, no waivers will be granted or special arrangements made for students to participate in any conflicting activities. If team members are involved in these pursuits, the students will need to determine which activity or event is in their best interest and make their selection within two weeks after the completion of the regional event. To be eligible for the National Science Bowl<sup>®</sup> a student must have competed on the eligible winning team at the regional event.
4. The winning team from each regional competition is **invited** to participate at the national event. If the winning team is ineligible to participate in the national event, the next ranking team, i.e., second place, will be invited as the winning team.

**Winning Team to National:** If your regional event includes both a car competition and an academic event, the winning team that will go to the NSB in Washington, DC will be the academic science bowl team **NOT** the winning regional car.

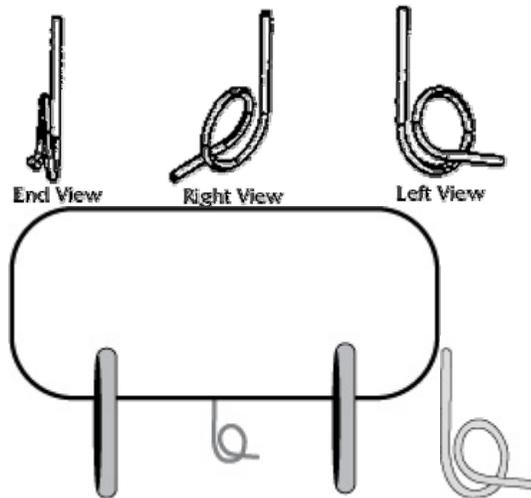
## Competition Structure

5. The national event will use preliminary time trials before progressing to a double elimination tournament for the finals. Each team will have two time trials to achieve their fastest time. Any car that does not finish in 40 seconds will be considered a Did Not Finish (DNF). Only the fastest sixteen teams will progress to the double elimination tournament. In the event of a tie, to qualify for the double elimination tied teams will have a race off.
6. There are two components to the national competition:
  - a. Design Document: At the national competition, each team must provide design notes for their car before being allowed to compete. The design document is not a daily journal. It is an engineering schematic. Minimum requirements include a complete component list for the vehicle, final specifications of the vehicle (body measurements, weight, gear ratio, drive type, top speed), scaled drawings, assembly procedures, at least three issues or problems encountered and solutions applied, and photos of the car and/or its construction. This document will not be returned to the team, and parts may be made public.
  - b. Speed Race: Student teams will be provided a fuel cell, motor, and a battery pack. Students must use the unaltered fuel cell, motor and battery pack that was provided in the fuel cell kits as the only method of charging and driving the car. The rest of the car design and components will be up to the creativity and ingenuity of the students. All cars must be designed and built by the students with limited assistance from the coach or other non-team members.

### **Race Specifications**

7. A fuel cell kit and teacher resource material will be provided to the winning regional teams following their regional event. The regional winning teams **must** bring a completed and functional hydrogen fuel cell car to the National event.
8. The vehicle must be safe to contestants and spectators, e.g., no sharp edges, projectiles, etc. The vehicle cannot exceed the following dimensions: 20 cm wide. by 40 cm. in length by 20 cm in height. Decals of the sponsor organizations (provided at the National competition) must be applied and visible from the side, top or front of the body of the car. A 3 cm. by 3 cm. space must be left for the assigned car number and sponsors.
9. Energy Source: The electricity needed for the electrolysis procedure will be provided by the battery pack that was included in fuel cell kit. The electrolysis will be completed in a designated charging area prior to the start of the race. For the National event, the electrolysis will be completed at the starting line. The only energy source permitted on the vehicle is the fuel cell with the hydrogen that was produced from the electrolysis procedure.
10. Steering: A guide wire attachment must be **attached** to the car. An example of a possible design is illustrated below. A guide wire such as a

fishing line will be no more than 1.5 cm. from the surface of the track, will go through the attached guide wire attachment(s) on the car, serving as the steering mechanism, and keeping the car in its lane. The vehicle must be easily removed from the guide wire, without disconnecting the guide wire. This is the only allowable method of steering the car. No radio control is permitted in the cars. Lane changing or crossing will result in a DNF.



11. The guide wire attachment must be used for steering only and must be directly hooked onto the guide wire. The guide wire attachment should not be used to support the vehicle such as a grooved spool located on top of the car guiding the car down the track. All wheels must be in contact with the track.
12. The length of the race course is 10 meters over flat terrain. Race lanes are at least 60 cm. wide. The guide wire will be located in the center of the track and will not be more than 1.5 cm. above the track surface. The track can be a hard, flat, smooth surface such as a tennis court or running track. A large sheet of rolled material, i.e., plastic, rubber, heavy paper, roofing paper (half-lap), or hardwood taped or bolted together may be used to cover an uneven surface. For the National competition, the track will be a black neoprene rubber material.

### **Race Conduct**

13. **Charging Station:** The battery pack received in the fuel cell kits must be used to supply the electricity needed for the electrolysis procedure. At regional competitions the solar cell that was provided in the teacher kit can be used to supply the electricity.
14. **Race Day Electrolysis Procedure:** Before the scheduled race start, all teams must report to the designated charging station with their hydrogen fuel cell car. Distilled water will be provided at the charging station for the electrolysis process. To manage the charging area, teams that are in the staging area and are scheduled to race in the next heat, will be given

- priority in the charging area. There is no time limit on the electrolysis procedure – a team may report to the charging station as early or late as practical; however, teams will have ONE minute to be ready to start their race at the specified time. The only energy source permitted on the vehicle is the fuel cell with the hydrogen that it produced from the electrolysis procedure.
15. There will also be a repair table set up separate from the recharging area to help facilitate quick repairs to the cars. Again, teams that are scheduled to race in the next heat will be given priority in the repair area. There will be a 3 minute time limit for repairs.
  16. At race time, the vehicle will be placed behind the starting line with all its wheels in contact with the ground. No more than two team members will be allowed in the start area.
  17. An early start or push start may result in a DNF for that heat.
  18. All vehicles will be started when the official signal is given. Each car will have two timed speed trials. The top sixteen cars with the fastest times will advance to the final competition to race for first, second, and third place.
  19. The judges will note the official time on the heat card. If the car does not finish the race, it will be noted as a Did Not Finish (DNF) on the heat card.
  20. One team member must wait at the finish line to catch the vehicle.
  21. Team members may not accompany or touch the vehicle on the track. Vehicles stalled on the track may be retrieved after the end of the race has been declared by the Lead Judge.
  22. The vehicle and team member must remain at the finish line until the time of the race has been noted on the heat card.
  23. Lane changing or hitting another car will result in a DNF.
  24. Challenges must be made before the race judges begin the next heat. All challenges must come from the team members who are actively competing, not the coach, parent or coordinator and all challenges need to be directed to the lead judge. The decisions of the race judges are final.
  25. Only competing students and race officials may be in the race area. All others including coaches, parents, coordinators, and non-competing students must remain in the spectator stands through the duration of the races.
  26. Judges **will** inspect cars prior to the final heat or at anytime during/after heats.